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Explanatory notes

The following symbols are used in tables in the *Review*:

… Three dots indicate that data are not available or are not separately reported.

(–) A dash indicates that the amount is nil or negligible.
A blank space in a table means that the item in question is not applicable.

(-) A minus sign indicates a deficit or decrease, unless otherwise specified.

(.) A point is used to indicate decimals.

(/) A slash indicates a crop year or fiscal year; e.g., 2006/2007.

(-) Use of a hyphen between years (e.g., 2006-2007) indicates reference to the complete period considered, including the beginning and end years.

The word "tons" means metric tons and the word "dollars" means United States dollars, unless otherwise stated. References to annual rates of growth or variation signify compound annual rates. Individual figures and percentages in tables do not necessarily add up to the corresponding totals because of rounding.

A regional reserve fund for Latin America

Daniel Titelman, Cecilia Vera, Pablo Carvallo and Esteban Pérez Caldentey

ABSTRACT

This paper analyses the viability, implications and challenges of expanding the Latin American Reserve Fund (FLAR) to Argentina, Brazil, Chile, Mexico and Paraguay. A regional reserve fund should be viewed as one of a broad range of mechanisms offered by the international financial architecture to address balance-of-payment difficulties. A fund with resources of between US$ 9 and US$ 10 billion at its disposal would be able to cover the potential funding needs of its members in the most likely scenarios, without necessarily becoming the lender of last resort for all its members. In more extreme scenarios, the fund should be able to "broaden its shoulders" by drawing on other components of the international financial architecture. Fund governance would present the main challenge resulting from an increase in the number of members.

KEYWORDS

Monetary reserves, monetary policy, capital movements, balance of payments, Argentina, Brazil, Chile, Mexico, Paraguay, Latin America

CLASSIFICATION JEL

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I
Introduction

Strengthening the Latin American Reserve Fund (FLAR) by expanding its size and scope in order to encompass a larger number of countries of the region would significantly contribute to financial stability as a regional and global public good.[1] This paper seeks to cast light on the viability, implications and challenges of expanding FLAR to another five countries in the region: Argentina, Brazil, Chile, Mexico and Paraguay.

In our view, regional reserve funds are one of the mechanisms that contribute to a denser international financial architecture and help enhance its capacity to provide global financial stability. Greater densification means not only that there is a wider range of tools, but also that there is greater interconnectivity between the institutions that make up the international financial architecture.

Regional funds are not, then, seen as the only defence mechanism for their member countries but rather as one line of defence in addition to other sources of balance-of-payments support. They should be regarded as a complement to global financial institutions, albeit within a multilevel framework of financial cooperation in keeping with principles of subsidiarity. The resources available to a regional fund are not limited to the contributions made by its member countries. A regional fund can leverage its resources through interactions with other components of the global financial system.

This has two fundamental implications for sizing the fund.

First, the fund should be sized bearing in mind that there are other sources to which member countries —in particular, the larger ones— can turn for meeting liquidity needs stemming from balance-of-payments constraints. Any expanded FLAR should be conceived as a fund essentially at the service of the countries with less easy access to other sources of financing. Countries for which it is easier to tap other resources could resort to an expanded FLAR as a fall-back line of defence.

Second, the fund should be sized to ensure it is able to respond to the most likely scenarios (according to the empirical evidence presented in this paper, the most likely scenarios are those where only a proportion of the 12 countries have balance-of-payments difficulties at the same time). In more extreme scenarios, the fund should be able to "broaden its own shoulders" by leveraging its capital to mobilize more resources or by taking action along with other components of the financial architecture. So, an expanded FLAR should be far smaller than it would need to be for addressing a tail risk scenario where all of the countries draw on it at the same time.

This report suggests that if, for example, capital contributions from new member countries were patterned after the current FLAR, an expanded fund would total nearly US$ 9 billion, which is equivalent to 1.4% of the total stock of international reserves held by the 12 countries reviewed.

A fund of this size could, unleveraged, simultaneously cover potential demand from the entire group of smaller countries plus half of the needs of medium-sized countries, for a total of US$ 7.8 billion.

Leveraging the fund's capital via medium- to long-term borrowing at a ratio of 65% of its paid-in capital (the maximum authorized for FLAR) would yield nearly US$ 13.3 billion in lending resources. At this volume, the fund could simultaneously cover more than 85% of the potential needs of the entire group of member countries —except for those of the two largest, estimated at US$ 15.3 billion.

Beyond feasibility and the potential benefits of an expanded FLAR as a shared insurance mechanism, working towards bringing in new members entails major challenges in terms of fund governance, including voting and decision-making mechanisms, credit allocation criteria and surveillance mechanisms.

FLAR has been shown to have such positive attributes as speed, responsiveness, a strong sense of member country ownership (as seen in its solid position as senior creditor) and low lending conditionality that helps to keep borrowing from FLAR from being stigmatizing for the countries. The big governance challenge for an expanded FLAR would be how to adapt to having more members and more resources without losing these positive attributes that often differentiate FLAR from other global and regional funds.

This article is divided into five sections. Following this introduction, section II sets out empirical exercises to gauge how simultaneous balance-of-payment difficulties are for the 12 countries reviewed. Section

[1] See annex 1 for a description of the FLAR and other regional reserve funds.

III focuses on what the size of the new, expanded FLAR should be and provides two scenarios for member country capital contributions in keeping with that size. Section IV examines the governance challenges that expanding FLAR would pose. Section V then offers some closing reflections.

II

Factors for evaluating the financial viability of an expanded FLAR

When assessing the sustainability and viability of a reserve fund, it is important that member country balance-of-payments problems and crises not occur simultaneously.

One of the standard ways to gauge the simultaneousness of balance-of-payments complications has been to take variables like variations in terms of trade, stock of international reserves and net capital flows and calculate simple correlation coefficients between them.[2]

Positive, statistically significant coefficients weaken the arguments in favour of a fund because they would mean that shocks impact the countries at the same time. By contrast, negative correlations would enhance arguments in favour of the fund as an insurance mechanism. Positive but not significant correlations also point in the direction of fund feasibility: with the intensity of the shocks varying from country to country, there will always be countries that are less affected and so have less need for tapping the fund.[3]

Determining whether there is a discernible pattern of simultaneousness within countries grouped by economy size was also regarded as a relevant exercise. After all, it is not the same for balance-of-payments difficulties (and, thus, the potential need to draw on the fund) to arise at the same time for large and medium-size countries as for smaller countries whose funding needs are within the fund's capacity to handle.

The study thus centred on two groups of countries ranked by the size of their economies: large and-medium-sized, including Brazil, Mexico, Argentina, Colombia, Bolivarian Republic of Venezuela, Peru and Chile; and small ones, including Ecuador, Costa Rica, Uruguay, Plurinational State of Bolivia and Paraguay.[4]

The findings in this section indicate that it is not the rule that balance-of-payments problems arise simultaneously. The examination by country grouping shows that any simultaneous balance-of-payments complications would tend to appear among smaller countries. This provides even more evidence in favour of the financial viability of an expanded FLAR, because the funding needs of the smaller countries in the group are, naturally, of a magnitude that is more manageable for the fund.

1. Terms of trade

The correlation exercise with 12 countries yielded 66 pairs of correlation coefficients.[5] Only 16 (24%) of them are significant and positive; 7 (11%) are significant and negative (see table 1).

These findings are expectable in that the terms-of-trade pattern varies from country to country because their export base is different. For instance, in a number

[2] See, for example, Agosin (2001); Machinea and Titelman (2007); Agosin and Heresi (2011).

[3] Generally speaking, the reason for using these variables instead of just determining whether international reserve gains or losses for the countries are highly correlated is that the effects of balance-of-payment shocks are not always reflected in variations in reserves. Other adjustment mechanisms are sometimes involved. For example, if part of the effect of a capital-account shock is absorbed by variations in the country's exchange rate, the impact on international reserves will be smaller. Likewise, negative (positive) terms of trade shocks could eventually come along with loss (accumulation) of reserves, depending on whether the central banks use reserves to buffer or slow the resulting exchange-rate depreciation (appreciation). Aizenman, Edwards and Riera-Crichton (2011) identify, with regard to the Latin American countries, the important role that active international reserve management at the country level can play in substantially reducing real exchange-rate volatility in the face of terms-of-trade shocks.

[4] For ranking by size, the most recent data available on GDP at purchasing power parity (PPP) rates were used. A country ranking based on average current-dollar GDP for 2009 and 2010 would only change the specific order of some countries within each group. The order between groups, which is the one that matters for this examination, does not change.

[5] Contemporaneous correlations were used for this exercise.

TABLE 1

Simple correlation coefficients between terms-of-trade variations
(Annual data, 1990-2010)

	Brazil	Mexico	Argentina	Venezuela (Bolivarian Republic of)	Colombia	Peru	Chile	Ecuador	Costa Rica	Uruguay	Bolivia (Plurinational State of)	Paraguay
Brazil	1.00											
Mexico	-0.53	1.00										
Argentina	**0.47**	-0.22	1.0									
Venezuela (Bolivarian Republic of)	-0.30	**0.62**	-0.05	1.00								
Colombia	0.35	0.14	0.34	**0.64**	1.00							
Peru	0.36	0.03	-0.13	0.25	0.20	1.00						
Chile	0.40	-0.15	-0.12	0.24	0.30	**0.84**	1.00					
Ecuador	-0.16	**0.53**	-0.07	**0.90**	**0.66**	0.34	0.22	1.00				
Costa Rica	**0.54**	-0.77	0.14	-0.64	-0.15	-0.03	0.07	-0.54	1.00			
Uruguay	0.37	-0.62	-0.06	-0.62	-0.28	-0.15	-0.04	-0.49	0.39	1.00		
Bolivia (Plurinational State of)	0.30	0.00	0.13	0.38	**0.63**	**0.54**	**0.55**	**0.53**	-0.10	-0.11	1.00	
Paraguay	**0.47**	-0.31	0.26	-0.07	**0.57**	0.03	0.10	0.04	**0.43**	0.23	**0.44**	1.00

Percentage of simple correlation coefficients between terms-of-trade variations that were significant and positive
(As a percentage of the total, by groupings of countries)

	Medium-sized and large	Small
Medium-sized and large	19.0	-
Small	25.7	30.0

Source: prepared by the authors on the basis of World Bank, Development Indicators [online database].

Note: the annual variation of the terms of trade index for goods and services was used. Coefficients that are positive and significant at the 5% level are in bold. Coefficients that are negative and significant at the 5% level are shaded.

of cases there are significant negative coefficients for pairs of countries where one is a net exporter of energy (basically, hydrocarbons) and the other is a net importer. Such is the case with the correlations between the Bolivarian Republic of Venezuela and Costa Rica and Uruguay, as well as the correlations between Ecuador and these two same countries.

By contrast, correlations between pairs of countries where both are major net energy exporters (like the Bolivarian Republic of Venezuela and Ecuador, the Bolivarian Republic of Venezuela and Mexico, Colombia and Ecuador, and Colombia and the Bolivarian Republic of Venezuela) are positive and significant as well as generally high.

A look at pairs of countries can yield some general conclusions at the country group level. For example, in table 1 showing correlations between terms-of-trade variations among countries in the medium-size and large group, only four (19%) are positive and significant. In nine cases (25.7%), correlations between medium-sized and large countries and small countries are positive and significant; in three (30%) they are positive and significant among countries in the small group. In other words, the occurrence of positive and significant correlations is low, both within and between country groupings.

This finding was to be expected, because a country's export structure is not necessarily related to the size of its economy.

2. International reserves

As for variations in the stock of international reserves, only 25 of the 66 correlation coefficients between pairs of countries were positive and significant; this is equal to 38% of the potential cases (see table 2).

An analysis was performed at the country grouping level. It shows that positive and significant correlations are found above all between pairs of small countries. Indeed, half of the correlation coefficients between pairs of small countries were significant and positive. The percentage of positive and significant correlations is lower (33.3%) between large and medium-sized countries.

TABLE 2

Simple correlation coefficients between variations in the stock of international reserves
(Quarterly data, 2000-2011)

	Brazil	Mexico	Argentina	Venezuela (Bolivarian Republic of)	Colombia	Peru	Chile	Ecuador	Costa Rica	Uruguay	Bolivia (Plurinational State of)	Paraguay
Brazil	1.00											
Mexico	**0.29**	1.00										
Argentina	**0.33**	0.09	1.00									
Venezuela (Bolivarian Republic of)	-0.09	0.09	-0.08	1.00								
Colombia	**0.54**	0.08	0.21	-0.04	1.00							
Peru	**0.62**	**0.30**	**0.30**	-0.13	**0.30**	1.00						
Chile	0.25	0.22	-0.03	0.07	0.02	0.21	1.00					
Ecuador	**0.30**	-0.07	0.01	0.03	**0.31**	**0.35**	0.24	1.00				
Costa Rica	**0.32**	0.07	0.25	-0.31	0.21	**0.53**	-0.22	-0.09	1.00			
Uruguay	0.19	0.14	0.09	0.02	0.25	0.20	**0.34**	0.21	0.04	1.00		
Bolivia (Plurinational State of)	**0.54**	0.22	0.15	0.17	**0.43**	**0.55**	**0.46**	**0.36**	0.04	**0.35**	1.00	
Paraguay	**0.47**	0.20	0.23	0.03	0.27	**0.39**	**0.29**	**0.35**	0.04	**0.57**	**0.45**	1.00

Percentage of simple correlation coefficients between variations in international reserves that were significant and positive
(As a percentage of the total, by groupings of countries)

	Medium-sized and large	Small
Medium-sized and large	33.3	-
Small	37.1	50.0

Source: prepared by the authors on the basis of World Bank, Development Indicators [online database].

Note: the annual variation of the terms of trade index for goods and services was used. Coefficients that are positive and significant at the 5% level are in bold. Coefficients that are negative and significant at the 5% level are shaded.

These findings are evidence in favour of the viability of the fund, because any simultaneous loss of reserves would come mainly from the small countries, whose liquidity requirements are always more manageable than those of medium-sized and large countries.

3. Capital flows

For net capital flows, only 17 of 66 coefficients (26% of the total) were significant and positive (see table 3). These findings provide initial evidence that capital-account shocks in the countries would not be simultaneous. In other words, systemic shocks and/or widespread financial contagion that would spark net capital outflows from the countries at the same time are not the rule.

The analysis based on groups of countries shows that the proportion of positive and significant correlations is low in all cases. Moreover, within the group of large and medium-sized countries, there are a few cases of significant but negative correlations, which provides evidence that in such cases there is no co-movement in capital flows but rather that they move inversely.

4. How simultaneous are sudden stops in capital flows?

The analysis set out in the foregoing sections hereof was completed by examining the simultaneity of sudden stops in capital flows. Doing so provides an objective measure of the degree of timing coincidence between sudden reversals of net capital inflows to the 12 countries reviewed. Such an analysis avoids two substantial weaknesses in the correlations methodology. First, contemporaneous correlation coefficients do not take account of the effect of lag structures on correlations between pairs of countries, which could impact the financial viability of the fund. Second, nor does it consider the effect of correlation risk: the fact that correlations can be low during "normal" periods but increase precisely in times of crisis, detracting from the fund's financial viability (see, for example, Levy-Yeyati, Castro and Cohan, 2012).

TABLE 3

Simple correlation coefficients between capital flows

(Net financial account in dollars, quarterly data, 2000-2011)

	Brazil	Mexico	Argentina	Venezuela (Bolivarian Republic of)	Colombia	Peru	Chile	Ecuador	Costa Rica	Uruguay	Bolivia (Plurinational State of)	Paraguay
Brazil	1.00											
Mexico	**0.36**	1.00										
Argentina	**0.34**	-0.02	1.00									
Venezuela (Bolivarian Republic of)	-0.48	0.05	-0.22	1.00								
Colombia	**0.61**	**0.36**	0.23	-0.33	1.00							
Peru	**0.65**	**0.34**	0.14	-0.41	**0.44**	1.00						
Chile	0.05	0.10	-0.20	-0.19	0.13	-0.03	1.00					
Ecuador	0.11	0.10	-0.10	-0.22	0.24	0.19	0.19	1.00				
Costa Rica	0.27	0.14	0.03	-0.09	**0.44**	**0.51**	-0.03	0.12	1.00			
Uruguay	0.17	-0.04	0.16	-0.13	0.26	0.20	0.25	0.01	**0.40**	1.00		
Bolivia (Plurinational State of)	0.06	**0.47**	-0.20	0.01	-0.24	0.22	**0.35**	0.05	-0.14	-0.08	1.00	
Paraguay	**0.32**	**0.41**	0.29	0.00	**0.44**	0.30	0.02	0.06	**0.37**	**0.32**	0.04	1.00

Percentage of simple correlation coefficients between capital flows that were significant and positive

(As a percentage of the total, by groupings of countries)

	Medium-sized and large	Small
Medium-sized and large	33.3	-
Small	20.0	30.0

Source: prepared by the authors on the basis of International Monetary Fund, International Financial Statistics (IFS).

Note: coefficients that are positive and significant at the 5% level are in bold. Coefficients that are negative and significant at the 5% level are shaded.

With the Calvo, Izquierdo and Mejía methodology (2004 and 2008), sudden stops in net capital flows were identified for each of the 12 subject countries, using monthly data for the period between January 1990 and December 2011. Considering that, for most of the countries, the capital flows appearing in balance-of-payments statistics are quarterly, a monthly proxy (like the one employed by these authors) was used for these flows (see annex 2 for an explanation of the methodology used).

The findings are set out in figure 1, with a focus on the following crisis periods: the tequila crisis (1994-1995); the Asian/Russian/Brazilian crisis (1997-1999); the Argentine crisis (2001-2002); and the global crisis (2008-2009). The shaded cells show the periods during which the countries experienced sudden stops. As can be seen, the methodology captures many of the sudden stops highlighted in the literature, such as in Mexico in 1994-1995, Brazil in 1998-1999 and Argentina in 2001-2002.

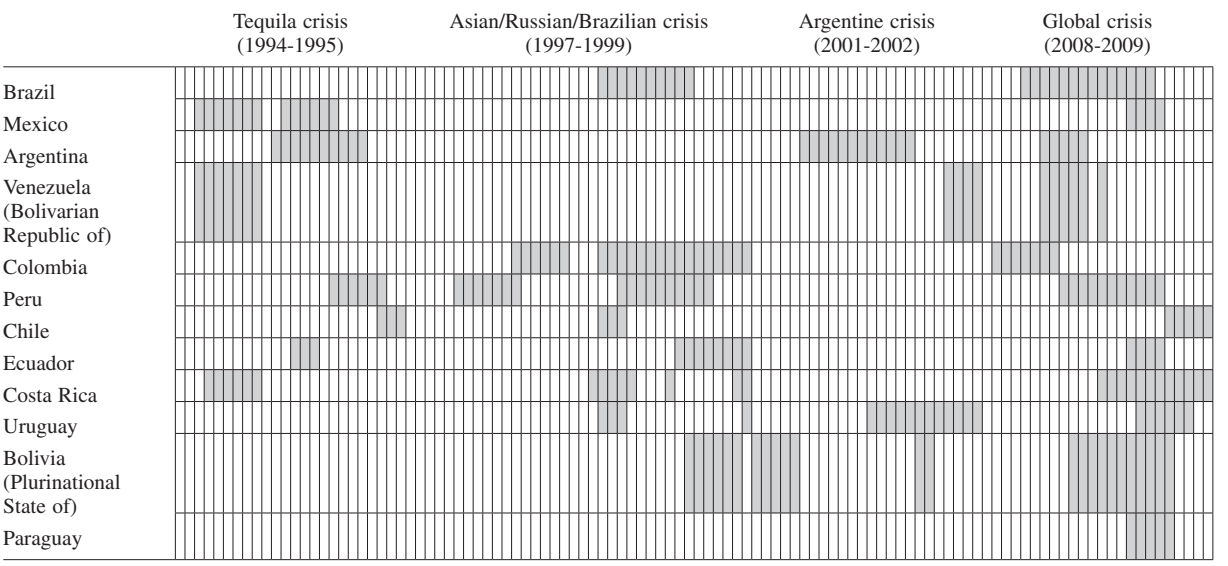
Other known events, like the short-term capital outflows from Argentina in 1999, are not detected by this methodology because, in this case, short-term financial outflows were offset by privatizations that drew a high volume of foreign direct investment (FDI) into the country. We see this as a methodology advantage because the aim is to detect sudden stops in total external financial flows to the countries, regardless of their form.

These findings were used to calculate the percentage of countries simultaneously undergoing a sudden stop episode in each period (see figure 1). This was done on an annual basis, meaning that if a country experienced a sudden stop in the first half of a given year and another country underwent one in the second half of the same year, the two episodes were taken as simultaneous for the purpose of our calculations.[6]

[6] Episodes starting in one year and running into the following year were attributed to the latter (for instance, some of the sudden stops that began in late 2008 and lasted into 2009 were attributed to 2009).

FIGURE 1

Sudden stops in net capital flows, 1994-2009



Source: prepared by the authors.

Note: sudden stops in net capital flows are shaded.

This makes sense, because if two countries experience balance-of-payments constraints with slight time lags it is, for a reserve fund, as if they were simultaneous because the funds disbursed to the first country might not be available for another country requesting assistance shortly afterward.

As can be seen, only in 1999 and 2009 were there simultaneous episodes in a majority (more than 50% of the total) of the countries. However, in both cases the simultaneous episodes occurred primarily in the group of small countries and not so much between the medium-sized and large countries. Moreover, the 2009 crisis was widespread: as the term "global crisis" indicates, it basically impacted the entire world in one way or another. It can thus be said that this most recent crisis was more an exception than the rule insofar as sudden stop episodes in the countries of the region are concerned.

The findings are consistent with those obtained during the correlations analysis, providing further evidence as to the financial viability of expanding FLAR to this set of 12 countries.

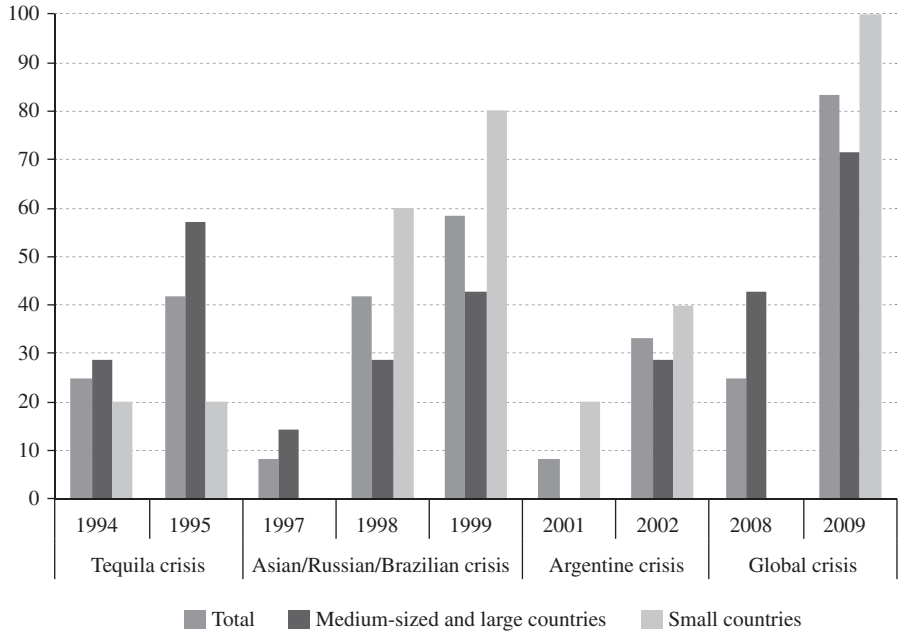
Systemic crises and widespread contagion are not the mode; instead, sudden stops tend to occur simultaneously in a certain percentage of countries but not in all of them. Moreover, in the two years with the highest percentage of simultaneous events, these were sudden stop episodes in small countries. For the medium-sized and large countries simultaneous events are less frequent.

The findings presented here are in line with historical usage of FLAR facilities by its members. The credit lines have been used more frequently during crisis periods, especially during the external debt crisis of the early 1980s, when FLAR extended loans to almost all of its member countries. However, in all subsequent crises, only a minority of member countries sought simultaneous support to meet liquidity needs (see figure 3). The reason might be that countries do not run into balance-of-payments difficulties simultaneously, but it also means that FLAR is not the only line of defence for its member countries but rather one instrument in a wider array of support options.[7]

[7] To cite an example, during the global crisis (in 2009), Colombia opted to request a nearly US$ 10.5 billion precautionary loan (flexible credit line, FCL) from the International Monetary Fund (IMF) despite being a FLAR member country.

FIGURE 2

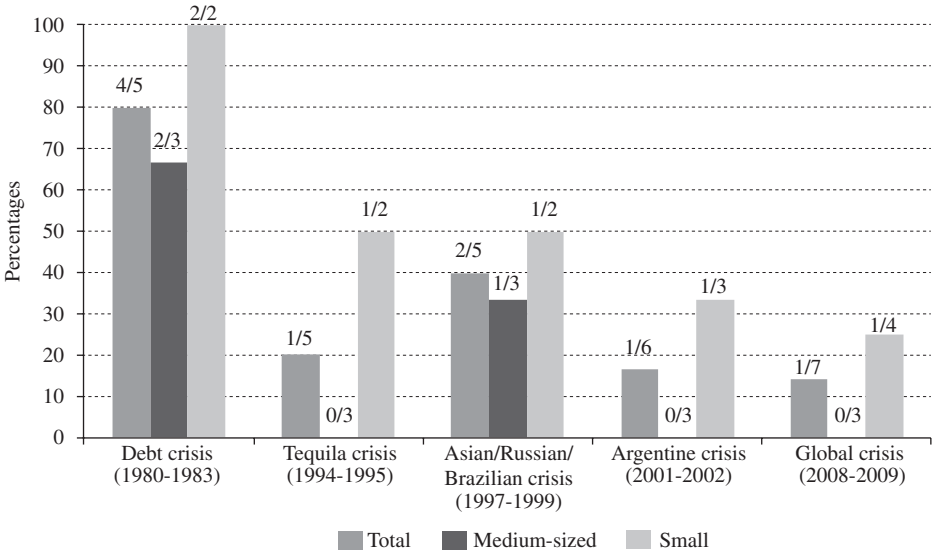
Countries undergoing sudden stop episodes at the same time, 1994-2009
(Percentages of total in each group)



Source: prepared by the authors.

FIGURE 3

Percentage of member countries drawing on FLAR during crisis episodes
(Balance-of-payments and/or liquidity loans)



Source: prepared by the authors on the basis of figures provided by the Latin American Reserve Fund (FLAR).

Note: the figures above the bars show the number of countries borrowing from FLAR over the total number of member countries at the time. The grouping of medium-sized countries includes the Bolivarian Republic of Venezuela, Colombia and Peru; the grouping of small countries includes Costa Rica (only since 1999), Ecuador, the Plurinational State of Bolivia and Uruguay (only since 2008). Only balance-of-payments and/or liquidity loans were taken into consideration. The figures 0/3 mean that none of the three countries belonging to the grouping of medium-sized countries borrowed from FLAR.

III

Size of an expanded FLAR

Deciding on the size of a reserve fund requires, first of all, drawing on historical experience to estimate the member countries' potential funding needs arising from balance-of-payments constraints.

Second, as discussed, the fund should be sized to cover the most likely scenarios (according to our findings, those where just a percentage of countries —usually, the smaller ones— need funding at the same time because of balance-of-payment constraints), with leveraging mechanisms in place for cases in which its capital is insufficient.

1. Potential funding needs

Potential funding needs were proxied by variations in net capital flows towards the countries (see table 4) as in Agosin and Heresi (2011) during the crisis episodes regarded as most representative for the region. The reason for taking variations in net flows instead of net flows per se is that for any given country the variation in available funding is more relevant than the absolute amount. If a country receives considerable funding in a given year and a drastically lower but still positive amount the following year, this could still be regarded as a sudden stop. The country would have to make a current-account adjustment or lose international reserves in order to counterbalance the decline in external funding.

The findings show, first, that funding needs have been disparate and vary significantly from one crisis to another. Second, the maximum funding needs shown in table 4 represent an upper bound determined by extreme need scenarios. For the reasons given earlier, it is therefore more useful to consider the statistical median of the data when deciding what size the fund should be.[8]

[8] The statistical median has an advantage over the average (which is another measure of central tendency) in that it is not sensitive to extreme values in the distribution. That is why the median would be the same if the figure for 2008 had not been so extreme.

TABLE 4

Expanded FLAR member countries: annual variations in net capital flows
(Billions of dollars)

	Tequila crisis		Asian/Russian/Brazilian crisis			Argentine crisis		Global crisis		Statistical median
	1994	1995	1997	1998	1999	2001	2002	2008	2009	
Brazil	1.0	21.6	-7.0	-3.2	-13.0	-13.6	-19.5	-46.6	11.3	
Mexico	-18.0	-26.3	11.1	-5.4	-4.5	12.8	-8.3	-3.7	1.0	
Argentina	-8.3	-6.4	8.1	-0.1	-5.1	-23.6	-6.5	-15.5	2.1	
Venezuela (Bolivarian Republic of)	-6.4	0.0	2.7	2.3	-3.4	2.4	-8.2	-1.1	11.4	
Colombia	0.6	1.3	0.4	-3.3	-4.5	2.1	-0.3	0.5	-2.3	
Peru	3.0	-0.2	2.0	-3.9	-1.2	0.6	0.4	0.6	-6.1	
Chile	2.8	-3.1	1.4	-4.8	-0.7	-1.8	-1.0	24.3	-10.3	
Ecuador	0.4	-0.4	-0.1	1.5	-2.8	7.1	0.5	-0.2	-1.7	
Costa Rica	-0.2	0.6	0.1	0.1	0.5	0.3	0.6	-0.1	-2.0	
Uruguay	0.3	-0.1	0.4	-0.1	-0.4	-0.3	-2.4	1.2	-1.8	
Bolivia (Plurinational State of)	0.0	0.2	0.2	0.3	-0.3	0.0	0.2	1.2	-0.3	
Paraguay	0.2	0.0	0.3	-0.1	-0.2	0.1	-0.1	-0.1	-0.1	
Total	-32.9	-36.5	-7.1	-20.8	-36.1	-39.2	-46.3	-67.4	-24.6	-36.1
Total medium-sized countries	-14.7	-9.7	0.0	-12.1	-14.8	-25.4	-16.0	-16.6	-18.7	-14.8
Total small countries	-0.2	-0.5	-0.1	-0.2	-3.7	-0.3	-2.5	-0.4	-5.9	-0.4

Source: prepared by the authors on the basis of International Monetary Fund, International Financial Statistics.

Note: refers to the balance-of-payments capital and financial account, excluding exceptional financing and including only the portion of FDI that corresponds to net inflows towards each economy. The bottom three rows of the table show sums (by groups of countries) of the variations in flows, considering only those that are negative.

For the group of 12 countries, the median value of funding needs is US$ 36.1 billion. For the group of medium-sized countries it is US$ 14.8 billion; for the group of small countries it is US$ 400 million.

Based on these estimates, an expanded flar with a size (paid-in capital) of between US$ 9 billion and US$ 10 billion, which could be leveraged to generate somewhat more than US$15 billion in lending resources, would provide the member countries with an adequate level of coverage for their liquidity needs.

2. Capital contribution scenarios and resource mobilization capacity of the fund

Set out below are two capital contribution and resource mobilization scenarios consistent with the estimated figures provided in the section above. In the first scenario, the capital contributions follow the rationale governing the Latin American Reserve Fund (FLAR). In the second scenario, the capital contributions made by the countries are determined by the formula used for assigning International Monetary Fund quotas.

3. Scenario following the FLAR contribution rule[9]

In the first scenario, the current flar member countries would maintain their contribution rate; contributions by "new" countries would be in keeping with their relative size within the group.[10]

Following this model would take the fund's total capital to nearly US$ 9 billion, equivalent to 1.4% of the total stock of international reserves of the 12 subject countries. A fund of this size (completely unleveraged) could simultaneously cover potential demand from the entire group of small countries along with half of the needs of medium-sized countries for a total of US$ 7.8 billion (see figure 4(a)).

Leveraging the fund's capital via medium- to long-term borrowing up to a ratio of 65% of its paid-in capital (as is currently authorized by FLAR) would generate lending resources totalling US$ 13.29 billion.[11] This volume of resources would enable the fund to simultaneously cover more than 85% of the potential needs of all the member countries, except for the two largest in the group, estimated at US$ 15.3 billion.

Implicit in a fund so designed is the fact that the large countries (notably, Brazil and Mexico, but also a few medium-sized countries in scenarios where the fund's resources are insufficient) would utilize alternative sources of funding and only turn to the fund as a back-up line of defence.

While the large countries' contribution to the fund's capital base is very important in this scenario (44% of total capital), their participation cost is not high in terms of their total stock of international reserves nor in comparison with their International Monetary Fund quota (see table 5).

By participating in an initiative of this kind, these countries would be playing a leading role in regional financial cooperation that could even bring them benefits stemming from greater financial stability region-wide. The fact that the countries' capital contributions could count as part of their stock of international reserves (as is currently the case with the International Monetary Fund) would be a further incentive.

4. Scenario following the IMF contribution rule

In this scenario, the countries' capital contributions are determined on the basis of the IMF quota formula, but they are then rescaled in keeping with a fund the size of flar, that is, a fund whose drawdown multiple is 2.5 times contributions (see annex 1) and not 6 times as with the International Monetary Fund.[12]

The simple way to determine contributions under this rule is to take the existing International Monetary Fund quotas for the countries and rebase them (rule

[9] In early July 2012 FLAR approved a 40% increase in subscribed capital. This scenario is based on capital after completion of the increase. The scenarios assume that the subscribed capital is wholly paid in.

[10] For example, Paraguay (as a small country) would contribute the same as the small countries that are members of FLAR (Costa Rica, Ecuador, Plurinational State of Bolivia and Uruguay): some US$ 328.2 million. Argentina and Chile would contribute the same amount as the medium-sized FLAR member countries (Bolivarian Republic of Venezuela, Colombia and Peru), that is, some US$ 656.3 million each or double the contribution for small countries. For Brazil and Mexico, the two largest countries in the group, this scenario assumes that each one would contribute three times the medium-sized country contribution, or some US$ 1.969 billion.

[11] Lending resources, or *LR*, are calculated as follows: $LR = K + 0.1K - 0.25K + eK$, where K is paid-in capital and e is the debt ratio, assuming that reserves are 10% of paid-in capital and that 25% of paid-in capital is for operations (see Alonso, Magali and Villa, 2012).

[12] Borrowing from IMF is capped at 200% of a country's quota annually and up to 600% cumulatively. IMF quota shares are set by IMF using a formula that weighs four variables: the size of its economy (measured as a blend of GDP based on market exchange rates and purchasing power parity); international reserves; openness (measured as the sum of current external payments and receipts); and variability of current external receipts and capital flows. See details at http://www.imf.org/external/np/pp/eng/2012/021012.pdf.

TABLE 5

Comparison of country contribution efforts[a]
(Percentages)

	Contribution, scenario 1	Contribution, scenario 2	IMF quota
Brazil	0.68	0.94	2.27
Mexico	1.63	1.93	4.63
LARGE COUNTRIES	0.96	1.23	2.96
Argentina	1.26	2.60	6.24
Venezuela (Bolivarian Republic of)	2.21	5.75	13.79
Colombia	2.34	1.77	4.24
Peru	1.48	0.93	2.22
Chile	2.36	1.97	4.73
MEDIUM-SIZED COUNTRIES	1.80	2.48	5.95
Ecuador	12.51	8.50	20.40
Costa Rica	7.09	2.27	5.45
Uruguay	4.29	2.57	6.16
Bolivia (Plurinational State of)	3.37	1.13	2.71
Paraguay	7.88	1.54	3.69
SMALL COUNTRIES	5.70	2.42	5.82
TOTAL expanded FLAR	1.43	1.66	3.97

Source: prepared by the authors on the basis of International Monetary Fund (IMF) [online] http://www.imf.org/external/np/sec/memdir/members.aspx#1; and World Bank, World Development Indicators [online database].

Note: data as of year-end 2010 were used for the stock of international reserves.
[a] Contribution to the expanded FLAR (scenarios 1 and 2) and IMF quota as a percentage of international reserves.

of three). If a country's IMF quota is x million dollars, the theoretical contribution to the new, expanded FLAR should be $x^*\left(\frac{2.5}{6}\right)$.[13]

In this scenario, the total capital of the fund would be US$ 10.3 billion. As in the first scenario, this fund would be able to simultaneously cover the potential needs of the entire group of small countries and half of the potential needs of the group of medium-sized countries (for a total of US 7.8 billion) without leveraging.

Under this scenario, were the fund to leverage its capital by borrowing at a ratio of up to 65% of paid-in capital it would generate US$ 15.4 billion in lending resources and thus easily cover all of the potential needs of the entire group of small and medium-sized countries —estimated at US$ 15.3 billion (see figure 4(b)).

5. Ways to "broaden the financial shoulders" of the regional fund

The regional fund is part of a broader network of components of the global financial architecture, so it should be feasible to provide the fund with mechanisms for broadening its scope through leveraging or by means of joint action with other institutions, such as the International Monetary Fund, in the event its capital falls short of member country needs.[14]

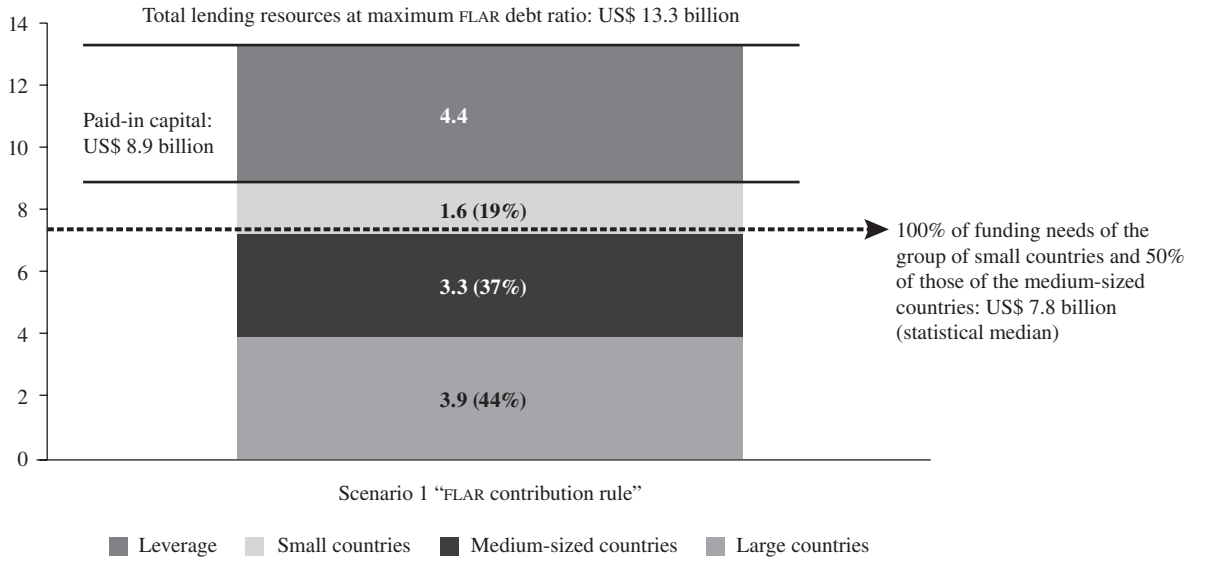
A first option would be for the fund to have signed dollar-denominated loan commitments, either with member countries or with countries outside the arrangement. Loan commitment agreements in favour of the reserve fund would be contingent and would be activated at the request of the fund. All of the loan conditions (term, interest rate and renewability, among others) should be pre-negotiated and spelled out in the

[13] The quotas were actually calculated in SDRs (Special Drawing Rights, an international reserve asset created by IMF, whose value is based on a basket of currencies comprising the US dollar, the euro, the Japanese yen and the pound sterling) and converted to dollars at the average US$/SDR exchange rate for March, April and May 2012.

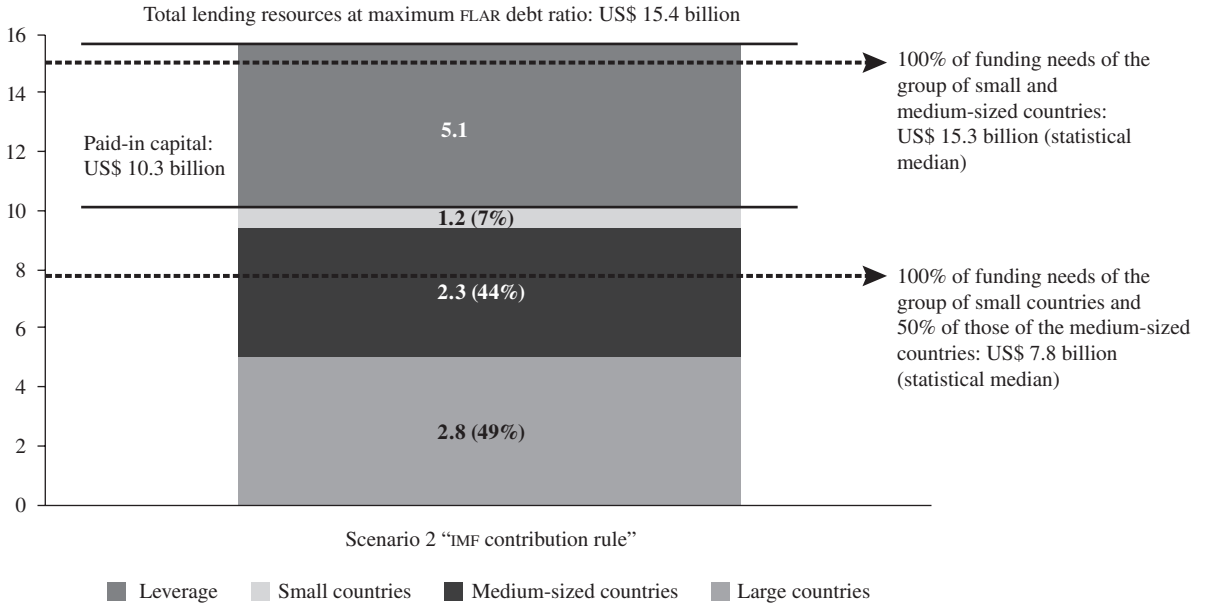
[14] Ideally, these alternatives for enabling the fund to draw on extra resources if needed should be pre-negotiated, thus providing more streamlined and less costly access than would be the case if they had to be negotiated once the need arose.

FIGURE 4

(a) Size of an expanded FLAR according to the "FLAR contribution rule"
(Billions of dollars)



(b) Size of an expanded FLAR according to the "IMF contribution rule"
(Billions of dollars)



Source: prepared by the authors.

IMF: International Monetary Fund.

loan agreements so that there is no need to negotiate them upon activation. The fund would therefore have, if necessary, streamlined access to resources beyond its own capital. The loan commitments would be similar to the New Arrangements to Borrow (NAB) established by IMF as a way to expand its lending capacity if needed. In our region, three countries (Brazil, Chile and Mexico) are IMF NAB participants, for some US$ 13.5 billion, US$ 2.1 billion and US$ 7.7 billion, respectively.

For countries signing loan agreements, interest rates (if and when the agreements were activated) would probably not be high, but neither should they be much lower than those obtained by Latin American central banks for the portion of their reserves invested in "safe" instruments. For example, if the system adopted is similar to the IMF NAB, the SDR interest rate would apply. In addition, the credit risk borne by countries signing agreements would be that of the reserve fund and not that of the individual member countries potentially borrowing from it.

Among the other options, the fund could have pre-negotiated stand-by lines of credit with international private banks (Agosin and Heresi, 2011) or debt instrument purchase agreements signed with interested countries. The International Monetary Fund recently made use of this option. Since 2009 it has signed agreements with a number of countries that have committed to purchase IMF notes if needed to boost IMF lending resources. For example, in 2010 Brazil signed an agreement to purchase up to US$ 10 billion in IMF notes.

In view of statutory limits on leveraging and constraints stemming from its potential negative impact on a fund's credit rating, a third option would be for the fund to seek joint action coupled with another arrangement —with IMF, for example.[15]

The possibility of IMF complementing a regional fund's packages for some of its member countries by means of a bilateral loan or a loan to the regional fund itself has already been considered by IMF in some of its documents, but this would require amending the provisions of the IMF Articles of Agreement concerning the conditions governing use of its General Resources Account (GRA) (Henning, 2011). Even if the amendment were made and this alternative became possible, there would be issues to be resolved in each case that are neither evident nor direct. For instance, it would have to be determined exactly how much the regional fund and IMF would contribute to the joint package, which one would set the eligibility requirements for the credit and which one would be responsible for surveillance (Henning, 2011).

[15] Higher leverage can trigger credit rating downgrades along with their concomitant negative consequences. See, for example, Levy-Yeyati and Cohan (2011).

IV

Governance challenges for an expanded FLAR

FLAR has positive attributes that include responsiveness and flexibility for facing external shocks. Also worthy of note is the strong sense of ownership on the part of its member countries, reflected in its solid position as senior creditor. In addition, its low loan conditionality helps keep borrowing from FLAR from being a stigma for the countries.

Meshing these attributes with the governance structure of an expanded FLAR with a broader membership and a greater volume of resources under its administration poses major challenges in terms of (i) voting mechanisms and their relationship to decision-making authority; (ii) criteria for allocating financial resources; and (iii) surveillance mechanisms.

1. Voting mechanisms and decision-making authority

In FLAR, member country voting power in the decision-making bodies (the Assembly of Representatives and the Board of Directors) is not based on the amount contributed to the fund's resource pool. Each member country has a chair and one vote on each body.[16] This, plus the fact that decisions by both bodies are adopted

[16] Under the "one country, one vote" rule, the capital paid in by the countries must be above a certain threshold. All of the member countries are currently in compliance with this rule, so all of them are entitled to their vote.

by affirmative vote of 75% of the total representatives or directors attending, means that, in practice, decisions adopted are supported by a clear majority of the countries. In order to ensure that all voices are heard, FLAR requires a super-majority, where negative votes do not exceed 20% of the total votes cast, for agreements reached by the Assembly of Representatives on essential issues (FLAR, 2012).[17]

This setup has bred a strong sense of ownership of the institution among its member countries, as seen in its sound position as senior lender. The member countries have always fulfilled their commitments to FLAR, even during sovereign debt moratoriums.[18] In turn, the fund's position as senior creditor is one of the reasons for its very good credit risk ratings —better than any of its individual member countries and, indeed, the best in Latin America at present (see Ocampo, 2012; Ocampo and Titelman, 2012).[19] Of course, a good credit rating enables FLAR to access the financial markets on advantageous terms and, therefore, lend to its member countries on terms that are more favourable than the ones they could obtain in the private credit markets (Ocampo, 2012).

FLAR governance in terms of voting mechanisms and decision-making authority stands in stark contrast to other global and regional arrangements, where voting power is concentrated in a handful of countries and the other members therefore have less of a say.

Voting power in the International Monetary Fund, for instance, is closely linked to each country's financial contribution. Of a total of 188 member countries, the 10 largest contributors together account for 55% of IMF resources and concentrate more than half of the voting power. In the Chiang Mai Initiative Multilateralization (CMIM), China, Japan and the Republic of Korea are the biggest contributors; they account for 80% of the contributions to the arrangement and concentrate more than 70% of the votes. As the Executive Level Decision Making Body (ELDMB) decisions require a two-thirds majority of votes, in practice this means that these three countries can make most of the decisions on their own.[20]

These examples make plain the major challenge an expanded FLAR would face in terms of decision-making mechanisms. Some thought should be given as to the feasibility of maintaining the "one nation, one vote" principle in an expanded FLAR with countries contributing very different amounts and with a high percentage of total contributions concentrated in larger countries like Brazil and Mexico. The alternative would be a mechanism in which voting power is more concentrated.

2. Credit eligibility requirements

Setting a fund's loan eligibility requirements is another crucial issue that poses substantial challenges.

The classic dilemma for a reserve fund lies in determining to what extent member countries should be able to access resources quickly and flexibly (that is, with little or no conditionality) and to what extent access should be subject to compliance with certain conditions aimed at counterbalancing potential moral hazard issues and situations of nonpayment by the countries.

FLAR essentially sets no conditionalities. This is one of its governance features that sets it apart from other funds, which usually have explicit or implicit conditionalities. However, these conditionalities have sometimes acted, in practice, as barriers to access, leading the countries to prefer not tapping the arrangements that impose them.

At the International Monetary Fund, for example, establishing conditionalities for accessing the Stand-By Arrangements, or SBA, that until recently were the ones most often approved for medium-income countries facing a crisis, contributed, over time, to negative perceptions of countries that had needed to turn to IMF. There was a kind of stigmatization in that borrowing from IMF meant that the country had run into difficulties because of poor economic policies. Obviously, a reserve fund that is subject to such stigmatization can do little to support its members in times of crisis. For one thing, stigmatization itself can exacerbate the crisis; for another, adjustment policy conditionalities imposed on a country can themselves end up worsening its economic performance.[21]

In the Chiang Mai Initiative Multilateralization, conditions for accessing financial support also posed problems. While the conditions are not explicit, there is an "IMF link" whereby more than 20% of the amount available to a country cannot be disbursed unless it

[17] A super-majority is required for agreements concerning capital increases, creation of special funds, amending the agreement for the establishment of the fund and changing credit limits and terms (FLAR, 2012).

[18] See Ocampo and Titelman (2009).

[19] The rating agencies themselves note its position as senior creditor as one of the reasons for giving FLAR good risk ratings (see, for example, Moody's, 2008 and Standard & Poor's, 2008).

[20] As with FLAR, the Chiang Mai Initiative Multilateralization (CMIM) has a different rule for decisions on what are regarded as core issues, which must be made by consensus.

[21] For a review of conditionalities and adjustment programmes imposed on countries under loan programmes approved by IMF since 1995, see Henning (2011).

first enters into an agreement with the International Monetary Fund. It is thought that the IMF link is exactly what kept the participating countries from drawing on the CMIM even in times of great need such as the recent global crisis.[22]

It is not obvious that the FLAR experience could be replicated in other arrangements or even in a FLAR with more members and funding, but it does seem that greater lending flexibility is a positive attribute that all reserve funds should seek.[23]

Indeed, in the wake of the most recent crisis (2008-2009), recognition of this attribute has been seen in the trend towards more flexible conditions for liquidity support under several arrangements.

At the height of the global crisis, IMF reformed its stand-by arrangements to make them more flexible and responsive to countries' needs.[24] Caps on access were increased, as were initial disbursement amounts, and conditions were streamlined. In addition, IMF created its Flexible Credit Line (FCL), which is approved for pre-qualified countries without ex-post target or policy conditions.[25]

The CMIM has also gone in the direction of more flexible ways to provide financial assistance to its members. It recently decided to increase the IMF de-linked portion of its loans and established the CMIM Precautionary Line (CMIM PL), modeled on the IMF FCL, that will have ex-ante conditions instead of ex-post ones.[26]

The expanded FLAR should consider whether to maintain the existing set-up for lending without conditions or introduce some kind of conditionality, such as ex-ante requirements. The latter would pose a significant challenge because macroeconomic policies differ from country to country and it is not clear that they could all agree on what the "appropriate" ex-ante requirements might be. Nor is it clear that they could agree on how to monitor and assess a country's compliance with its conditions.

3. Surveillance mechanisms

Surveillance mechanisms are a third area that poses challenges for an expanded FLAR. Surveillance refers to the processes for monitoring and consulting regularly with fund members to help the countries detect potential vulnerabilities early and thus help ward off crises (Ciorciari, 2011).

Designing a fund's surveillance system is no trivial matter, as it involves sensitive policy issues at the country level. Surveillance between peers through regional arrangements is especially sensitive and does not lack for problems, because countries often prefer not to sit in judgement of neighbour country policies. This issue is compounded by the fact that it is not clear what regional arrangements might have the capacity (not only in terms of technical independence but also in terms of sufficient financial and human resources) to conduct the requisite surveillance.

In Asia, when the Chiang Mai Initiative was multilateralized (2010) there were already formalized surveillance mechanisms that had not been successful. The Economic Review and Policy Dialogue (ERPD), intended to facilitate the voluntary exchange of information between countries, as well as peer reviews, had run into obstacles because the countries did not always provide information on a timely basis or in the right way and were generally reluctant to criticize their neighbours' policies (Ciorciari, 2011). The Macroeconomic and Financial Surveillance Office (MFSO), established in 2008, had been underresourced and had, moreover, run into serious political obstacles. Its reports could be revised by the countries, which could delete sections they did not agree with or could prove embarrassing.

[22] Strictly speaking, what was in effect in Asia in 2008 was the precursor to CMIM, then referred to as the Chiang Mai Initiative (CMI). It consisted of a network of bilateral foreign exchange swap facilities among the countries and also had an IMF link for access to credit. CMI was never used. Although the Republic of Korea had US$ 18.5 billion in swap agreements through CMI, during the global crisis it turned to a US$ 30 billion bilateral swap arrangement with the United States Federal Reserve because only US$ 3.7 billion could have been drawn without being part of an IMF programme. Moreover, some believe that entering such a programme would have been "political suicide" for the government after its bad experience during the 1997-1998 crisis (see Sussangkarn, 2010; Dixon, 2012). Singapore and Indonesia, as well, sought a swap line with the Federal Reserve during the global crisis instead of tapping CMI, although one was not provided for Indonesia.

[23] The fact that FLAR does not tie its conditions to those of other funds (as CMIM does with its IMF link) is without question another factor contributing to the greater sense of ownership by its member countries.

[24] See IMF [online] http://www.imf.org/external/spanish/pubs/ft/survey/so/2009/new032409as.pdf.

[25] For qualified countries (those that, according to the IMF, have very strong economic fundamentals and policy frameworks and therefore meet stringent pre-established eligibility requirements), there is no predetermined FCL cap and disbursement is immediate instead of in tranches. These lines do offer countries flexibility to draw the entire amount upon approval or else treat it as a precautionary facility. In 2011 IMF established its Precautionary and Liquidity Line (PLL) for flexibly meeting the liquidity requirements of countries with vulnerability factors that keep them from drawing on the FCL. The ≠ combines ex-ante eligibility requirements for access with some ex-post conditions focused on reducing those vulnerabilities.

[26] See the press release relating to the 15th ASEAN+3 Finance Ministers and Central Bank Governors' Meeting held in early May 2012 http://www.aseansec.org/Joint%20Media%20Statement%20of%20the%2015th%20ASEAN+3%20Finance%20Ministers%20and%20Central%20Bank%20Governors'%20Meeting.pdf).

Obviously, the outcome was reports lacking in objectivity and credibility (Ciorciari, 2011).

A key part of the negotiations for establishing CMIM therefore included setting up a strong, effective surveillance unit. The Asean+3 Macroeconomic Research Office (AMRO) was finally established in May 2011 in order to "monitor and analyze regional economies" and thus contribute to "early detection of risks, swift implementation of remedial actions and effective decision-making of the CMIM."[27] Current discussion in Asia has precisely to do with how to enhance AMRO, improve internal procedures at and coordination with the other surveillance mechanisms and make them more complementary.

While FLAR does not have a formal surveillance unit, it does monitor the macroeconomic performance of its member countries, reviewing their status, performance outlook and environment over the short and medium term.[28]

Nonetheless, it is not clear whether not having an institutionalized surveillance mechanism could continue to be an option for an expanded FLAR. It might be necessary to establish formal arrangements for this task by creating a surveillance office with the capacities needed to perform this function.

The surveillance office could and should eventually seek to divide the work appropriately with institutions, such as IMF, that at present monitor FLAR member countries. As noted by Henning (2011) concerning AMRO (but also applicable to an expanded FLAR), the regional surveillance office should be able to (i) render opinions that might sometimes differ from those of IMF concerning the vulnerabilities of the countries participating in the arrangement; (ii) provide evaluations more frequently than IMF; and (iii) participate in evaluation discussion forums jointly with IMF. In short, there should be a division of work that, while avoiding duplication of effort, yields a more complete view that is more in line with reality than would otherwise be the case.[29]

[27] See [online] http://www.aseansec.org/documents/JMS_13th_AFMM+3.pdf.

[28] Where there are outstanding loans to a country, the FLAR Division of Economic Studies usually evaluates the country's balance of payments situation and its repayment capacity over the term of the loan. This can involve technical visits to authorities and experts at the country's economic institutions, as well as reporting to the Office of the FLAR Executive President and Board of Directors. See FLAR (2010) for follow-up on the loan approved for Ecuador during the global crisis.

[29] This is something like what is happening in Asia, where IMF and Asian Development Bank (ADB) reports are taken as input for the Economic Review and Policy Dialogue.

V
Conclusions

- Strengthening the Latin American Reserve Fund (FLAR) by expanding its size and membership would be a substantial contribution to providing a regional and global public good: financial stability.
- This report sought to cast light on the viability, implications and challenges of expanding FLAR to five more countries of the region: Argentina, Brazil, Chile, Mexico and Paraguay.
- Its approach grew out of the authors' idea of what a regional reserve fund should be.
- Such funds should not be seen as the only line of defence for their member countries. Rather, they are part of a broader network of instruments and sources of support available to the countries for facing external shocks.
- As such, they help densify the international financial architecture as an additional line of defence for countries within a multilevel financial cooperation structure in keeping with principles of subsidiarity.
- This way of looking at regional reserve funds has two fundamental implications for deciding on the size of an expanded FLAR.
- It means, first, that when deciding the size of the fund it should be borne in mind that there are other sources that the member countries (especially the larger ones) can turn to for meeting liquidity needs in the face of balance-of-payments constraints.
- An expanded FLAR could therefore be much smaller than it would have to be if it were to be a lender of last resort for all of its members.
- Second, seeing the regional fund as one component of a broader global financial architecture framework means that an expanded FLAR would not necessarily have to be large enough to cover extreme scenarios. Instead, it should be sized for facing the most likely ones.
- According to this article, the most likely scenarios are those where only a certain percentage of the countries of the region run into balance-of-payments difficulties at the same time. Systemic crises and widespread contagion are not the mode.
- A fund designed to deal with these more benign scenarios should obviously be far smaller than one seeking to cover extreme scenarios.
- For addressing extreme cases (which are, according to our findings, less likely) such as a systemic crisis or widespread contagion, and even for intermediate scenarios where the fund's capital is not enough to meet the requirements of its member countries, the fund should be able to "broaden its shoulders" by leveraging its capital in order to mobilize additional resources or by acting jointly with other components of the financial architecture.
- In view of the above, basing capital contributions from new member countries on the same rationale behind the existing FLAR would yield an expanded fund totalling nearly US$ 9 billion, which is equivalent to 1.4% of the total stock of international reserves held by the 12 subject countries.
- A fund of this size, unleveraged, could simultaneously cover the potential needs of the entire group of small countries along with half of the requirements of the medium-sized countries, for a total of US$ 7.8 billion.
- Leveraging the fund's capital by borrowing, up to a medium- and long-term debt to paid-in capital ratio of 65% (the maximum authorized for FLAR), would generate lending resources totaling almost US$ 13.3 billion.
- At this volume of resources, the fund could simultaneously cover more than 85% of the potential needs of the entire group of member countries except for the two largest. These needs have been estimated at US$ 15.3 billion.
- In this contribution scenario (and in another set out herein), the amount that Brazil and Mexico —the region's two largest economies— contribute to the total capital of the fund is very important.
- However, the cost of participation for these two countries is not high, either in terms of their total stock of international reserves or in comparison with their IMF quotas.
- By participating in an initiative of this kind, both countries would be playing a central role in promoting regional financial cooperation —a role that would even provide them the benefits stemming from greater regional financial stability.
- The fact that capital contributions from the countries could count as part of their stock of international reserves (as is now the case with the International Monetary Fund) would be an additional incentive.

- Aside from the potential benefits of an expanded FLAR, working towards bringing in new members would pose major challenges for fund governance, that is, decision-making and surveillance mechanisms and criteria for allocating funding.
- The existing FLAR has been shown to have a number of positive attributes, among them the strong sense of ownership on the part of its member countries that is, in practice, reflected in the fund's solid position as senior creditor, its quick and timely response, and its low loan conditionality that helps to keep borrowing from FLAR from being stigmatizing for the countries.
- The governance of an expanded FLAR should be in line with a fund with more members and resources while seeking not to lose the positive attributes that in many cases set FLAR apart from other global and regional funds.

ANNEX 1

TABLE A.1

Comparison of three regional reserve funds

Member countries	Objectives	Types of credit facilities	Management	Relevance for member countries
		Latin American Reserve Fund (FLAR) 1989		
Bolivarian Republic of Venezuela, Colombia, Costa Rica, Ecuador, Peru, Plurinational State of Bolivia, and Uruguay	(i) Provide financial balance-of-payments support to member countries; (ii) improve the conditions for member country reserve investments; and (iii) help harmonize member country monetary and financial policies.	Balance-of-payments support loans: three years plus one-year grace period for capital subscriptions. The access limit is 2.5 times paid-in capital. The interest rate is three-month LIBOR plus 400 basis points. Must be approved by the Board. Public external debt restructuring loans: Three years plus one-year grace period for capital subscriptions. The access limit is 1.5 times paid-in capital. The interest rate is three-month LIBOR plus 400 basis points. Must be approved by the Board. Liquidity loans: terms of up to one year. The access limit is 1 time paid-in capital. The interest rate is three-month LIBOR plus 150 basis points. Approval requires clearance by FLAR Executive President. Contingency loans: six months, renewable. The access limit is 2 times paid-in capital. The interest rate is three-month LIBOR plus 150 basis points. Approval requires clearance by FLAR Executive President. Treasury loans: terms from 1 to 30 days, with an access limit of 2 times paid-in capital. Approval requires clearance by FLAR Executive President.	The countries made capital contributions (reserves) to FLAR, which manages the resources contributed by the countries.	The size (paid-in capital) of FLAR is US$ 2 billion (data from March 2012), which is approximately 1.61% of the average stock of international reserves held by its member countries and 0.21% of their GDP, although the relative importance of each member country's capital contribution varies.
		Arab Monetary Fund (AMF) 1977		
Twenty-two members of the Arab League of States: Jordan, United Arab Emirates, Bahrain, Tunisia, Algeria, Djibouti, Saudi Arabia, Sudan, Syria, Somalia, Iraq, Oman, Palestine, Qatar, Kuwait, Lebanon, Libya, Egypt, Morocco, Mauritania, Yemen and Comoros	(i) Correct balance-of-payments disequilibria in the member States; (ii) promote exchange-rate stability among member States; (iii) establish policies and modes of monetary cooperation that favour integration; (iv) render advice, upon request, with regard to the investment of the financial resources of member States in foreign markets; (v) promote the development of Arab financial markets; (vi) promote the use of a common unit of account (the Arab dinar) and the creation of a unified Arab currency; (vii) coordinate member State positions on international monetary and economic issues; and (viii) settle current-account balances between States in order to promote trade.	Balance-of-payments loans: there are four modalities: automatic (up to 75% of the paid subscription); ordinary (up to 100% of the paid subscription); extended (up to 175% of the paid subscription); and compensatory loans (up to 100% of the paid subscription). Some of these can be combined, bringing the access limit up to 250% of the paid subscription. Structural Adjustment Facility (SAF): for funding sectoral structural reforms in the States, focusing on sectors within the fund's purview (finance, banking and public finance). As a rule, loans under the SAF are capped at 175% of the paid subscription but a State can apply for more than one. Since 2007 there is a facility for States that are net importers of petroleum, capped at 200% of the paid subscription. Loans for States facing liquidity constraints: this new facility was approved in 2009 for States that have a sound track record but are facing liquidity constraints. Access is capped at 100% of the paid contribution.[a]	The States paid in capital contributions (reserves) to the AMF, which manages the resources contributed by the States.	The size (paid-in capital) of the AMF is US$ 2.75 billion (data as of year-end 2010), which is approximately 0.26% of the average stock of international reserves held by its member States and 0.14% of their GDP. As with FLAR, the relative importance of each State's capital contribution in terms of its stock of reserves and GDP varies.

Table A.1 (*conclusion*)

Member countries	Objectives	Types of credit facilities	Management	Relevance for member countries
		Chiang Mai Initiative Multilateralization (CMIM) 2010[b]		
Member States of ASEAN+3, comprising the 10 member States of the Association of Southeast Asian Nations (Brunei Darussalam, Cambodia, Indonesia, Lao People's Democratic Republic, Malaysia, Myanmar, Philippines, Singapore, Thailand and Viet Nam, plus China, Japan and Republic of Korea)	(i) Address balance-of-payments and short-term liquidity difficulties in the region; and (ii) supplement existing international financial arrangements.	Swaps: CMIM provides liquidity to enable its member States to address balance-of-payments constraints by swapping their local currencies for United States dollars held by the fund. The States are entitled to swaps for an amount up to their contribution to the fund multiplied by a certain number (0.5 for China and Japan, 1 for the Republic of Korea, and 2.5 or 5 for the other, smaller countries). But there is an "IMF link" whereby more than 20% of the amount available to a country cannot be disbursed unless it first enters into an agreement with the International Monetary Fund. Swaps mature in 90 days and can be rolled over for up to 720 days. The interest rate is LIBOR plus 1.5%, increasing by 0.5% every 180 days up to a maximum of LIBOR plus 3%.[c] CMIM Precautionary Line (CMIM-PL): the precautionary line was established in May 2012; it has ex-ante conditions for countries to qualify. Duration of access to the facility is six months for the portion that is delinked from IMF and one year for the IMF-linked portion.	Central banks participating in the Chiang Mai Initiative Multilateralization sign letters of commitment of funds in dollars that are transferred only when a swap has been requested and approved. In practice, the international reserves remain in possession of the countries, so each country manages them on an individual basis.	The size of the swap network is US$ 120 billion (US$ 96 billion contributed by the "+3" countries and US$ 24 billion contributed by the 10 ASEAN member States). This is approximately 2.4% of the average stock of international reserves of the member States and 0.84% of their GDP. At the 15th ASEAN+3 Finance Ministers and Central Bank Governors' Meeting in early May 2012 it was decided to double the size of CMIM, to US$ 240 billion.

Source: prepared by the authors, on the basis of information from the respective funds; agreements establishing FLAR and AMF; World Bank, World Development Indicators [online database]. Calculations of international reserves are based on data including gold as of year-end 2010.

[a] For AMF, as a general rule and beyond the caps for each kind of loan, loans issued to a member over a period of 12 months shall not exceed twice the amount of its paid-up subscription. Outstanding loans to a member shall not at any time exceed three times the amount of its paid-up subscription. The Board of Governors may decide by a three-fourths majority to raise the limit to four times the amount of the paid-up subscription (Article 21 of the Agreement Establishing the AMF).

[b] Effective from March 2010. The precursor of CMIM was the Chiang Mai Initiative (CMI) established in 2000, which consisted of a network of bilateral swap arrangements between countries.

[c] In May 2012 it was agreed that the IMF de-linked portion of available credit would be increased (see footnote 26). It was also agreed that swap maturity would be extended to one year (and may be rolled over for two additional one-year periods for a total of three years) for the IMF de-linked portion. For the other portion, maturity will be lengthened from 90 days to six months, renewable three times for a total not to exceed two years.

ANNEX 2

Identifying episodes of sudden stops in capital flows

The methodology proposed by Calvo, Izquierdo and Mejía (2004, 2008) was used to determine what is considered to be a sudden stop episode. This methodology seeks to detect periods with substantial unexpected slowdowns in net capital flows and therefore utilizes a series of variations in those flows. A sudden stop episode thus meets the following conditions:

(i) It contains at least one observation where the variation in net capital flows lies at least two standard deviations below the mean for the series of variations.[30]

(ii) Having found an observation that meets condition (i), the starting point of the episode is that observation where the variation in net capital flows first fell at least one standard deviation below the mean.

(iii) The episode continues for as long as the variation in net capital flows remains at no more than the mean minus one standard deviation.

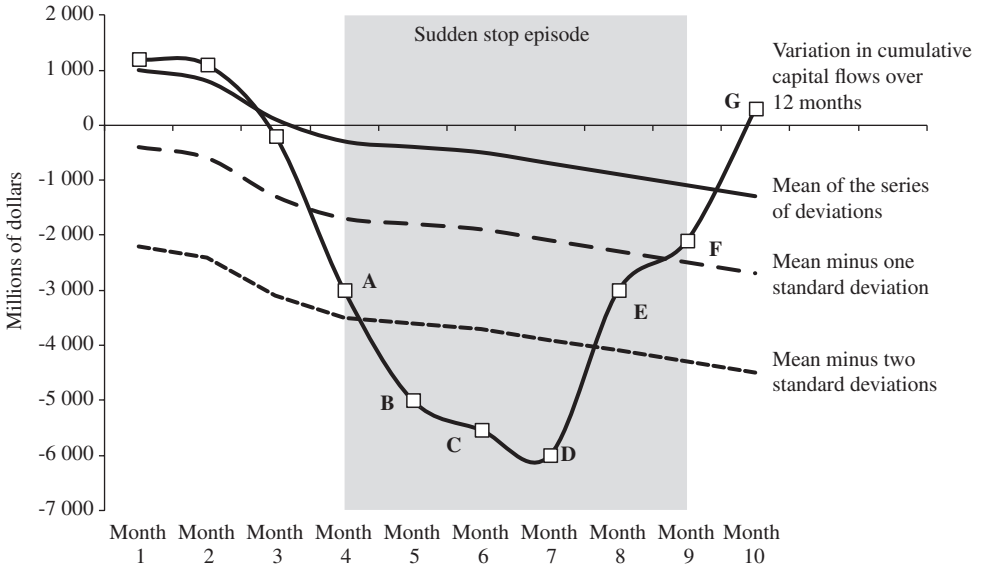
The graphic example in figure A.1 clarifies the methodology. The variation in net capital flows is positive in the first two months and turns negative in month three. According to the methodology used, the sudden stop begins in month four (point A), when the variation in capital flows first falls at least one standard deviation below the mean for the series of variations. The episode continues for as long as the variation in net capital flows is below the mean minus two standard deviations (points B, C and D) or is between the mean minus one and two deviations (point E). In this example, the final point in the episode is exactly point E, because the following point (F) lies above the mean minus one standard deviation.

Using this methodology, episodes of sudden stops in net capital flows were identified for each of the 12 subject countries, employing monthly data for the period between January 1990 and December 2011. Because the capital flows in balance-of-payments statistics are, for most of the countries, quarterly, a monthly proxy like the one utilized by Calvo, Izquierdo and Mejía (2004, 2008) was used for these flows. This proxy was obtained by netting out changes in international reserves from the trade balance; both variables are recorded monthly. While this proxy implicitly includes the portion of the current account corresponding to net factor payments and current transfers, any problem that this could cause

[30] Both the mean and the standard deviation are calculated each period using an expanding window with a start date fixed at the first observation so as to capture the behaviour of the entire series.

FIGURE A.1

Example of the methodology for identifying sudden stops in net capital flows



Source: prepared by the authors.

would be minor since what is relevant for such an exercise is not so much the level of the respective accounts but rather their volatility. Because these categories do in fact include low-volatility elements such as interest payments on long-term debt, they should not introduce spurious volatility into the proxy (Calvo, Izquierdo and Mejía, 2008). Capital flows were taken as cumulative over 12 months; changes in them were measured on a half-yearly basis in order to avoid the extreme volatility of monthly variations.

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A proposal for a modified Human Development Index

María Andreina Salas-Bourgoin

ABSTRACT

The Human Development Index (HDI) is an indicator designed to track the development of countries in respect of three dimensions of development: health, education and income. Since it was first published in 1990, great efforts have been made to improve HDI, which, as has been stressed on numerous occasions, cannot be seen as a definitive measure of development. This paper includes a reflection on what constitutes human development, the pillars underpinning it and two new dimensions that should be incorporated into HDI (employment and political freedoms) for it to better express progress in development. This document will also present, in addition to the modified HDI, detailed instructions for its calculation and an annex including modified HDI scores for 117 countries.

KEYWORDS

Human development, measurement, UNDP, economic indicators, social indicators, statistical methodology, statistical data

JEL CLASSIFICATION

I31, I32, I39

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I
Introduction

The Human Development Index (HDI) is an aggregated indicator, designed by the United Nations Development Programme (UNDP) to track progress in the development of countries and provide useful information for policymakers. Since it was first published in the 1990 Human Development Report, it has become widely accepted as a global yardstick for the development performance of nations and a starting point for drawing up rankings.

Because HDI plays such an important role in, for example, studies on quality of life, equity and social justice, UNDP has devoted considerable effort to improving it. These attempts have been directed both at accurately gauging living standards and at providing evidence of progress, stagnation and regression in the formation of human capabilities, enlarging people's choices and access to other opportunities that allow individuals to realize long-held aspirations.

An important milestone was reached in 2010 when that year's Human Development Report included an HDI calculated using new indicators so as to take account of education and income, together with a new index, the Inequality-adjusted HDI (IHDI), which measured inequalities in each of the dimensions making up the original index.

The HDI has thus far been calculated on three dimensions: health, education and income. The aim is to reflect, using specific criteria, the multidimensional nature of development by introducing elements that, for various reasons, are considered to be of the utmost importance in the creation of human capabilities, opportunities and choices: mean years of schooling, expected years of schooling, life expectancy at birth and gross national income per capita. However, as many far-reaching studies have shown, development goes beyond these factors to encompass others such as environmental sustainability, employment or freedom that are just as relevant in gauging progress in it. Therefore, with a view to fuelling further debate on these issues, a proposal has been made for a modified HDI, on the basis of a review of the literature and statistics, which incorporates two fundamental dimensions for development:

(i) Employment, as it provides more than merely the financial means to satisfy people's material needs and lift them out of poverty and is also a source of human dignity.

(ii) Democracy, as it is the form of government which, by virtue of the development and quality of life it brings, is most widely respected and which most effectively safeguards individual and collective freedoms.

This proposal uses the same criteria for selecting indicators and the same method of calculation as UNDP. Two indicators are proposed for the measurement of employment: the employment-to-population ratio and the share of non-vulnerable employment in total employment. The Democracy Index (DI) is proposed as a way of gauging freedom.

With a view to illustrating how the modified HDI works and what a useful tool it can be in analysing the development strengths and weaknesses within and between countries, the index has been calculated for 2012 using data from UNDP, the International Labour Organization (ILO) and the Economist Intelligence Unit (EIU) on a set of countries in different continents.

After the introduction, this article includes the following sections: section II, which provides a brief overview of human development as a model of development, including a precise explanation of what it should mean for human beings; section III discusses HDI as the foremost indicator of progress in human development; section IV examines the basic premises of HDI; section V concerns employment and freedoms; section VI presents the modified human development index and section VII delivers the conclusions.

II

Human development as a development model

From the 1980s onwards, with Max-Neef's writings on human-scale development and Sen's notion of development as a process of enhancing people's freedoms to enable them to realize their aspirations, human beings have been considered the focal point and ultimate beneficiary of development. Economic growth was no longer seen as the be-all and end-all, and ensuring quality of life and creating conditions conducive to the achievement of individual and collective goals became the overriding aim.

In the late 1980s this line of thinking gave rise to the concept of human development, defined as the process of expanding, by creating capabilities, the range of opportunities and choices open to people for them to have a quality of life able to match their hopes and dreams. Creating capabilities is understood in this instance to mean enhancing people's skills for the purposes of autonomous development, doing things, existing or acting, as Sen pointed out in 1988, in his speech at the Wider Conference on Quality of Life[1] (Vethencourt, 2008).

As Recalde (1999) has noted, individuals must have the right to equal opportunities with which to make the most of their capabilities. The way in which people actually take the opportunities offered by society and use the resources they obtain is their choice, but within a society the freedom to choose, both in the present and in the future, is paramount. "The real objective of development is to improve people's choices" (UNDP, 1992).

Sen (2000) saw development as the strengthening of five types of freedom: political freedoms, economic facilities, social opportunities, transparency guarantees and protective security. Political freedoms are linked to human rights, the possibility of electing one's leaders in a climate of press freedom without censorship and the right to free association and to criticize and investigate authorities.

Economic facilities, meanwhile, are opportunities to use economic resources and to consume, produce, trade and to engage in transactions. Social opportunities refer to health care, education and other services which are essential for the population. Transparency guarantees ensure that business relationships are underpinned by trust between parties concerning the nature of what is offered and, lastly, protective security entails a social safety net to reduce people's vulnerability (Hernández, 2008).

According to the Human Development Report 1992, development should be by, of and for the people. It should therefore enable individuals to take an active part in all spheres of society and in the planning and implementation of activities aimed at improving the quality of their lives and meeting their needs, within a scenario of greater opportunities.

But what does the widening of opportunities and choices as part of human development mean?

It is the creation of a scenario which enables individuals and groups to achieve a better quality of life by making use of the instruments, tools and goods needed for them to attain the goals they have set and to contribute to achieving the objectives of the society of which they are members.

These choices represent the whole range of possibilities open to individuals to increase their quality of life and realize their aspirations, i.e. as the word itself makes plain, the ability to choose from a wider range of things that an individual can do or be, which entails liberty and free choice (UNDP, 2000).

It therefore follows that: (i) the various choices should be qualitatively and quantitatively different; (ii) there should be no obligation to make any specific choice and individuals should, therefore, have the awareness or clarity to make the choice, from the range of options open, that is most closely aligned with their interests and value system, and (iii) people must be free to choose the option that best suits them.

In respect of opportunities, human development equates to bringing about equitable conditions that enable individuals to take advantage of the choices they have made. This would require an "enabling" environment, in other words, a context in which individuals and society at large can, by and large, realize their aspirations because they have been provided with the basic means for doing so.

People in societies with a high level of human development can therefore be expected to be able to make choices and have access to the means to ensure that they become reality, to choose, according to their aspirations,

[1] Conference on the quality of life of the United Nations University World Institute for Development Economics Research.

the quality of life they desire and to obtain the goods, services and material and spiritual living conditions to enable them to achieve it without —as the Human Development Report 1992 rightly stresses— depriving others or other generations of them. Human development should thus be sustainable at both the intragenerational and the intergenerational level.

The logic of human development dictates that the choices and opportunities it offers are "endless". The following conditions are, however, essential: (i) a long life, (ii) the acquisition of knowledge and (iii) access to the necessary resources to satisfy basic needs and "achieve a decent standard of living". However, as a result of "distortions in the development process",[2] the positive combination of these three factors does not always lead to development; factors such as full employment, freedom and environmental quality are also fundamental in facilitating individual and collective development.

It could be, for example, that, despite a relatively high average number of years of schooling and, most importantly, of expected years of schooling, people have insufficient choices to benefit from the capacities that have been created because the supply of jobs is restricted or insufficiently diversified or employment is poorly remunerated. Such a situation would not be an example of a high level of human development, because even though there is a skilled labour force, the "limited" context has given rise to unemployment, low wages, or underemployment.

There may also be societies that make adequate provision for health care and education and enjoy a high per capita gross national income but curtail political pluralism, legal equality, due process and free speech. In such a case, the level of human development appears high but is actually not, since it runs counter to the UNDP idea of development: "Freedom is more than an idealistic goal —it is a vital component of human development" (UNDP, 1992, p. 72).

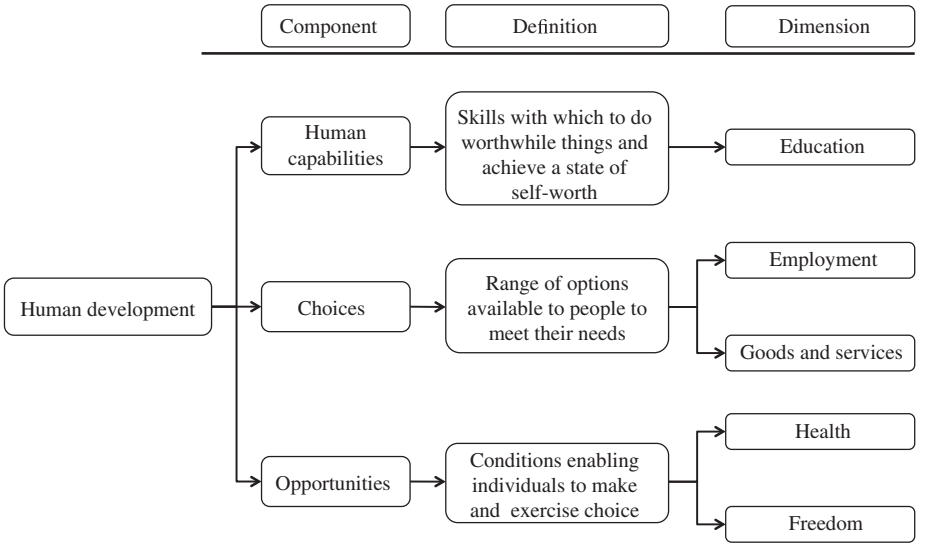
As these cases illustrate, a level of human development that appears high may hide a non-sustainable material lifestyle which endangers the sustainability of the quality of life achieved and its continuity to future generations.

Distortions of this type suggest that human development encompasses more than education, health and income. It is a society's ability to provide the right conditions for individuals to achieve a better quality of life, which include employment and freedom. A breakdown of this approach is shown in figure 1.

[2] Changes for the worse that will inevitably take place during development.

FIGURE 1

Breakdown of the concept of human development



Source: prepared by author.

III

Human Development Index

The Human Development Index (HDI) has been published each year since the first Human Development Report in 1990, and has become a widely accepted yardstick of progress in development that also breaks down this progress into the performance of societies in three key areas of life: health, education and income. Health is assessed by life expectancy at birth, education by the mean years of schooling for adults and the expected years of schooling for children and income by gross national income (GNI) per capita.

As an indicator, it is "... a mathematical relationship that expresses how various inputs —such as nutrition or primary schooling— produce a certain level of human development" (UNDP, 1992, p. 52). The formula for its calculation is as follows:

$$\text{HDI} = \sqrt[3]{\text{Health.sub} \times \text{Education.sub} \times \text{Income.sub}}$$

where:

Health subindex is estimated on the basis of life expectancy at birth;

Education subindex is estimated on the basis of the geometric mean of mean years of education of adults and the expected years of education for children;

Income subindex is estimated on the basis of gross national income (GNI) per capita.

The formula is a quantitative approximation of the creation of: (i) human capabilities as measured by education, (ii) choices, as measured by the possibility of acquiring goods and services and (iii) opportunities, as measured by health.

From 1990 to 2009, HDI was calculated on rates of literacy and gross school enrolment, as well as life expectancy at birth and gross domestic product (GDP) per capita. Expert opinion held that even if it were possible to use a greater number and wider variety of indicators to obtain a broad view of development, this could produce a perplexing picture and perhaps undermine the utility of the HDI for policymaking (UNDP, 1990). The decision was therefore taken not to load the HDI at the outset with burdens but rather to improve it incrementally (UNDP, 1992).

From the outset, the most widely debated and controversial element of the HDI was freedom. The Human Development Report 1992 noted in this regard that "...no measure of freedom can do it full justice... and while many of the quantitative measures that are developed may be no more than rough approximations, they can be an important stimulus to thought and debate" (UNDP, 1992, p. 72).

The report also introduced the political freedom index (PFI), an indicator focused on: (i) personal security, (ii) the rule of law, (iii) freedom of expression, (iv) political participation and (v) equality of opportunity. Its most apposite conclusions were, firstly, that: "Political freedom and human development do seem to move in tandem. Countries with a high HDI have an average PFI of 84%, while countries with a low HDI have an average PFI of 48%" (UNDP, 1992, p. 83); and, secondly, that the PFI was highly subjective and based on yes-no questions, which meant that further fine-tuning of the quantification and weighting system was needed.

In an effort to measure the level of development in countries in a more comprehensive manner, each year the Human Development Reports incorporated more and more indicators on key variables, which led to the compilation of statistical yearbooks on sensitive issues such as health, education, well-being, the environment, the economy and gender, but, strangely, no indicators on freedom were included.

UNDP capitalized on this progress in 2010 by making amendments to the HDI which entailed both replacing certain indicators and changing the method for its calculation. While the same structure, based around three dimensions, was maintained, the following replacements were made: (i) GDP per capita was abandoned in favour of GNI per capita, and (ii) the rates of literacy and gross school enrolment were substituted by mean years of schooling for adults and the expected years of schooling for children. Similarly the method of aggregation was changed from an arithmetic mean to a geometric meanand the upper and lower bounds used to normalize the index were redefined (Klugman, Rodríguez and Choi, 2011).

The Human Development Reports posit that nations make progress periodically. This is reflected in changes to their HDIs and movement within the global rankings. However, when account is taken of the three new indicators UNDP has published since 2010 to reflect "deprivation and inequalities": the Inequality-adjusted HDI, the Gender Inequality Index and the Multidimensional Poverty

Index, progress is not always so obvious. Unfortunately, these indices are kept apart from HDI and therefore have no bearing on global HDI rankings. If the factors they measure were included in HDI together with freedoms, for instance, the order and dynamics of the rankings might be very different.

Although human development provides people with the means to achieve their aspirations, freedom is the sine qua non. As Sen rightly points out in Development and Freedom (Sen, 2000), freedom enables people within a society to better themselves in line with their aspirations and expectations and makes them better able to influence their environment.

Employment is another relevant factor in, and dimension of, development that is not considered in the HDI. Neither GDP per capita, which was formerly used to calculate the HDI, nor gross national income (GNI) per capita, which is used now, reflects the range of choices available to people to meet their needs. Employment does, however, above all because it enables people to bring to bear the capabilities they have acquired or consolidated through education for the benefit of society as a whole or themselves as individuals. A society that offers its people various sources of employment enables them to select the one that best suits their aspirations and provides them with the necessary resources to meet their needs and contribute to national development.

The ILO has stated that: "...work is the way out of poverty for poor households and... the expansion of productive and decent employment is the way economies grow and diversify" (ILO, 2012, p. 1). Further, "access to safe, productive and fairly remunerated work —as a wage employee or as an own-account worker— is a key vehicle for individuals and families to gain self-esteem, a sense of belonging to a community and a way to make a productive contribution" (ILO, 2012, p. 1).

Indeed, full and productive employment and decent work for all, including women and young people, was one of the three aims set out in 2005 with a view to achieving the first of the eight Millennium Development Goals, namely to "eradicate extreme poverty and hunger". However, although achieving this objective is currently just as important as ever, the human development report fails to monitor it and it is not considered in the calculation of the HDI.

As a result of what have been termed "distortions of development", a society may well have a high GNI per capita due to the nature of economic activities performed within it but experience rising unemployment, making it harder for people to achieve their aspirations and perhaps even leading to a deterioration in material living conditions, a state of affairs that, moreover, would not be reflected in its HDI score.

The case of Spain is a good example of the importance of employment in human development. According to ILO data (2012), in the fourth quarter of 2011, Spain had an unemployment-to-population ratio of 22.8%, which had increased by 2.5 points on the fourth quarter of 2010. Despite this, its HDI increased from 0.863 to 0.878.

Although development is a long-term process in which progress occurs slowly, the HDI varies constantly, as changes in any of its dimensions are reflected in HDI rankings. Can changes in employment status not also therefore influence human development? Unemployment may be cyclical, but returning to the conditions enjoyed before an economic crisis is, for example, a long and arduous process. Monitoring employment is just as important as tracking progress in education and health.

Unemployment in Spain, although caused by an economic crisis that one hopes will be short-term, has driven down people's material living standards as it has curtailed the range of options at their disposal to meet their needs. However, this impact is not evident in Spain's current HDI.

In view of this, and even though it must be recognized that there are limitations to what can be achieved in developing a composite indicator to provide a comprehensive picture of progress in human development, other factors that have hitherto been ignored by the HDI (freedom and employment) could well be added so as to broaden the range of dimensions considered.

IV

Grounds for the proposed modification of HDI

The HDI is a composite index that incorporates other standardized indices whose thresholds are adjusted over time as the world progresses.

The HDI was designed to measure three dimensions: health, education, and GNI per capita, the first two being basic conditions to ensure a decent standard of living, and the third reflecting the availability of resources with which to acquire goods and services. So why is HDI based on just three indicators which, what is more, share the same drawback of being averages that conceal great differences within the population? According to various development reports it is because:

- Too many indicators could produce a perplexing picture of a country's development (UNDP, 1990);
- Owing to the scarcity of data on potential variables there is limited potential for using other indicators (UNDP, 1990);
- The HDI is made up of comprehensive indicators that measure data that overlaps with other indicators, such as, life expectancy at birth, which increases as progress is made in reducing the rate of mortality (UNDP, 1992); and
- The most conceptually suitable indicators are only produced for a small number of countries in relation to the amount covered by the human development reports (Klugman, Rodríguez and Choi, 2011).

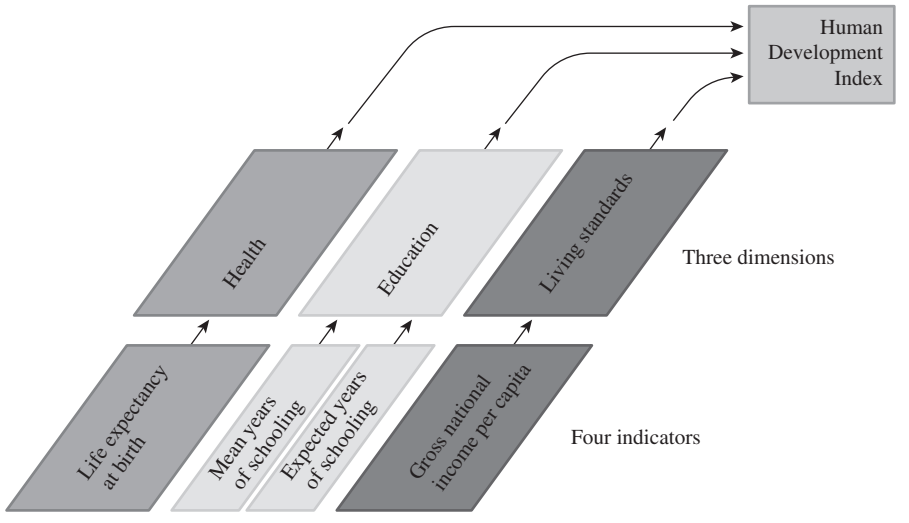
More specific reasons are used to justify the selection of indicators that make up the HDI. These include those given to justify abandoning the political freedom index (PFI), namely that it: (i) was based on qualitative criteria rather than quantifiable empirical data; (ii) that it was used to analyse a complex problem on the basis of short, yes-no answers with no explanatory criteria, and (iii) it can be hard to discern why a country has been placed in a given category and not another (UNDP, 1992).

The HDI was therefore structured as shown in figure 2.

Now, however, improvements in the global monitoring of certain conditions, the availability of global statistics issued by supranational organizations and the standardization of criteria for measuring variables are proof that a sea change has occurred, and most of the reasons which justified an HDI composed of three dimensions are no longer valid. This would appear to justify the proposal to add two new dimensions: employment and freedoms.

FIGURE 2

Dimensions of the Human Development Index



Source: own elaboration based on the United Nations Programme for Development (UNDP).

V
Employment and freedoms

From a theoretical perspective, it would appear that new indicators can, indeed must, be incorporated into the HDI to better reflect progress in building capabilities and expanding the range of opportunities and choices within a society.

As Klugman, Rodríguez and Choi have rightly said: "The Human Development Reports have always stressed that the HDI is not and was never intended to be a definitive measure of development… the aim is to stimulate discussion and debate..." (2011, p. 7). Exploring other options would therefore entail looking into alternative ways of achieving a more detailed quantitative approach to levels of human development of a society.

This would open the way to many options for the improvement of the HDI, such as by incorporating the ecological footprint of a society to show how sustainable its patterns of consumption are. However, as per the criterion of not loading the indicator with unnecessary burdens, the intention here is to stress the fundamental dimensions of work and freedom by including them in the current HDI, as shown in figure 3.

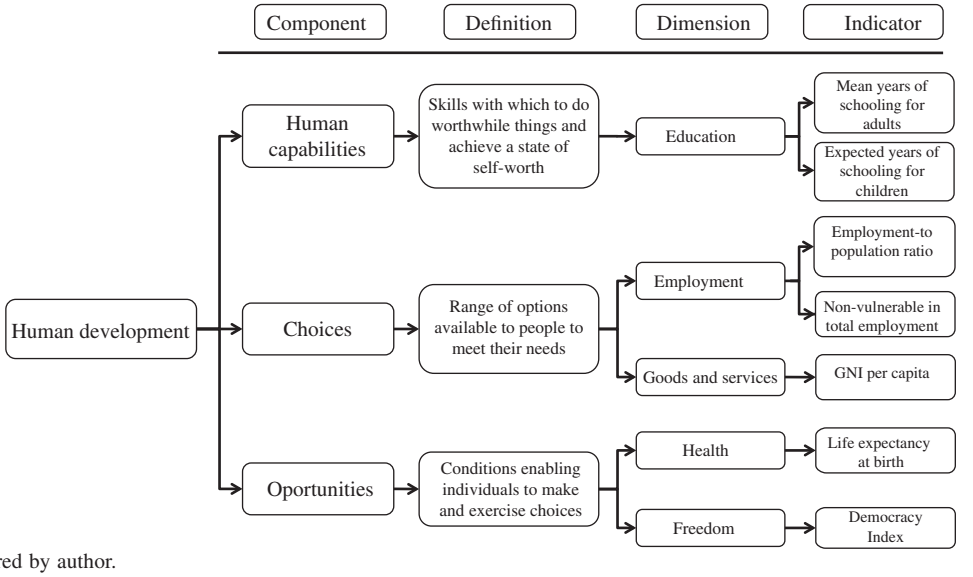
Two indicators are proposed to measure employment, as a reflection of the choices in a society: (i) the employment-population ratio, and (ii) the proportion of non-vulnerable employment in total employment. The Democracy Index (DI) as it is called is proposed to reflect both the dimension of freedom and the opportunities on offer. These indicators are all complied using data published regularly by reliable sources such as the International Labour Organization (ILO) and the Economist Intelligence Unit (EIU).

The employment-population ratio reflects the range of options open to individuals able to work, to find a job or start a business; the proportion of non-vulnerable employment[3] in total employment quantifies the supply of jobs with suitable social security entitlements, the right to unionization, adequate income and safe working conditions. It takes account not only of the quantity of employment but also of its quality, since as the ILO has

[3] It includes neither own-account workers nor auxiliary family caregivers.

FIGURE 3

Proposal for a modified HDI



Source: prepared by author.

GNI: gross national income.
HDI: Human Development Index.

said: "A shift to inclusive and sustainable development will not be possible if millions of people are denied the opportunity to earn their living in conditions of equity and dignity" (ILO, 2013b, p. 1).

The DI quantifies the set of political freedoms that individuals enjoy within a society and which enable them to participate in the development and administration of the rules and institutions that govern them (UNDP, 2002). Sen (2000) states that democracy encourages a society to prioritize what it aims to do and UNDP (2002) sees it not only as a value but also a means with which to achieve development.

The DI is published by the EIU and was designed to measure the state of democracy in 167 countries. Its basic premise is that free elections and civil liberties are necessary conditions for democracy, but that they are insufficient if unaccompanied by transparent and at least minimally efficient government, citizen participation and a democratic political culture (EIU, 2010).

Although studies published by the EIU suggest that there is a moderately low correlation between the DI and economic development,[4] the HDI is more closely correlated with it. Estimations made for this proposal on the basis of data from 2012, gave a value of 0.7 (moderately high), and it can therefore be inferred that, while there is not a perfect correlation, human development is greater if there is democracy.

As an indicator, the DI is the simple average of responses given to a survey drawn up by experts consisting of 60 questions which places countries in one of four different, mutually exclusive categories: (i) full democracies (> 8); (ii) flawed democracies (6-7.9); (iii) hybrid regimes (4-5.9), and (iv) authoritarian regimes (< 4).

The DI is made up of five categories of indicators: (i) 12 indicators on political pluralism and the electoral process; (ii) 14 indicators on how the government functions; (iii) nine indicators relating to political participation; (iv) eight indicators on the political and democratic culture, and (v) 17 indicators on civil liberties (Benavides, 2012).

The value in each category is the sum of scores given for each indicator, on a scale of 0 to 1, where 0 is "no", 1 "yes" and 0.5 corresponds to a grey area, as clearly explained in the survey. For example: are municipal elections both free and fair? 1: free and fair; 0.5: free, but not fair; 0: neither free nor fair.

A country's score is reduced if it does not score a "1" in any of the following critical areas for democracy: (i) whether national elections are free and fair; (ii) the security of voters; (iii) the influence of foreign powers on government, and (iv) the capability of the civil service to implement policies. If the country scores 0 or 0.5 in the first three areas, one point is deducted from the category of "electoral process and pluralism" or "functioning of the government" category. If it scores 0 in the fourth area, one point is deducted from the "functioning of the government" category.

If the answer to certain questions is "no" (0 points), then the next question cannot be asked and also yields a score of 0. For example, if the answer to the question of whether presidential and national legislative elections are free is "no" (0), then the answer to the following question of whether these elections are fair must also be "no".

The DI is evidently a subjective indicator that is not without its drawbacks and can give rise to controversy. However, its scoring and aggregation system means that it can quantify the complex question of democracy in a highly meticulous manner. The advantage it has over other objective indicators, such as the number of voters, is that it attempts to bring together the factors that make up a democratic regime and quantitatively define what separates it from an authoritarian one.

[4] Estimated from the logarithm of GDP per capita.

VI

A modified Human Development Index

Since the HDI is made up of positive indicators, i.e. values that measure characteristics conducive to human development, and because, therefore, rises in them show improvements in these conditions, this proposal takes the same approach. Its basic premise is therefore that there is a positive correlation between employment, freedom and development, and that increases in the first two variables mean that a society has expanded the range of people's opportunities and choices.

The proposed modification entails incorporating three subindices into the HDI: democracy, employment and non-vulnerable employment, calculated in the same manner as the education and health subindices.

To illustrate step-by-step how it is calculated, each subindex will be addressed firstly with an example, and then, using data from ILO, UNDP and EIU, the modified HDI formula will be applied to a set of countries selected by continent.

1. Democracy subindex

Each subindex is calculated by applying the formula used by UNDP for the HDI to data from the 2012 EIU report:

$$\text{Subindex} = \frac{\left(\text{country score} - \text{lowest score}\right)}{\left(\text{highest score} - \text{lowest score}\right)}$$

If, for example, the highest score for the DI is 9.98 points (Norway, 2010) and the lowest is 1.08 points (Democratic People's Republic of Korea, 2012) the democracy subindex for Argentina is calculated as follows using the DI for that year which is 6.84 points:

$$\text{Democracy subindex} = \frac{\left(6.84 - 1.08\right)}{\left(9.98 - 1.08\right)}$$

$$\text{Democracy subindex} = 0.647$$

2. Employment and non-vulnerable employment subindices

The HDI addresses, for example, the dimension of education using an aggregated index that is calculated on the basis of the mean years of schooling for adults and the expected years of education for children. The minimum value for both is 0 years.

As the basic premise of the minimum values in the HDI is that they relate to living conditions, the data set used to draw up minimum values for both indicators has been revised for the 2000-2010 period, which is covered by the seventh edition of Key Indicators of the Labour Market.

Between 2000 and 2010, the lowest employment-to-population ratio anywhere in the world was 34%. If the rate of non-extraordinary change to this indicator is taken as 5 percentage points, a minimum global threshold of 29% can be set.

For the rate of non-vulnerable employment in total employment in respect of this period,[5] a minimum threshold of 5%[6] can be set.

Therefore, as these two minimum thresholds are different, no aggregated subindex can be estimated for employment, unlike the case with education. Individual subindices must thus be calculated for subsequent aggregation using the HDI formula.

The example below illustrates how the employment and non-vulnerable employment subindices can be calculated using the minimum values given above and the data presented in table 1.

TABLE 1

Selected countries: employment-to-population ratio and non-vulnerable employment ratio, 2012

Country	Employment-to-population ratio (*percentage*)	Non-vulnerable employment ratio
Germany	56.7	93
Colombia	60.5	51
Sri Lanka	52.3	58

Source: prepared by author on the basis of data from the International Labour Organization (ILO), "Key Indicators of the Labour Market (KILM)".

Taking the maximum thresholds of 90.1% (figure reported by Qatar for 2011) for the employment-to-population ratio and of 98% (as reported by Bahrain for 2008) for the proportion of non-vulnerable employment in total employment yields the following results:

[5] ILO provides the indicator "vulnerable employment as a percentage of total employment", on the premise that it is a proportion; non-vulnerable employment is calculated by subtracting this figure from 100.

[6] No rate of change over time is calculated.

Germany	Employment subindex = $\frac{56.7 - 29}{90.1 - 29}$ Employment subindex = 0.453	Non-vulnerable employment subindex = $\frac{93 - 5}{98 - 5}$ Non-vulnerable employment subindex = 0.946
Colombia	Employment subindex = $\frac{60.5 - 29}{90.1 - 29}$ Employment subindex = 0.516	Non-vulnerable employment subindex = $\frac{51 - 5}{98 - 5}$ Non-vulnerable employment subindex = 0.495
Sri Lanka	Employment subindex = $\frac{52.3 - 29}{90.1 - 29}$ Employment subindex = 0.381	Non-vulnerable employment subindex = $\frac{58 - 5}{98 - 5}$ Non-vulnerable employment subindex = 0.570

This example shows that Germany is experiencing problems in providing its people with work but is able to ensure that its citizens who are in work have adequate working conditions, are productive and have full enjoyment of their rights, unlike in Colombia where this is the case for only a small portion of the working population.

3. Modified Human Development Index

Using the subindices calculated above, the modified Human Development Index would be:

$$\text{Modified HDI} = \sqrt[6]{Health.sub \times Education.sub \times Income.sub \times Democracy.sub \times Employment.sub \times non\text{-}vulnerable\ employment.sub}$$

Germany's modified HDI, using data provided by UNDP for 2010, would be:

$$\text{Modified HDI} = \sqrt[6]{0.955 \times 0.944 \times 0.867 \times 0.816 \times 0.453 \times 0.946}$$

$$\text{modified HDI} = 0.806$$

Table 2 provides modified HDI values calculated for the countries indicated.

A comparison of the HDI with the proposed modified HDI is shown in table 3 and figure 4.

TABLE 2

Selected countries: modified HDI, 2012

Country	Health subindex	Education subindex	Income subindexs	Democracy subindex	Employment subindex	Non-vulnerable employment subindex	Modified HDI
Norway	0.966	0.990	0.913	0.994	0.563	0.968	0.883
Germany	0.955	0.944	0.867	0.816	0.453	0.946	0.806
Argentina	0.884	0.815	0.743	0.647	0.450	0.817	0.709
Brazil	0.849	0.674	0.682	0.679	0.597	0.317	0.607
Colombia	0.850	0.666	0.659	0.624	0.516	0.495	0.625
Spain	0.972	0.871	0.821	0.780	0.255	0.892	0.706
Republic of Moldova	0.783	0.714	0.517	0.589	0.177	0.710	0.527
Paraguay	0.831	0.643	0.562	0.582	0.638	0.570	0.632
Peru	0.855	0.713	0.669	0.606	0.696	0.591	0.683
Sri Lanka	0.870	0.723	0.582	0.525	0.381	0.570	0.589
Turkey	0.855	0.608	0.726	0.526	0.277	0.677	0.578
Uruguay	0.902	0.764	0.722	0.797	0.537	0.785	0.742
Venezuela (Bolivarian Republic of)	0.861	0.697	0.700	0.457	0.524	0.667	0.637
Russian Federation	0.774	0.862	0.734	0.299	0.501	0.957	0.642

Source: prepared by author on the basis of data from the United Nations Development Programme (UNDP) and the International Labour Organization (ILO), *Informe sobre el trabajo en el mundo, 2012. Resumen de España*, 2012 [online] http://www.ilo.org/wcmsp5/groups/public/---dgreports/---dcomm/documents/briefingnote/wcms_179517.pdf.

TABLE 3

Selected countries: HDI and modified HDI, 2012

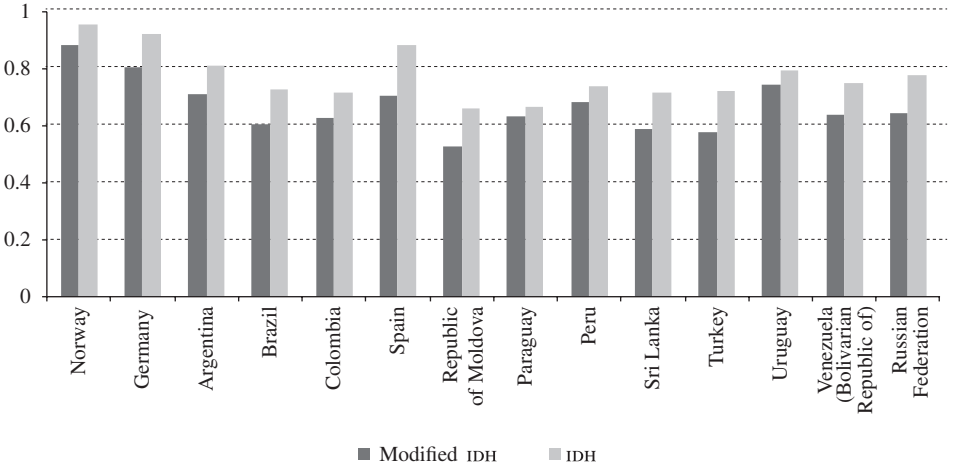
Country	HDI	Ranking [a]	Modified HDI	Ranking [b]	Difference
Norway	0.955	1	0.883	1	0.072
Germany	0.920	5	0.806	7	0.114
Argentina	0.811	45	0.709	28	0.102
Brazil	0.730	85	0.607	54	0.123
Colombia	0.719	91	0.625	50	0.094
Spain	0.885	30	0.706	23	0.179
Republic of Moldova	0.660	113	0.527	74	0.133
Paraguay	0.669	111	0.632	47	0.037
Peru	0.741	74	0.683	34	0.058
Sri Lanka	0.715	92	0.589	60	0.126
Turkey	0.722	90	0.578	62	0.144
Uruguay	0.792	51	0.742	21	0.050
Venezuela (Bolivarian Republic of)	0.748	71	0.637	47	0.111
Russian Federation	0.778	55	0.642	43	0.136

Source: prepared by author on the basis of data from the United Nations Development Programme (UNDP).

[a] Ranking of 187 countries.
[b] Ranking of 117 countries.

FIGURE 4

Selected countries: HDI and modified HDI, 2012



Source: prepared by author.

It should be stressed, in respect of tables 2 and 3, as well as figure 4 that:

(i) Under the modified HDI, all countries have a lower human development score.

(ii) Under the proposed approach, the largest rise occurs in the health subindex and the greatest fall in the employment subindex.

(iii) Countries with high HDI scores, such as Norway and Germany, have a lower modified HDI owing to the influence of the employment subindex. Although these countries have the highest rates of non-vulnerable employment, they are less able to guarantee jobs for citizens of working age.

(iv) Countries with low and middling HDI scores, however, show weaknesses in their ability to provide employment and non-vulnerable employment.

(v) Spain and the Republic of Moldova are most affected by the emphasis that this approach places on employment in human development.

(vi) Of the countries selected, the Bolivarian Republic of Venezuela and the Russian Federation, especially the latter, are the countries for which the democracy subindex has the greatest impact on their modified HDI scores.

A comparison of the countries' rankings by their HDI and modified HDI[7] scores reveals that:

(i) Norway is the only country which occupies the same position in both rankings;

(ii) Countries such as Germany and Spain rank lower in the modified HDI table than in that of the HDI, chiefly as a result of the influence of employment on the former. Germany is overtaken by Denmark, Sweden and Switzerland, and Spain by countries including Argentina, Panama, Portugal, Lithuania and Slovakia in the modified HDI table;

(iii) The United Arab Emirates and the Russian Federation also move down the table, but as a result of their scores on democracy. The United Arab Emirates is overtaken by Jamaica, Trinidad and Tobago, Argentina and Costa Rica, and the Russian Federation by Peru, Malaysia and Jamaica, among others;

(iv) Botswana and Thailand are cases of note as they score substantially higher for the modified HDI than for the HDI, as a result of employment, vulnerable employment and democracy subindices that resemble those of developed countries. This places them in forty-fourth and forty-eighth place, respectively, in a ranking of 117 countries, ahead of the Bolivarian Republic of Venezuela, Turkey, Ecuador, Greece, Brazil and Bulgaria; and

(v) Chad is in last place, for two specific reasons: its low democracy subindex (0.061) and very low non-vulnerable employment subindex (0.011) gives it a modified HDI score of 0.158.

[7] See table A.1 in the statistical annex.

VII
Conclusions

The modified HDI is a proposal to fuel discussion on how to make the HDI better able to serve as a proxy for progress in human development.

It is based on two new dimensions that are essential factors in creating and expanding opportunities and choices —employment and freedoms— and makes use of three indicators that are derived from reliable sources in respect of countries that UNDP monitors regularly: (i) employment-to-population ratio; (ii) non-vulnerable employment as a share of total employment, and (iii) the Democracy Index. There is an acknowledged correlation between these indicators and human development.

The modified HDI is calculated using the same logic as the HDI, being the geometric average of its component subindices. As these subindices are provided individually, they illustrate each country's strengths and weaknesses in terms of human development.

The two dimensions added in the modified HDI help to take greater account of differences between countries and provide a more accurate "snapshot" of human development. This is shown in the fact that, for instance, the modified HDI reveals that the weaknesses in countries with high overall HDI scores relate mainly to employment, while developing countries lag behind in the quality of employment.

The modified HDI also pays attention to democracy. Certain countries, including the Russian Federation and the Bolivarian Republic of Venezuela, with high HDI scores are marked down in terms of human development as a result of limits placed on political freedoms. This is also the case with Saudi Arabia and China, for example.

The modified HDI calculated for selected countries is lower than their HDI scores. This in no way diminishes the achievements they have made in human development, but rather provides a "magnifying glass" that more accurately shows where their strengths and weaknesses lie.

STATISTICAL ANNEX

In order to show changes in countries' rankings under the modified HDI, table A.1 gives their scores for each subindex, the modified HDI and their HDI ranking.

TABLE A.1

Modified Human Development Index, 2012

	Education subindex	Income subindex	Health subindex	Democracy subindex	Employment subindex	Non-vulnerable employment subindex	Modified HDI	a	b
Norway	0.99	0.913	0.966	0.994	0.563	0.968	0.883	1	1
Iceland	0.912	0.838	0.977	0.963	0.658	0.935	0.873	2	14
Switzerland	0.873	0.886	0.985	0.900	0.591	0.925	0.849	3	9
Sweden	0.913	0.87	0.971	0.972	0.491	0.946	0.839	4	8
Denmark	0.92	0.858	0.93	0.948	0.488	0.957	0.829	5	15
United States	0.994	0.897	0.926	0.790	0.475	0.968	0.818	6	3
Germany	0.944	0.867	0.955	0.816	0.453	0.946	0.806	7	5
Austria	0.859	0.871	0.962	0.847	0.475	0.925	0.803	8	18
Japan	0.888	0.854	1.000	0.787	0.450	0.968	0.799	9	11
Finland	0.88	0.854	0.949	0.897	0.432	0.914	0.795	10	20
Luxembourg	0.778	0.912	0.948	0.876	0.406	0.957	0.782	11	26
United Kingdom	0.828	0.854	0.951	0.801	0.457	0.892	0.777	12	27
Ireland	0.964	0.835	0.958	0.840	0.378	0.892	0.776	13	7
Singapore	0.804	0.925	0.966	0.539	0.574	0.925	0.768	14	19
China, Hong Kong (SAR)	0.831	0.904	0.994	0.600	0.458	0.957	0.762	15	13
Estonia	0.919	0.762	0.868	0.734	0.448	0.968	0.761	16	34
Czech Republic	0.916	0.797	0.912	0.799	0.419	0.860	0.759	17	28
Slovenia	0.936	0.809	0.938	0.764	0.391	0.882	0.756	18	22
France	0.871	0.843	0.973	0.764	0.350	0.946	0.752	19	21
Belgium	0.89	0.858	0.947	0.783	0.329	0.914	0.744	20	17
Uruguay	0.764	0.722	0.902	0.797	0.537	0.785	0.742	21	51
Malta	0.816	0.791	0.944	0.809	0.319	0.925	0.725	22	32
Costa Rica	0.713	0.692	0.937	0.789	0.481	0.806	0.722	23	62
Trinidad and Tobago	0.698	0.796	0.794	0.664	0.553	0.849	0.719	24	68
Slovakia	0.87	0.78	0.878	0.704	0.360	0.892	0.716	25	35
Lithuania	0.873	0.757	0.829	0.692	0.375	0.925	0.713	26	41
Portugal	0.741	0.781	0.942	0.769	0.375	0.839	0.713	27	43
Panama	0.741	0.724	0.888	0.674	0.561	0.710	0.710	28	60
Argentina	0.815	0.743	0.884	0.647	0.450	0.817	0.709	29	45
Latvia	0.868	0.737	0.846	0.671	0.367	0.946	0.708	30	44
Spain	0.871	0.821	0.972	0.780	0.255	0.892	0.706	31	23
Mauritius	0.659	0.722	0.844	0.797	0.430	0.860	0.701	32	80
Poland	0.819	0.765	0.888	0.679	0.352	0.828	0.692	33	39
Malaysia	0.731	0.726	0.859	0.599	0.484	0.785	0.686	34	65
Peru	0.713	0.669	0.855	0.606	0.696	0.591	0.683	35	77
Italy	0.852	0.822	0.977	0.748	0.234	0.828	0.680	36	25
Hungary	0.89	0.75	0.862	0.661	0.270	0.957	0.679	37	37
Kuwait	0.62	0.925	0.863	0.303	0.614	1.000	0.672	38	54
Romania	0.821	0.694	0.855	0.613	0.376	0.688	0.653	39	56
Croatia	0.784	0.744	0.896	0.657	0.250	0.849	0.647	40	47
Jamaica	0.748	0.621	0.841	0.709	0.421	0.624	0.646	41	86
United Arab Emirates	0.686	0.894	0.894	0.169	0.769	1.011	0.645	42	42
Russian Federation	0.862	0.734	0.774	0.299	0.501	0.957	0.642	43	55
Botswana	0.683	0.72	0.521	0.761	0.561	0.634	0.641	44	119
Ecuador	0.679	0.637	0.88	0.528	0.599	0.570	0.640	45	89
Greece	0.856	0.786	0.947	0.738	0.205	0.699	0.638	46	29
Venezuela (Bolivarian Republic of)	0.697	0.7	0.861	0.457	0.524	0.667	0.637	47	71
Paraguay	0.643	0.562	0.831	0.582	0.638	0.570	0.632	48	111
Thailand	0.599	0.642	0.856	0.615	0.687	0.452	0.630	49	103
Kazakhstan	0.839	0.686	0.747	0.322	0.638	0.699	0.629	50	69
Colombia	0.666	0.659	0.85	0.624	0.516	0.495	0.625	51	91
Dominican Republic	0.625	0.656	0.846	0.608	0.444	0.624	0.623	52	96
El Salvador	0.634	0.602	0.827	0.606	0.468	0.613	0.616	53	107
Bahrain	0.748	0.776	0.87	0.174	0.589	1.000	0.611	54	48
Brazil	0.674	0.682	0.849	0.679	0.597	0.317	0.607	55	85
Philippines	0.679	0.535	0.773	0.587	0.509	0.591	0.606	56	114
Cape Verde	0.445	0.529	0.856	0.769	0.535	0.591	0.605	57	132

Table A.1 (*conclusion*)

	Education subindex	Income subindex	Health subindex	Democracy subindex	Employment subindex	Non-vulnerable employment subindex	Modified HDI	a	b
Serbia	0.787	0.673	0.862	0.590	0.244	0.742	0.604	58	64
Bolivia (Plurinational State of)	0.743	0.56	0.74	0.535	0.678	0.430	0.603	59	108
Bulgaria	0.81	0.7	0.845	0.634	0.291	0.518	0.598	60	57
Sri Lanka	0.723	0.582	0.87	0.525	0.381	0.570	0.589	61	92
Mongolia	0.726	0.553	0.769	0.592	0.501	0.409	0.578	62	108
Turkey	0.608	0.726	0.855	0.526	0.277	0.677	0.578	63	90
Indonesia	0.577	0.55	0.785	0.638	0.558	0.409	0.575	64	121
Honduras	0.575	0.522	0.842	0.535	0.504	0.452	0.560	65	120
Vietnam	0.539	0.501	0.874	0.203	0.764	0.839	0.560	66	127
Guatemala	0.439	0.553	0.811	0.539	0.592	0.484	0.559	67	133
South Africa	0.705	0.674	0.526	0.754	0.173	0.914	0.557	68	121
Fiji	0.812	0.548	0.779	0.291	0.458	0.602	0.551	69	96
Lebanon	0.699	0.711	0.833	0.446	0.209	0.720	0.551	69	72
Former Yugoslav Republic of Macedonia	0.697	0.67	0.868	0.571	0.154	0.785	0.551	69	78
Kyrgyzstan	0.721	0.443	0.758	0.406	0.535	0.516	0.548	70	125
Nicaragua	0.527	0.478	0.856	0.503	0.484	0.516	0.548	70	129
Tunisia	0.646	0.649	0.863	0.516	0.203	0.710	0.547	71	94
Republic of Moldova	0.714	0.517	0.783	0.589	0.177	0.710	0.527	72	113
Azerbaijan	0.76	0.65	0.802	0.233	0.542	0.430	0.527	72	82
Egypt	0.587	0.589	0.843	0.391	0.231	0.774	0.523	73	112
Bhutan	0.356	0.585	0.75	0.401	0.668	0.452	0.516	74	140
Namibia	0.557	0.604	0.672	0.580	0.213	0.667	0.515	75	128
Cambodia	0.52	0.449	0.687	0.436	0.858	0.290	0.509	76	138
Armenia	0.763	0.593	0.858	0.338	0.213	0.613	0.508	77	87
Gabon	0.659	0.713	0.68	0.301	0.362	0.452	0.500	78	106
Timor-Leste	0.48	0.59	0.677	0.683	0.417	0.269	0.495	79	134
Lesotho	0.501	0.433	0.453	0.627	0.813	0.280	0.491	80	158
Algeria	0.679	0.636	0.842	0.309	0.172	0.710	0.489	81	93
Ghana	0.596	0.417	0.703	0.555	0.620	0.215	0.485	82	135
Jordan	0.697	0.585	0.844	0.304	0.133	0.914	0.483	83	100
Kenya	0.584	0.404	0.594	0.408	0.517	0.344	0.465	84	145
Bosnia and Herzegovina	0.705	0.641	0.88	0.453	0.070	0.753	0.461	85	81
India	0.459	0.515	0.722	0.724	0.403	0.151	0.442	86	136
Nepal	0.358	0.359	0.774	0.346	0.863	0.247	0.441	87	157
Swaziland	0.583	0.581	0.456	0.238	0.244	0.796	0.439	88	141
Senegal	0.402	0.414	0.625	0.563	0.660	0.183	0.438	89	154
Pakistan	0.397	0.479	0.721	0.392	0.357	0.344	0.433	90	146
Bangladesh	0.415	0.425	0.777	0.537	0.630	0.108	0.413	91	146
Zambia	0.503	0.385	0.464	0.582	0.622	0.151	0.412	92	163
Cameroon	0.534	0.45	0.507	0.265	0.640	0.204	0.402	93	150
Democratic Republic of Congo	0.515	0.499	0.596	0.203	0.596	0.215	0.398	94	142
Islamic Republic of Iran	0.707	0.69	0.839	0.101	0.169	0.570	0.398	94	76
Malawi	0.443	0.302	0.549	0.562	0.782	0.118	0.395	95	170
Zimbabwe	0.571	0.213	0.516	0.179	0.877	0.355	0.389	96	172
Madagascar	0.49	0.312	0.74	0.320	0.894	0.097	0.383	97	151
Liberia	0.429	0.232	0.589	0.435	0.493	0.280	0.390	98	174
Guinea	0.249	0.331	0.545	0.192	0.668	0.484	0.375	99	178
Equatorial Guinea	0.433	0.794	0.495	0.084	0.823	0.183	0.359	100	136
Syrian Arab Republic	0.544	0.568	0.883	0.062	0.164	0.667	0.350	101	116
Benin	0.367	0.394	0.576	0.553	0.707	0.054	0.347	102	166
Lao People's Democratic Republic	0.453	0.471	0.754	0.139	0.782	0.075	0.331	103	138
Togo	0.498	0.329	0.592	0.266	0.745	0.065	0.328	104	159
Mozambique	0.222	0.325	0.485	0.427	0.797	0.075	0.311	105	185
Mali	0.257	0.316	0.502	0.454	0.319	0.129	0.302	106	182
Ethiopia	0.289	0.342	0.627	0.297	0.823	0.043	0.294	107	173
Rwanda	0.403	0.36	0.564	0.256	0.925	0.032	0.292	108	167
Niger	0.177	0.287	0.553	0.346	0.530	0.108	0.287	109	186
Burkina Faso	0.196	0.367	0.566	0.274	0.851	0.054	0.283	110	183
Sierra Leona	0.326	0.321	0.444	0.408	0.604	0.032	0.268	111	177
Chad	0.223	0.374	0.471	0.061	0.614	0.011	0.158	112	184

Source: prepared by author on the basis of data from the United Nations Development Programme (UNDP).

[a] Ranking of 187 countries.
[b] Ranking of 117 countries (own calculations).

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From the classroom to the workplace: Three decades of evidence for Latin America

Mariana Viollaz

ABSTRACT

This study draws on household survey results spanning a period of three decades in length to analyse young people's entry into the labour market in 10 Latin American countries. It finds that: (i) the employment status of young people had deteriorated over time until seeing an improvement in the late 2000s, although youth unemployment and informality rates are still very high; (ii) young people are entering into a typical employment cycle in which they are surpassing the results obtained by adults of earlier generations. Informality is not a part of this pattern, however, indicating the existence of penalties associated with youth informality. Nonetheless, the outcomes are, for the most part, promising. The author concludes that efforts to improve the position of young people in the workforce should be continued in order to sustain the recent upturn in youth employment.

KEYWORDS

Young people, labour market, youth employment, working conditions, wages, gender, unemployment, employment statistics, Latin America

JEL CLASSIFICATION

J13, J24, O17

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I
Introduction

There has been growing concern in recent years about the deteriorating employment status of young entrants into the labour market. While youth employment is typically associated with limited job opportunities and high job turnover rates, successive increases in the youth unemployment rate and the existence of a large percentage of young people who are neither studying nor working have spurred interest in determining what underlying factors are driving this trend.

Youth is a stage in the working life cycle that is associated with limited job opportunities and job instability (Breen, 1992). Another typical characteristic of the position of young people in the workforce is high unemployment. A variety of reasons are often given for this situation. One possibility is that demographic changes may have increased the relative supply of young workers. Blanchflower and Freeman (2000) evaluate this hypothesis in a developed-country context but find no evidence of demographic effects in the increase in the youth unemployment rate witnessed during the 1990s. In the case of Latin America, the slowdown in population growth seen in the last two decades has had a favourable effect on youth employment (Weller, 2006; Fawcett, 2001). A decline in young people's level of education has also been advanced as a possible explanation for higher youth unemployment. However, Bell and Blanchflower (2010) find that young people in industrialized countries are more educated than they were before, and Bassi and Galiani (2009) and Weller (2006) report similar findings for Latin America. Other explanations focus on changes in labour institutions and shifts in the sectoral structure of the job market that work to the detriment of the sectors that are the main employers of young workers. Minimum wage laws may, for example, discourage employers from hiring people in this age group (Neumark and Nizalova, 2007). The introduction of new technologies tends to increase the demand for skilled labour, which could have an impact on the recruitment of young people (Dolado, Felgueroso and Jimeno, 2000). Another important factor that hinders many young people in the Latin American region from successfully entering the labour market is the sharp inequalities that mark young people's opportunities for human and social capital formation (Weller, 2006).

There are a number of different theories about why young people's position in the workforce is also so unstable. The "job shopping" theory suggests that many young people's job transitions are voluntary because they are taking advantage of the stage in their working lives when the opportunity cost is low to move from one occupation to another in search of better options (Neumark, 2002). Some degree of instability could also stem from frequent entries and exits from the labour force associated with human capital formation. On the other hand, high labour turnover in the younger segment of the population could be an involuntary phenomenon linked to characteristics of the individuals concerned and of the workplaces where they are employed. For example, because young people have less work experience than their older counterparts, they are often in a more vulnerable position, since the direct and indirect costs of dismissing them are lower than they would be in the case of workers with more seniority. In addition, young people are often employed in low-productivity activities in which the opportunities to gain expertise in a given area are much more limited (Maurizio, 2011).

Earlier studies have shown that economic and labour conditions in the 1990s and the early 2000s were not conducive to the entry of young workers into the labour force in Latin America (Weller, 2006). This study will extend the period of analysis up to the end of the 2000s. The data that are available for this longer period will provide a basis for analysing recent trends in labour indicators pertaining to the young population. This will make it possible to determine whether the employment prospects for young people have improved in recent years or whether unfavourable conditions have persisted despite the growth of Latin American economies during this period.

To that end, as part of this study a detailed analysis of various labour indicators has been undertaken for 10 countries of the region. The countries selected for this purpose, based on the availability of the relevant information, were: Argentina, Brazil, Chile, Costa Rica, El Salvador, Honduras, Mexico, Panama, Uruguay and

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the Bolivarian Republic of Venezuela.[1] The data used in this analysis were drawn from the Socio-Economic Database for Latin America and the Caribbean (SEDLAC), which contains household survey data for the countries of Latin America and the Caribbean and is maintained by the Centre for Distributive, Labour and Social Studies (CEDLAS) of the National University of La Plata and the World Bank. Table 1 shows the information available for each country and period of analysis, while table A.1 (see the appendix) details the household surveys that were the source of those data. The information is divided up into six periods corresponding to the early and later years of each decade. The only exception to this is the last period, for which information from the latest available surveys was also included.

For the purposes of this study, young people will be defined as persons between the ages of 15 and 24, while those between the ages of 25 and 65 will be classified as adults. The labour statistics used here are averages for the 10 countries covered by the study. This average is arrived at by weighting the results for each country on the basis of the share of the total population that its population represents in each period. In order to avoid giving a disproportionate weight to countries for which more information was available, a single year within each period was selected, with an effort being made to use the same year for all of the countries (see table A.2 in the appendix). It follows that the results computed on the basis of weighted averages will be skewed towards the countries with larger populations. In order to determine if the results are primarily reflecting the trends in those countries, the simple averages are also given and the cases in which the results for those simple averages differ from the weighted averages will be discussed.

This study is structured as follows. Section II briefly reviews the trends in labour supply relating to young adults in Latin America and their characteristics. Section III looks at various indicators that provide information about the labour market for young and adult workers over the past three decades; this information is broken down by sex and level of education. Section IV presents a pseudo-panel analysis using birth cohorts in order to shed light on the behaviour of these indicators once the persons concerned enter adulthood. Section V concludes with some closing remarks and policy proposals.

[1] Taken together, the populations of these countries represented 74% of the total population of Latin America as of 2012 (World Bank, 2012).

TABLE 1

Available surveys

Country	Early 1980s	Late 1980s	Early 1990s	Late 1990s	Early 2000s	Late 2000s
Argentina	1980	1985-1989	1990-1994	1995-1999	2000-2004	2005-2012
Brazil	1981-1984	1985-1989	1990, 1992-1993	1995-1999	2001-2004	2005-2009, 2011
Chile	…	1987	1990, 1992, 1994	1996, 1998	2000, 2003	2006, 2009, 2011
Costa Rica	…	1989	1990-1994	1995-1999	2000-2004	2005-2010
El Salvador	…	…	1991, 1993	1995, 1996, 1998, 1999	2000-2004	2005-2010
Honduras	…	…	1990-1994	1995-1999	2001-2004	2005-2011
Mexico	…	1989	1992	1996, 1998	2000, 2002, 2004	2005-2006, 2008, 2010
Panama	…	1989	1991	1995, 1997, 1998	2001-2004	2005-2006, 2009-2012
Uruguay	…	1989	1992	1995-1999	2000-2004	2005-2011
Venezuela (Bolivarian Republic of)	…	1989	1992	1995, 1998, 1999	2000-2004	2005-2011

Source: Socio-Economic Database for Latin America and the Caribbean (SEDLAC) of the Center for Distributive, Labor and Social Studies (CEDLAS) and the World Bank.

II
The youth labour supply

The growth rate of the young population in Latin America has been slowing since the early 1980s. While the young population grew by 11% between 1980 and 1985, it rose by just 1% between 2005 and 2010. And while it is true that the growth rate of the working-age population as a whole (persons between 15 and 65 years of age) has also been declining, the decrease has not been nearly as sharp (see figure 1).

The figures reflect the ageing of the working-age population in Latin America: whereas young people accounted for 36% of the working-age population in the early 1980s, that figure had dropped to 27.5% by the late 2000s.

In terms of levels of education, the proportion of the young population with no more than a primary education has fallen steeply. In the early 1980s, primary education was the highest level reached by 72% of all young people, but this figure had plummeted to 26% by the late 2000s, with a commensurate rise in the percentage of young people with a secondary or higher education during the three decades under study (see figure 2).

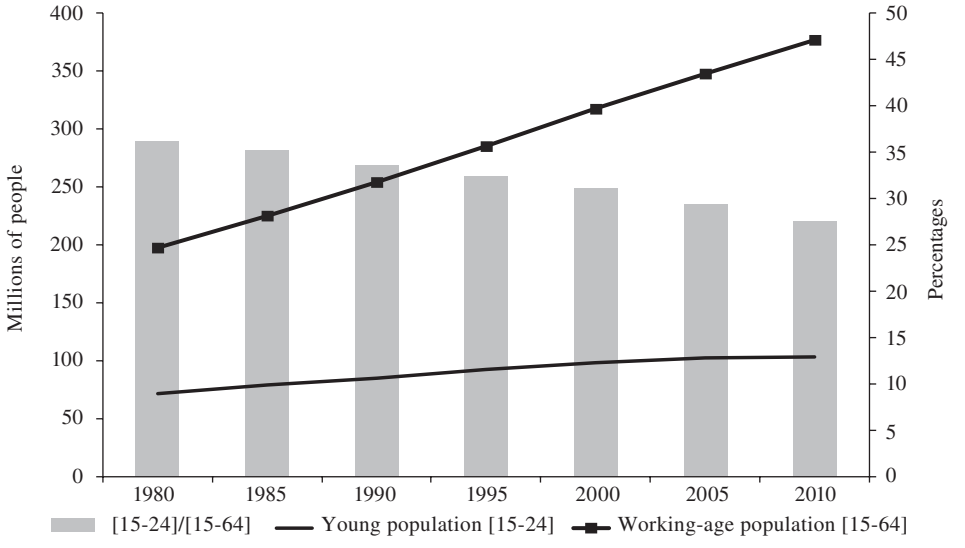
The lengthening of the period during which investments in human capital are being made can also be observed by analysing the distribution of young people in Latin America in terms of their status as students and/or workers. The proportion of the young population that is studying and not working increased by 10 percentage points during the period under study, with a reduction of a similar magnitude being seen in the proportion who are working and not studying; during the same period, the proportion of young people who are neither studying nor working shrank by 5 percentage points.[2] The proportion who both study and work increased, as did the percentage of unemployed youths (see figure 3).

This first brief overview of the trends in the young labour force in Latin America shows that this age group

[2] Although the percentage of young people who are not in school and are not working has shrunk, the size of this group in absolute terms is nonetheless quite large. Cárdenas, de Hoyos and Székely (2011) analyse its members' characteristics and the reasons for the persistence of this phenomenon.

FIGURE 1

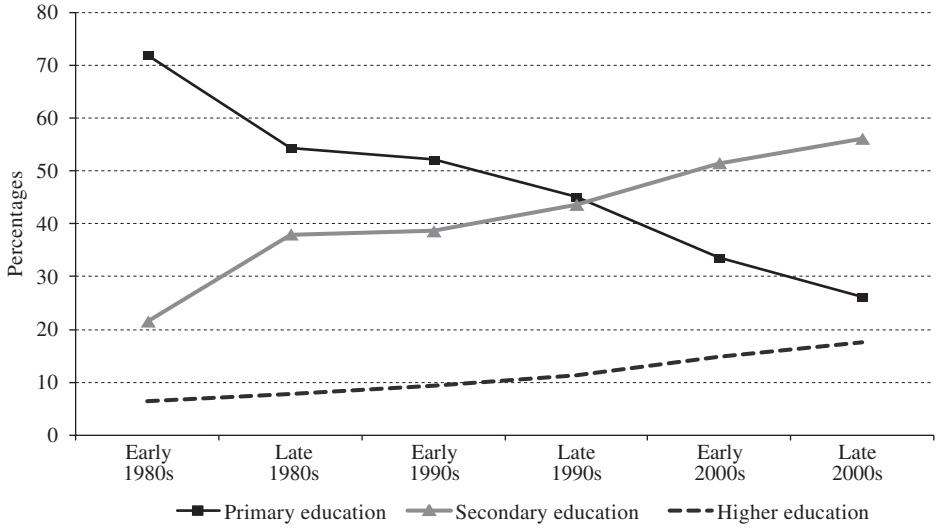
Young population in Latin America, 1980-2010
(Millions of people)



Source: prepared by the author on the basis of Databases and Statistical Publications (CEPALSTAT) of the Economic Commission for Latin America and the Caribbean (ECLAC).

FIGURE 2

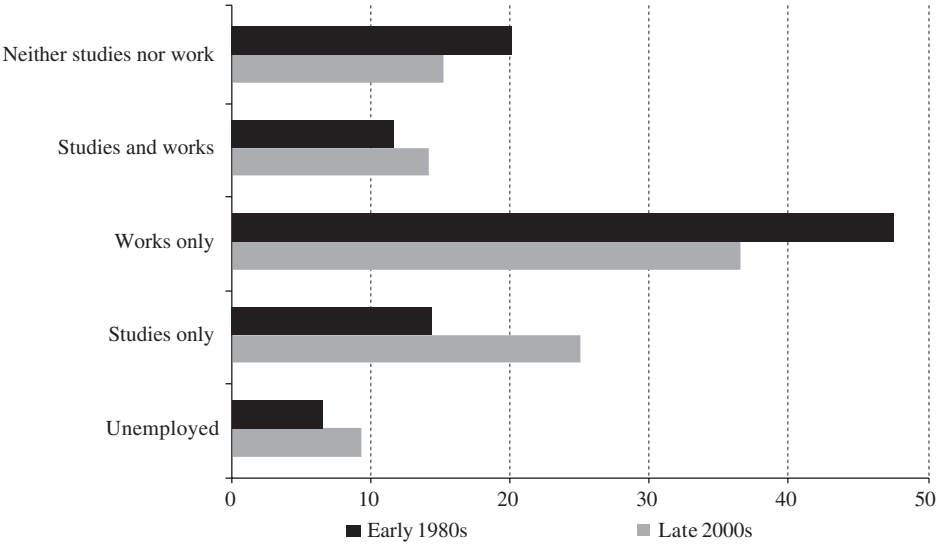
Young people's level of education
(Average for Latin America)



Source: prepared by the author on the basis of the Socio-Economic Database for Latin America and the Caribbean (SEDLAC) of the Center for Distributive, Labor and Social Studies (CEDLAS) and the World Bank.

FIGURE 3

Distribution of the young population, by schooling and employment status
(Average for Latin America)



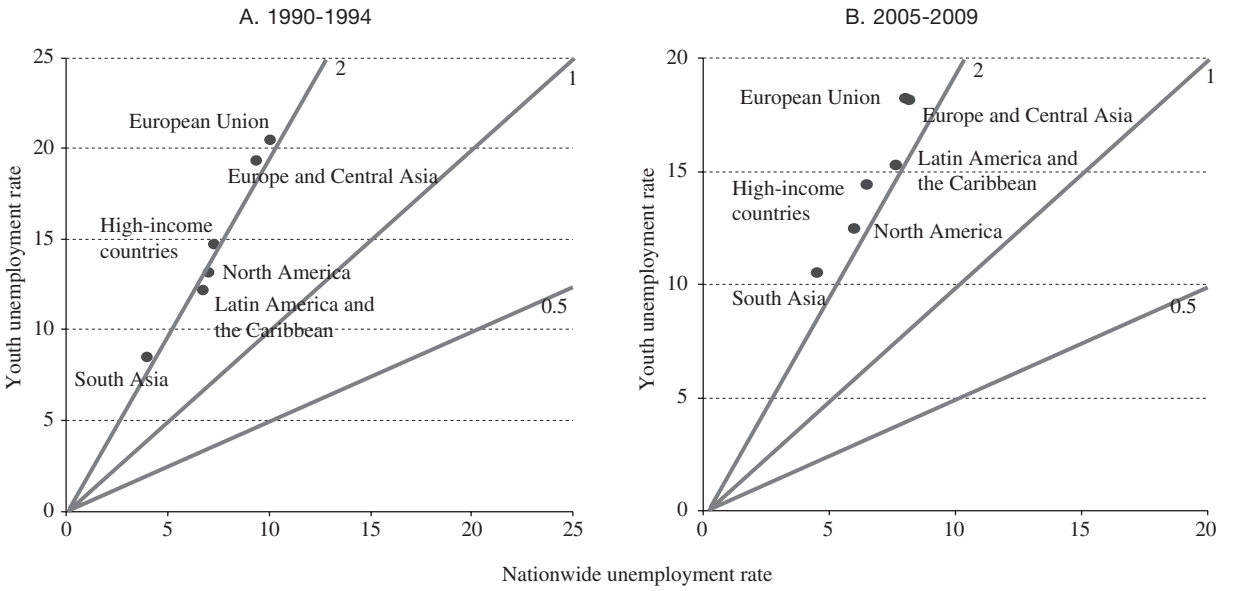
Source: prepared by the author on the basis of the Socio-Economic Database for Latin America and the Caribbean (SEDLAC) of the Center for Distributive, Labor and Social Studies (CEDLAS) and the World Bank.

makes up a smaller and smaller portion of the region's working-age population. It also shows that young people's level of education has risen considerably over the period in question, and despite this, their unemployment rate has climbed as well.

The high rate of youth unemployment is a trend that is not confined to Latin America. The ratio between the youth unemployment rate and the nationwide unemployment rate took a turn for the worse during the 1990s in other world regions as well (see figure 4).

FIGURE 4

Ratio between youth and nationwide unemployment rates
(Percentages)



Source: prepared by the author on the basis of World Bank, *World Development Indicators*.

At that time, the Latin American region had one of the lowest indicators in this respect (youth unemployment was 83% higher than the nationwide rate), but it also witnessed one of the sharpest deteriorations in this ratio during that time and exhibited the steepest increase in youth unemployment.

III

Employment status of young people in Latin America

1. Participation and labour market integration

The labour-force participation rate for young Latin Americans has declined since the early 1980s. The trend in the adult population has been just the opposite, so the gap between the two groups' participation rates has widened during this period (see table A.3 in the appendix). The left-hand panel of figure 5 traces the movement of this indicator when it is calculated as a weighted average. For the first part of this period, information is available only for Argentina and Brazil, while the sample for the late 1980s can be expanded to include Chile, Costa Rica, Mexico, Panama, Uruguay and the Bolivarian Republic of Venezuela. In order to show how much of the change seen between the early and late 1980s is attributable to the expansion of the sample, the dotted lines denote what the value for this indicator would be in the late 1980s if the observations were confined to Argentina and Brazil. The expansion of the sample thus leads to a drop in the activity rate for young people. This is accounted for by the addition of Chile and the Bolivarian Republic of Venezuela, whose youth participation rates are far below those of Argentina and Brazil for this period.[3] When the

[3] The statistics for the individual countries are available and will be supplied by the author upon request.

indicator is computed as a simple average, the level and trend remain much the same for adults but the values for young people fall (see the right-hand panel in figure 5).

One possible explanation for this downturn in the young population's participation rate may lie in the extension of the period of investment in human capital. The proportion of young people who are studying and not working rose by 67% during the period in question and amounted to one fourth of the young population of Latin America by the late 2000s. As a result, the percentage of young people with no more than a primary education shrank and the percentage with a secondary or higher education rose. In the case of the adult population, the increase in the participation rate can be accounted for by the entry of more women into the workforce. Table A.4 of the appendix shows that the participation rate for adult men remained steady at around 91%, while the rate for women jumped from 40% in the early 1980s to 61% by the late 2000s. When the rates for young people are disaggregated by sex, we see that the drop in this group's participation rate was concentrated among men, with the rate for women rising slightly.

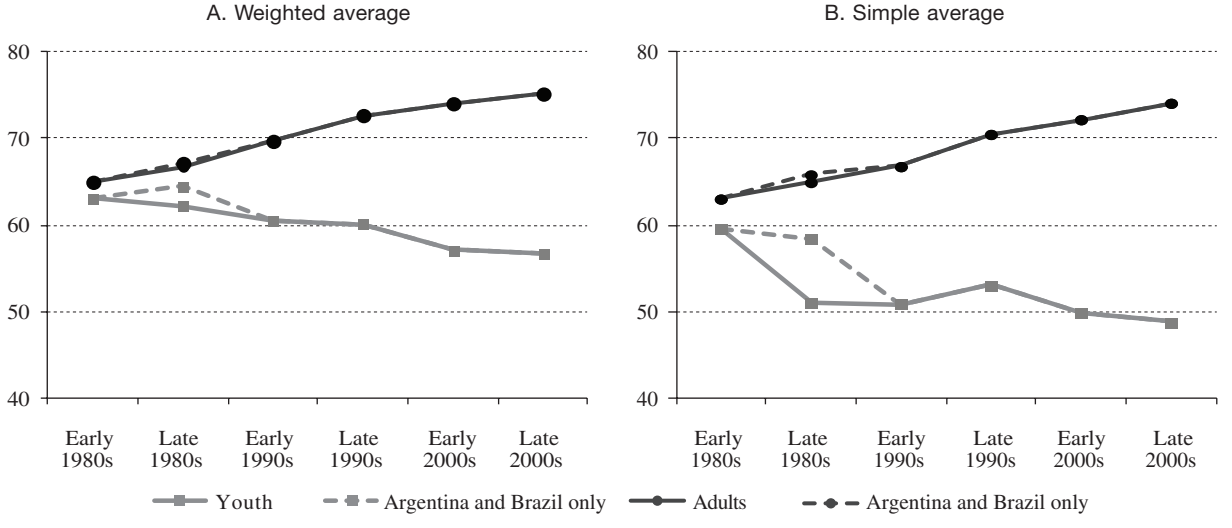
Restricting the sample to people who are not attending school provides a way of controlling for the extension of the period of investment in human capital (see table A.5 in the appendix). In this case, the youth participation rate does not exhibit any large fluctuations but instead remains around an average of 73%. This is higher than the rate for the young population as a whole, which reflects the choices made between the vying options of studying and working (Marchionni, Bet and Pacheco, 2007), and is actually higher than the participation rate for adults in the 1980s and 1990s. It follows from these figures that approximately 30% of the young people who are not studying are not working or actively seeking work either. When the data are disaggregated by sex, it can be seen that the participation rate remained at around 90% for men and climbed from 50% to 60% for women. This difference is undoubtedly associated to some extent with the performance of unpaid domestic work and care for family members by women.

The trend in the youth employment rate is similar to the trend in the youth participation rate (see figure 6). Youth employment levels dropped significantly during the period under study, while just the opposite occurred in adult employment levels, although the youth employment rate did recover slightly between the early and late 2000s. Here again, the addition of other countries to the sample in the late 1980s leads to a lower employment rate than the rate that is registered for Argentina and Brazil alone. As a result, the calculation of the indicator as a simple average yields a lower employment rate.

The hypothesis has been advanced that the drop in the labour-force participation rate for young people can be accounted for by increased investment in human capital. But what about the young people who remained

FIGURE 5

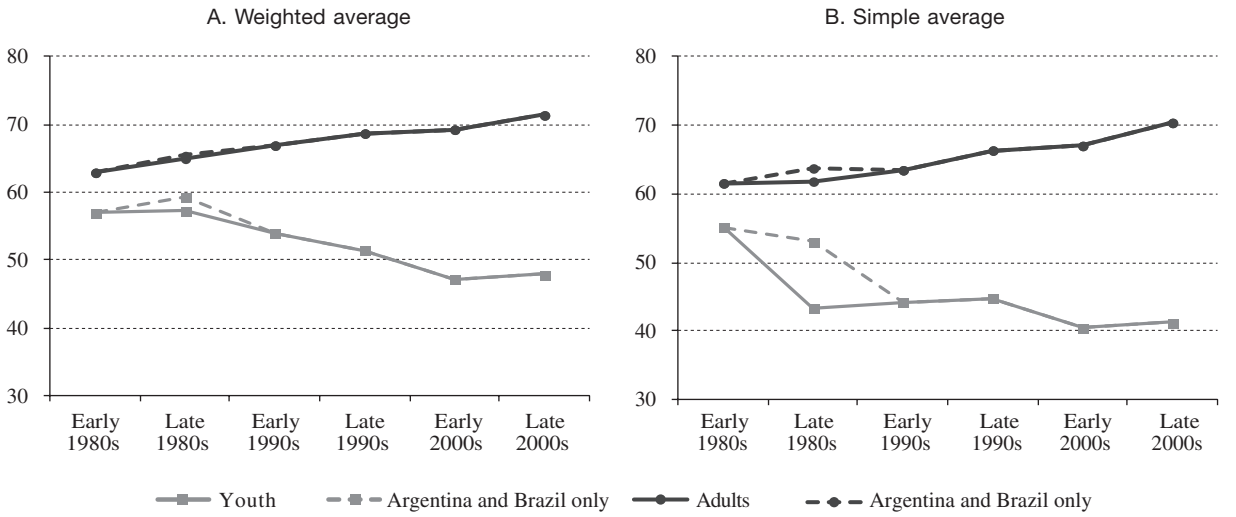
Labour-force participation rate
(Average for Latin America)



Source: prepared by the author on the basis of the Socio-Economic Database for Latin America and the Caribbean (SEDLAC) of the Center for Distributive, Labor and Social Studies (CEDLAS) and the World Bank.

FIGURE 6

Employment rate
(Average for Latin America)



Source: prepared by the author on the basis of the Socio-Economic Database for Latin America and the Caribbean (SEDLAC) of the Center for Distributive, Labor and Social Studies (CEDLAS) and the World Bank.

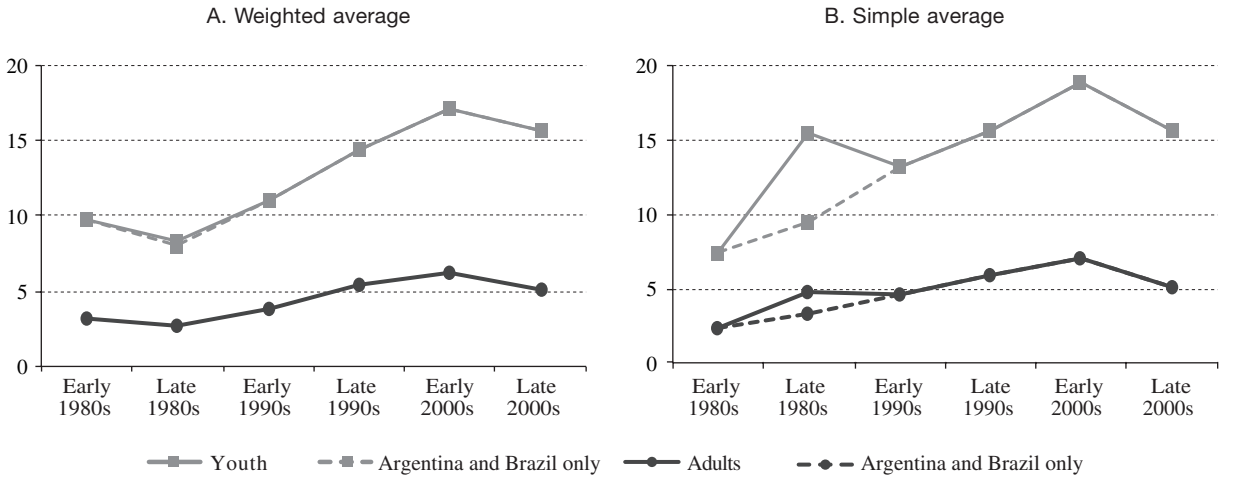
in the labour market and were not studying? When the sample is restricted to people who were not attending an educational institution, the youth employment rate was higher than it was for the young population as a whole, but it still declined over the period under study. At this point, something quite interesting can be observed. When the sample is reduced by excluding people who are studying, the youth participation rate remains steady, rather than declining as it did for the larger sample, but the employment rate remains on a downward trend, although a less steep one, with a recovery then being noted between the early and late 2000s. When the figures are disaggregated by level of education, it can be seen that the drop in formal-sector employment was greater for young people with primary or secondary educations than for those with a higher education (see table A.7 in the appendix). In the latter portion of the period under study, these overall trends changed, with the decline in the employment levels of less-educated young people levelling off, an upswing being registered for those with a secondary education and a slight reduction in the rate for those with a higher education. When the figures are disaggregated by sex, we see that the drop in employment occurred only among men, while the employment level for women increased, especially during the latter part of the period under analysis. This provides clear evidence of an increase in the number of unemployed young people among those who are not accumulating human capital, with a possible improvement towards the end of the period under study.

The trend in the youth unemployment rate is a major problem in the labour markets of the region. Between the late 1980s and the early 2000s, the youth unemployment rate doubled. It then began to descend, as did the adult unemployment rate (see figure 7). When the indicator is computed as a simple average, we see that the expansion of the sample for the late 1980s triggers a sudden change owing to the addition of the high youth unemployment rates in "small" countries such as Chile, Panama and Uruguay. In the early 1990s, this indicator improved for those countries, thereby giving way to a similar trend to that obtained for the indicators when calculated using figures weighted by the size of the population, although the rate was somewhat higher.

While these values are averages of starkly different situations across countries, the comparisons of the figures nonetheless show that, during the latter portion of this period, the youth unemployment rate was more than double the nationwide unemployment rate in 7 out of the 10 countries concerned. The exceptions are Honduras, El Salvador and the Bolivarian Republic of Venezuela, where the youth unemployment rates in the late 2000s were 78%, 88% and 92% higher than the rate for adults, respectively. In all the countries considered, unemployed youths represent between 37% (Bolivarian Republic of Venezuela) and 54% (Honduras) of the total number of unemployed persons (see figure 8).

FIGURE 7

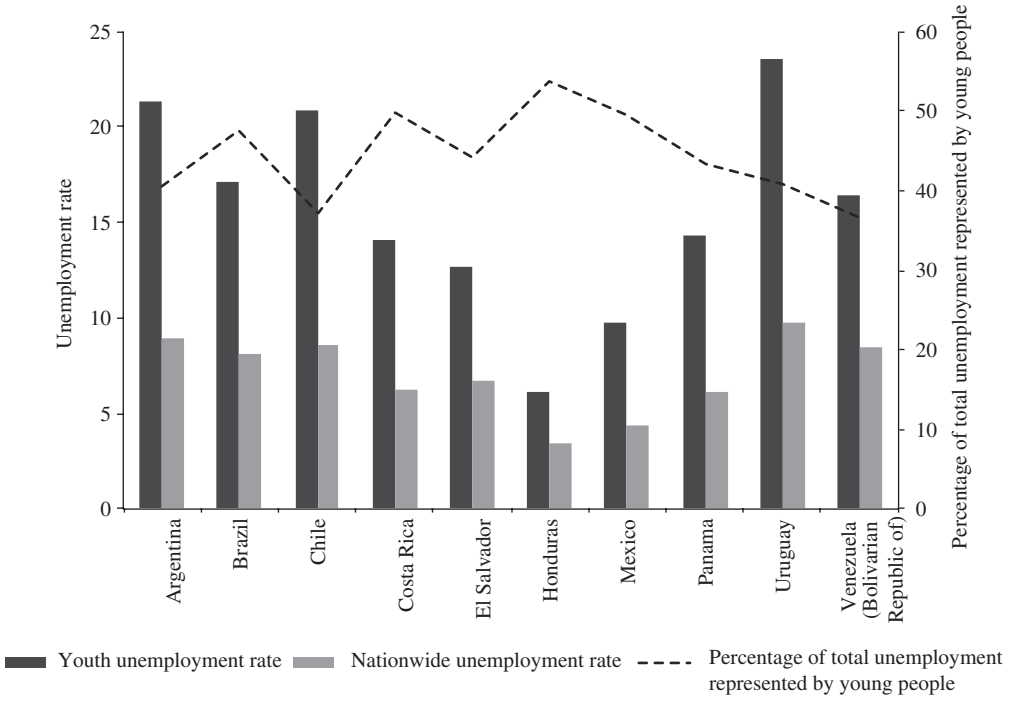
Unemployment rate
(Average for Latin America)



Source: prepared by the author on the basis of the Socio-Economic Database for Latin America and the Caribbean (SEDLAC) of the Center for Distributive, Labor and Social Studies (CEDLAS) and the World Bank.

FIGURE 8

Nationwide unemployment as compared to youth unemployment
(Late 2000s)



Source: prepared by the author on the basis of the Socio-Economic Database for Latin America and the Caribbean (SEDLAC) of the Center for Distributive, Labor and Social Studies (CEDLAS) and the World Bank.

By restricting the sample to people who are not attending school, we can isolate the cases in which unemployment is attributable to engagement in a competing activity (studies). In this case, we find a similar trend in the youth unemployment rate but at a lower level than in the full sample. When the figures are disaggregated by sex, we see that unemployment is lower among men. A disaggregation by levels of education turns up a number of patterns: (i) unemployment rates rose for all levels of education but then improved in the late 2000s; (ii) youth unemployment trends follow an inverted u-curve as a function of the level of education for all periods (see figure 9); and (iii) unemployment rates for young people with a higher education were slightly higher than the rates for young people with primary educations except in the 1980s.

There may be two possible explanations for this last trend. The first has to do with an involuntary aspect of the job turnover rate for young people. Employers offering highly skilled jobs often require that candidates have experience in performing the tasks involved, and young people have a harder time fulfilling that requirement. Highly educated young people may also have difficulty in finding a job because low-productivity activities account for a larger share of youth employment (Maurizio, 2011). This second possible explanation has to do with a voluntary aspect of job turnover. The search for a "good match" may take longer for more educated youths, since they will be trying to find a position that is in line with their qualifications.

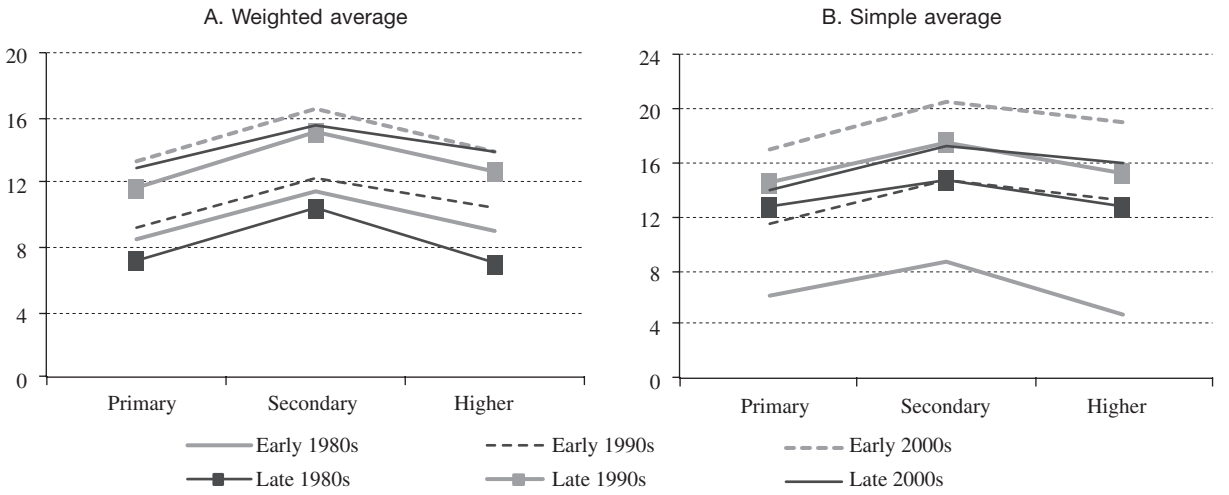
The inverted u-curve for youth unemployment and level of education could be related to the increase in the number of young people who have completed their secondary education (see figure 2). However, this ratio is evident for all periods, not just the 2000s, which is when the proportion of young people with a secondary education surpassed the proportion of those with no more than a primary education. The explanation would therefore appear to lie in labour demand. The activities that are the largest employers of young workers tend to be low-productivity activities that generate a demand for less-educated workers. The demand for more highly skilled young workers is thought to be smaller, but, then, so is the supply. Workers with a secondary education are therefore in a segment for which demand is low and supply is on the rise.

The length of time spent unemployed is higher for adults. Figure 10 depicts the distribution of three categories of unemployed persons: those who have been unemployed for up to 6 months; those who have been unemployed for a period lasting between 6 months and 1 year; and those who have been looking for work for more than 1 year. In the 1980s, unemployed youths were concentrated in the first two categories; from the 1990s on, the distribution became polarized between the shortest and longest periods of unemployment. The

FIGURE 9

Unemployment rates, by level of education

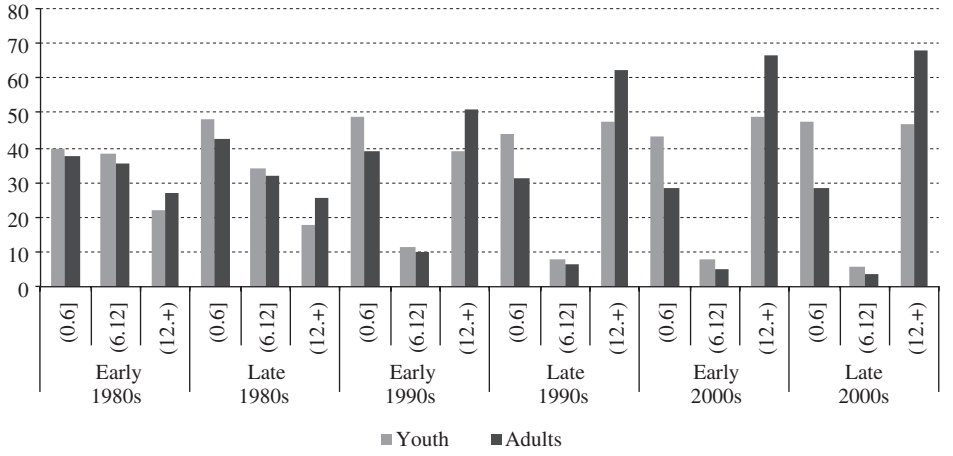
(People who are not attending an educational institution)



Source: prepared by the author on the basis of the Socio-Economic Database for Latin America and the Caribbean (SEDLAC) of the Center for Distributive, Labor and Social Studies (CEDLAS) and the World Bank.

FIGURE 10

Distribution of the unemployed population, by duration of unemployment
(Average for Latin America)



Source: prepared by the author on the basis of the Socio-Economic Database for Latin America and the Caribbean (SEDLAC) of the Center for Distributive, Labor and Social Studies (CEDLAS) and the World Bank.

Note: (x,y) interval does not include the two extreme values for x;
(x,y] interval excludes the lowest value for x and includes the highest value for y.

distribution for the unemployed adult population is similar but with a slightly larger proportion of adults falling into the longest-duration category than in the case of young people. This result appears to be counter-intuitive, since young job-seekers are at a disadvantage because they have less work experience. It is important to remember, however, that the length of time that a person has been unemployed is reported at the time that the survey was taken, so the overall duration of unemployment is not known. It follows that young workers who have spent relatively little time in the labour market will also have been unemployed for less time. Another possible reason for this gap is the existence of differing preferences on the part of job seekers. Young people who are only recently entering the job market are not fully aware of what types of positions may be available and may rotate between different types of occupations, interspersed with fairly brief periods of unemployment between one job and the next. Adults who have a better understanding of the job market and who have more clearly defined preferences may take longer to find a job that is a good match for them.

2. Youth employment characteristics

The percentage of people who would like to change jobs or work more hours is a subjective indicator of employment status. This figure has invariably been higher for young people, on average, in Latin America, although the level and trend of this indicator vary across countries. In Brazil, Costa Rica, Honduras and the Bolivarian Republic of Venezuela, it has trended upward. In Panama, it has trended downward. And in Argentina and Uruguay, this indicator rose until the late 2000s and then began to decline.[4]

The informality rate —defined as the percentage of jobs performed by people who are not registered with the social security system— has invariably been higher for young people, with the differential between young and adult workers traditionally being around 20 percentage points. The trend has been moving upward for both age groups, with a slight recovery for young people towards the end of the 2000s. It is difficult to gauge the welfare implications of informal employment for young workers. If they continue to be listed as dependents of an adult (the head of household, for example), they may have social security coverage if that person is working in the formal sector of the economy.[5] Otherwise, informal employment while young may influence people's ability to position themselves in the labour market later on by either increasing the likelihood that they will remain in the informal sector as adults or by lowering their wage-

[4] Information for this indicator for Chile, Mexico and El Salvador is not available.

[5] In most Latin American countries, a formal-sector worker can provide social security coverage (e.g., health insurance) to his or her family members (primarily the spouse and children).

level prospects if informality is interpreted as a sign of low productivity (Cruces, Ham and Viollaz, 2012).

There is a clear-cut negative correlation between the informality rate and level of education (see table A.6 in the appendix). Young workers with no more than a primary education are the worst off: the differential between the informality rate for young people with primary educations and those with secondary educations amounts to 26 percentage points, while the gap between those with a secondary education and those with a higher education totals 37 points. The decline in the informality rate for the young population in the late 2000s is wholly accounted for by the drop in the rate for people with a higher education.

The rising rate of youth unemployment, coupled with the rising informality rate for this age group, suggests that young people are entering the informal sector because they are running up against some sort of barrier to entry into the formal sector of the economy and that this barrier is particularly difficult for less-educated youths to overcome. The evidence of rising skill levels runs counter to the idea that educational differentials account for the higher informality rate among young people. On the other hand, we would appear to be witnessing an occupational segregation process whereby employment in jobs that do not afford social security coverage is being taken up by young workers to a disproportionate degree.

The hourly wage (in purchasing power parity (PPP) dollars at 2005 prices) has always been higher for adults. This is to be expected, since years of work experience increase with age. The wage differential peaked in the late 1990s, when an adult worker was earning, on average, US$ 2.00 per hour more than a young worker. The wage gap separating young and adult workers increases as their level of education rises, with the differential being less than US$ 1.00 for people with a primary level of education, US$ 2.00 for people with a secondary education and US$ 5.00 for persons with a higher education. Another interesting point is that the wage gap, as a regionwide average, has narrowed for less-educated young people.

Wage differentials for young people corresponding to different levels of education differ from one country to the next (see table 2).

In Argentina, Chile and Costa Rica, the differential has fluctuated around 1.4. Uruguay is the only country in which this ratio increased over time. Brazil, El Salvador and Panama registered downturns, while in Mexico and the Bolivarian Republic of Venezuela, the wage ratio between skilled and unskilled young workers has fluctuated up and down.

The differential in the number of hours worked by young and adult workers decreased over the period under study, with the number of hours worked by young people dropping somewhat more than the number registered for adult workers. At the start of the 1980s, the gap in the number of hours worked was 0.7 hours (with the larger figure being registered for adults), while at the end of the 2000s, the figure had climbed to 2.1 hours. More highly educated adults and young people both work fewer hours, on average, than their counterparts who have not completed their primary or secondary education.

TABLE 2

Youth: wage differentials by educational level, early 1980s-late 2000s
(Quotients)[a]

	Early 1980s	Late 1980s	Early 1990s	Late 1990s	Early 2000s	Late 2000s
Argentina						
Mean	…	1.417	1.305	1.401	1.385	1.399
Standard error	…	0.005	0.002	0.001	0.002	0.001
Brazil						
Mean	2.444	2.476	2.236	1.905	1.696	1.490
Standard error	0.001	0.002	0.001	0.001	0.001	0.001
Chile						
Mean	…	…	1.396	1.398	1.244	1.321
Standard error	…	…	0.004	0.007	0.003	0.004
Costa Rica						
Mean	…	1.486	1.491	1.477	1.577	1.435
Standard error	…	0.008	0.003	0.004	0.004	0.002

Table 2 (*conclusion*)

	Early 1980s	Late 1980s	Early 1990s	Late 1990s	Early 2000s	Late 2000s
El Salvador						
Mean	…	…	1.996	1.599	1.374	1.401
Standard error	…	…	0.022	0.003	0.002	0.002
Honduras						
Mean	…	…	2.298	1.878	1.924	1.782
Standard error	…	…	0.009	0.004	0.005	0.005
Mexico						
Mean	…	…	1.887	1.724	1.935	1.518
Standard error	…	…	0.003	0.001	0.002	0.001
Panama						
Mean	…	…	1.693	1.519	1.566	1.420
Standard error	…	…	0.012	0.008	0.004	0.003
Uruguay						
Mean	…	1.227	1.256	1.292	1.346	1.410
Standard error	…	0.006	0.007	0.004	0.004	0.004
Venezuela (Bolivarian Republic of)						
Mean	…	1.447	1.539	1.783	1.567	1.218
Standard error	…	0.002	0.003	0.004	0.007	0.001

Source: Socio-Economic Database for Latin America and the Caribbean (SEDLAC) of the Center for Distributive, Labor and Social Studies (CEDLAS) and the World Bank.

[a] Quotients of the hourly wage of skilled young workers (workers who have completed their secondary or higher education) and the hourly wage of unskilled young workers (workers who have an incomplete secondary education or less).

3. Employment outcomes for young people as viewed from a gender perspective

The way in which males and females position themselves in the labour market differs, as do their employment outcomes. Generally speaking, women are confronted with less favourable working conditions than men because of the difficulties they have in combining gainful employment with the work that they are called upon to do in the home, and because of the gender-based discrimination and segregation to which they are subject in Latin American labour markets (Maurizio, 2010).

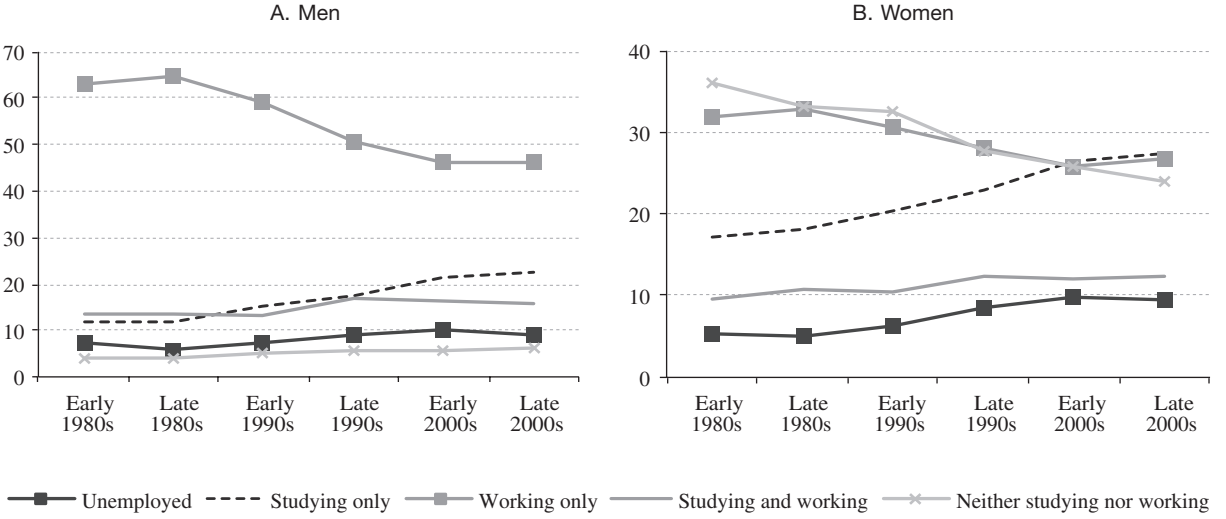
As noted earlier, the drop in the participation rate for young people over the period under study is accounted for by the lower activity rate for men. An increasing number of women, on the other hand, have been entering the workforce, although in absolute terms there are still fewer women than men in the labour market. Employment rates for both young men and young women are continuing to fall, however.

At this point it will be useful to analyse the distribution of young men and women in terms of their schooling and employment status. Figure 11 shows that the gender-based distributions differ substantially, even though the trends for the two categories have moved in the same direction. For young men, the largest category is "works and does not study", even though it declined from 63% in the early 1980s to 46% in the late 2000s. For women, the largest categories were "works and does not study" and "neither works nor studies", with percentages ranging from over 30% to around 25% at the close of this period. The proportion of young women who studied but did not work and the proportion of young women who were unemployed consequently rose. These changes in trends notwithstanding, the percentage of young women who confine their activity to domestic tasks continues to be far greater than the corresponding figure for men.

Youth unemployment rates for both men and women have been rising, although the unemployment rate for women has consistently been higher than the rate for men. Young men and women have both had informality rates of around 50%, but the upswing in this indicator was sharper in the case of men between the late 1980s and the early 2000s. Hourly wages trended upward for both sexes, but the upturn was so much sharper in the case of young women that the wage gap had been closed by the early 2000s.

FIGURE 11

Distribution of the young population, by employment and school attendance
(Average for Latin America)



Source: prepared by the author on the basis of the Socio-Economic Database for Latin America and the Caribbean (SEDLAC) of the Center for Distributive, Labor and Social Studies (CEDLAS) and the World Bank.

IV
Analysis of the working life cycle

The aim of this section is to analyse labour market dynamics in Latin America in order to see what labour indicators may have to tell us about the course of the working life cycle. The idea is to discern behavioural patterns that do not show up in cross-section analyses. For example, we will try to see if the difficulties encountered by young people who are just entering the labour market persist once they have reached adulthood and if this situation changes as time goes on or not. The job instability experienced by young people during their early years in the labour market may have an impact on their future employment prospects. For example, it is possible that young people who were unemployed during that stage in their working life may be penalized in the sense that they may be more likely to be unemployed when they are adults as well.

The available information cannot be structured as panel data. The proposed methodology therefore involves defining birth cohorts and following their behaviour over time (see table 3). Based on the available information for the 10 countries covered in this study, 6 cohorts were constructed. The first is made up of people born during the first half of the 1960s, who were then observed between the time that they were 16 years old and the time that they reached the age of 49. The second cohort is composed of people born in the second half of that decade, who were observed between the time that they were 15 years of age and the time that they reached the age of 44. The third, fourth and fifth cohorts were constructed in a similar way. Their members were observed from the time that they were 15 years old up to a given point in their adult life. The time span covered is inevitably shorter for the younger cohorts. People born in the second half of the 1980s make up the sixth and last cohort, for which observations are available only for the period during which they were young. The averages for the region as a whole have been weighted on the basis of each country's share in the relevant age group, such that, for each cohort and each age group, the weightings equal unity. The indicators were also computed as simple averages for all the countries in order to control for the influence of those with larger populations.

Figure 12 depicts the labour-force participation and employment rates for three of the cohorts and seven age intervals. These are the oldest cohort (born between 1960 and 1964), an intermediate cohort (born between 1970

TABLE 3

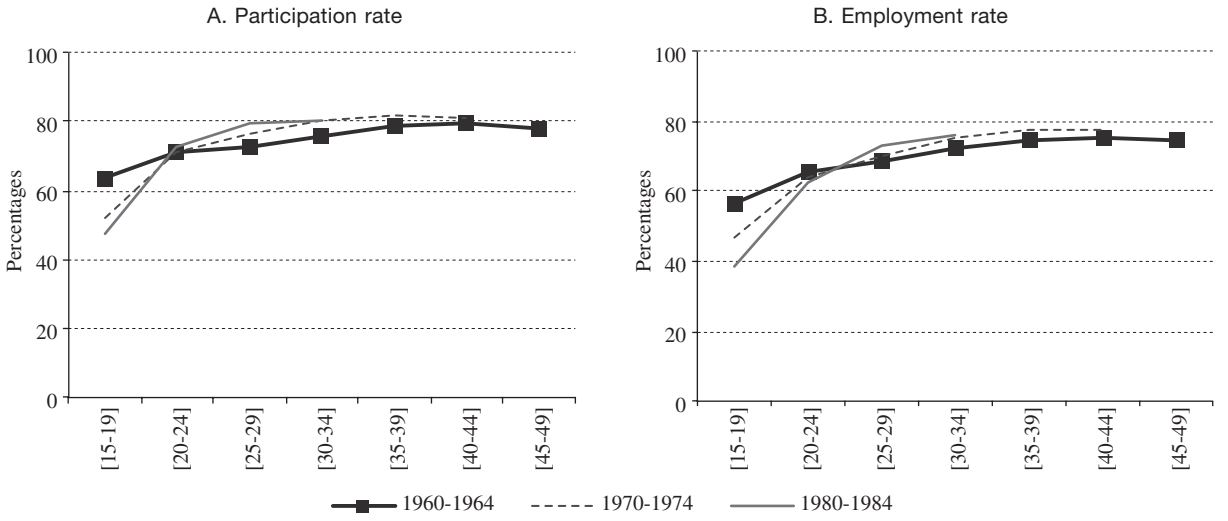
Birth cohorts
(By age intervals)

Cohorts	Early 1980s	Late 1980s	Early 1990s	Late 1990s	Early 2000s	Late 2000s
1960-1964	16-24	21-29	26-34	31-39	36-44	41-49
1965-1969	15-19	16-24	21-29	26-34	31-39	36-44
1970-1974		15-19	16-24	21-29	26-34	31-39
1975-1979			15-19	16-24	21-29	26-34
1980-1984				15-19	16-24	21-29
1985-1989					15-19	16-24

Source: prepared by the author.

FIGURE 12

Labour-force participation and employment rates for three birth cohorts
(Weighted average)



Source: prepared by the author on the basis of the Socio-Economic Database for Latin America and the Caribbean (SEDLAC) of the Center for Distributive, Labor and Social Studies (CEDLAS) and the World Bank.

Note: [x,y] interval includes both extremes.

and 1974) and a younger cohort (born between 1980 and 1984). This approach is used as a means of simplifying the picture so that the main behavioural patterns captured by the labour indicators can be discerned. The detailed results for each of the cohorts are shown in table A.8 in the appendix.

The inter-cohort differences observed in the first age groups reflect the pattern analysed in section III. Activity and employment rates are lower for the more recent cohorts, especially for the 15-19 age group. In the next age group, participation and employment rates rise and the differentials between cohorts begin to narrow. The members of all the cohorts display a typical working life cycle, whereby participation and employment rates for young people increase as they age but at a descending pace. The evidence provided by this type of analysis indicates that the ranking of the cohorts is reversed once the members of those cohorts become adults. Once they have reached the age of 25, their participation and employment rates are higher than those of the adults in earlier cohorts. This same pattern emerges when the results are computed as a simple average. When the figures are disaggregated by sex, it can be seen that, for men, the inter-cohort differential begins to narrow as they reach adulthood and thereafter hardly varies at all. In the case of women, the upturn in activity and employment rates is faster. Starting with the 20-24 age group, the youngest cohort surpasses

its predecessors, and this pattern remains in evidence throughout the labour life cycle (see table A.9 of the appendix). The disaggregation by level of education shows that the upswing for the most recent cohort occurs more slowly for people with a higher education (see table A.10 of the appendix).

The unemployment rate for young people in the most recent cohort is far higher than the rate for young people in earlier cohorts (see the left-hand panel of figure 13).[6] As the members of the cohorts continue their careers, their unemployment rate drops. The unemployment rate for the 1970-1974 birth cohort matches the rate for the oldest cohort when its members reach 34-39 years of age and is lower thereafter. The unemployment rate for the 1980-1984 birth cohort drops more steeply and matches the rate for the 1970 -1974 birth cohort upon entry into adulthood. The analysis also shows that people born between 1980 and 1984 had very high unemployment rates during their youth but have since then made a very fast recovery during adulthood. The patterns for men and women are similar, although the unemployment rate for men is lower. The analysis by levels of education reveals similar patterns, with higher unemployment rates for people with secondary and higher educations, which fits in with the findings discussed in section III. The members of younger cohorts who have no more than a primary education have improved upon the performance of earlier generations, but this pattern is not seen in the groups with a secondary or higher education when weighted averages are computed.[7]

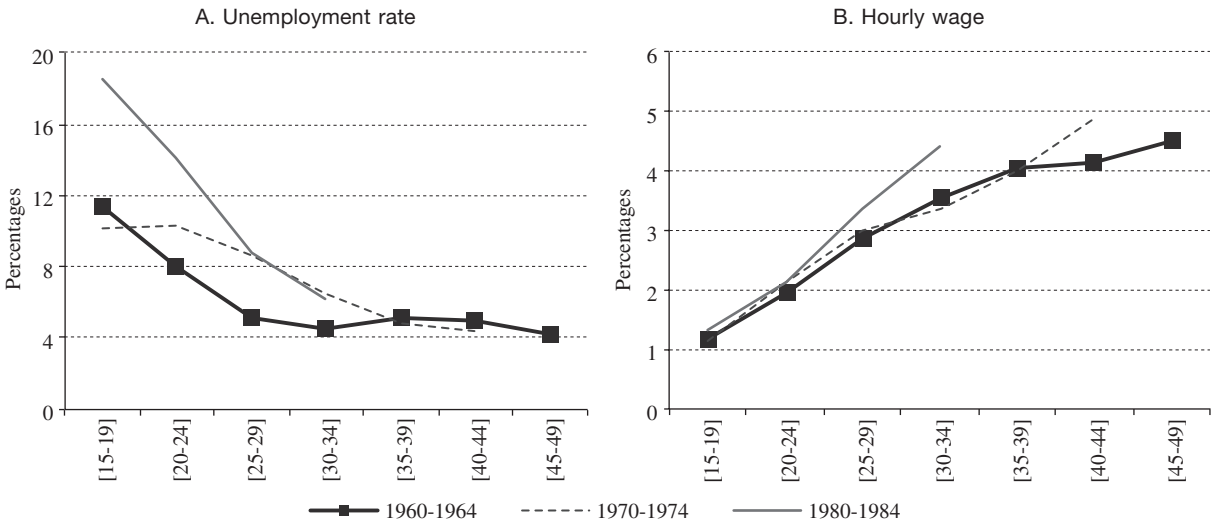
Hourly wages positively correlate with age in all birth cohorts (see the right-hand panel in figure 13). Increases in wages are also apparent in younger cohorts, especially when the 1980-1984 birth cohort is compared with earlier cohorts. This fits with the analysis discussed in section III, which shows that the wages of young people and adults trend upward over time. Here again, wage trends for men and women are much the same,

[6] Inter-cohort differentials are even sharper when simple averages are used and reflect the differences existing across countries.

[7] Improvements in wage levels for all educational categories are seen when simple averages are used, however.

FIGURE 13

Unemployment rate and average hourly wage for three birth cohorts
(Weighted average)



Source: prepared by the author on the basis of the Socio-Economic Database for Latin America and the Caribbean (SEDLAC) of the Center for Distributive, Labor and Social Studies (CEDLAS) and the World Bank.

Note: [x,y] interval includes both extremes.

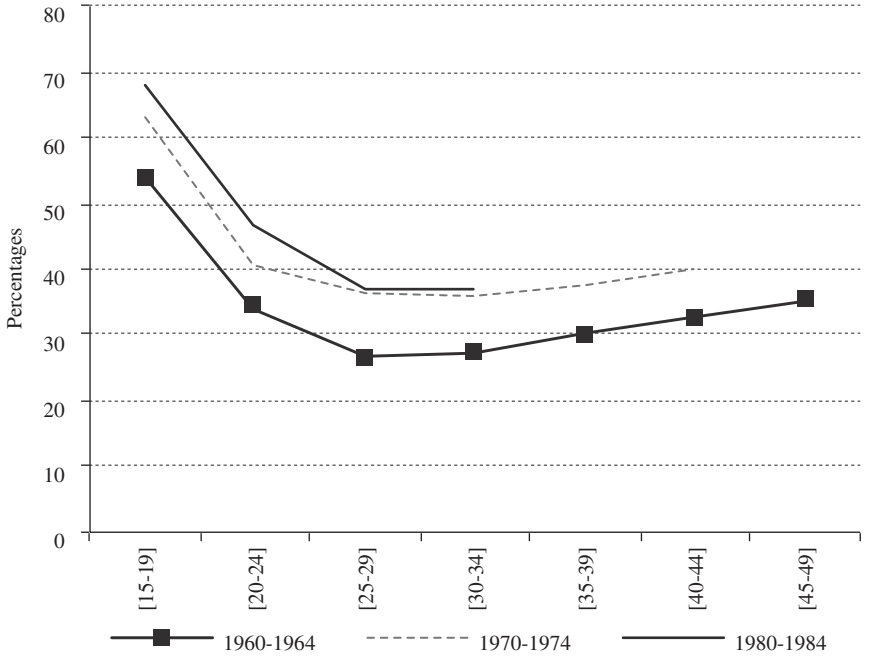
but the level of wages is higher for men. This pattern is also seen in the wages earned by people with no more than a primary education, which are lower than the wage levels recorded for the sample as a whole. The upswing for people with a secondary education is slower, and wage levels for the members of the youngest cohort who have a higher education never do reach the levels of older cohorts.

The last indicator that will be examined in this section is the informality rate. The analysis depicted in figure 14 indicates, first of all, that informal employment decreases with age until the first years following entry into adulthood, after which it begins to increase over time. In section III, we saw that the informality rate for adults was consistently lower than the rate for young people but that the rate for adults increased more sharply over time than the rate for young people did. The U-curve pattern that emerges from the cohort analysis reflects this phenomenon. Secondly, it shows that, when more recent cohorts were examined, the rate of informality was higher at all stages in the working life cycle. Thirdly, it suggests that the gap is tending to narrow during adulthood for the most recent cohort, which succeeds in matching the performance of the preceding cohort but which is still a long way from attaining the levels reached by the oldest cohort. This holds for both men and women and may be signalling that some sort of penalty is associated with employment in the informal sector during one's youth. Fourthly, the results disaggregated by level of education show that the informality rate for members of the most recent cohort who have a higher education drops sharply to levels close to that of the 1970-1974 cohort by 30-34 years of age. Members of the most recent cohort who have completed no more than their primary or secondary educations reduce their informality rate as they gain work experience, but they do not actually manage to close the gap between them and the 1970-1974 cohort. The penalty associated with employment in the informal sector during one's youth would appear to be greater in these cases.

FIGURE 14

Informality rate for three birth cohorts

(Weighted average)



Source: prepared by the author on the basis of the Socio-Economic Database for Latin America and the Caribbean (SEDLAC) of the Center for Distributive, Labor and Social Studies (CEDLAS) and the World Bank.

Note: [x,y] interval includes both extremes

V
Conclusions

This study has focused on a range of characteristics and patterns in Latin American labour markets over the last three decades. The analysis of trends in labour indicators shows that the employment status of young people had deteriorated over time but then began to improve in the late 2000s. The amount of time required to make the transition from the stage of human capital formation to the stage at which entry into the labour market takes place has increased because the first of those stages now covers a longer time span, but the employment status of the young people who remain in the labour market has worsened. Despite the improvement in young people's qualifications, their unemployment and informality rates have risen, which indicates that new formal-sector entry barriers have arisen or existing ones have become more formidable, and these barriers are particularly difficult for less-educated young people to surmount. This suggests that the efforts made to improve young people's position in the labour market should be continued with a view to prolonging the upswing seen towards the end of the period under study.

The analysis also indicates that young people whose prospects are somewhat dim when they first try to enter the workforce eventually manage to enter into a typical working life cycle as they gain more work experience. As a result, young people in the more recent birth cohorts are achieving higher employment rates during adulthood, as well as lower unemployment rates and better hourly wages than the adults belonging to previous cohorts. The more recent cohorts' rate of informality declines as they pass into adulthood, but the more recent generations are not succeeding in matching the performance of older generations. This indicates that there is some type of penalty associated with employment in the informal sector during one's youth. This phenomenon is concentrated among people with no more than a primary education. While it is true that informal employment can provide a person with on-the-job training and work experience (Bosch and Maloney, 2010; Cunningham and Bustos, 2011), this analysis shows that the kind of training and work experience acquired in the informal sector during people's youth may not be enough to propel them into formal-sector jobs in their adulthood (Cruces, Ham and Viollaz, 2012).

An analysis undertaken from a gender perspective shows that young women are entering the labour market, but that the proportion who neither study nor work remains far above the proportion of young men in that situation. And for those who are active participants in the labour market, the unemployment rate is also higher than the rate for men. The brighter employment prospects for young people that emerged in the late 2000s had a strong impact on women in some cases, with both the uptrend in wages and the reduction in the informality rate being sharper for women than for men.

To sum up, the results indicate that the dim prospects facing young people on the verge of entering the labour market during the 1990s and early 2000s began to brighten in the late 2000s. In addition, the working life cycle analysis shows that young people's position in the labour market improves once they become adults. While these findings are very promising, it is important to remember that this improvement in young people's employment status takes time, and that the nature of their positions in the labour market may be associated with penalties during their adult years in terms of lower wages, fewer job opportunities or a reduced ability to obtain work in the formal sector of the economy.

In view of the fact that the deterioration in the employment status of young people seen up to the early 2000s occurred despite the fact that these young people were more educated than their predecessors, it is clear that policies aimed at helping people to obtain their first job are called for. The high rate of informality for this group and recent evidence that employment in the informal sector during one's youth may not provide sufficient training to allow a person to transition into the formal sector of the economy (Cruces, Ham and Viollaz, 2012) add another policy challenge into the equation. Monetary incentives for the recruitment of young workers or a reduced minimum wage for this age group may lower what employers may perceive as the high cost of hiring such workers and thereby encourage them to hire young people. Another possible strategy would be to lower the cost of seeking employment by, for example, providing transportation subsidies that would make it more affordable for job seekers to travel from their place of residence to areas where formal jobs are located.

The combination of the young population's high unemployment rate and that population's rising level of education calls the quality of the region's education

systems into question. Latin America has made major strides in recent decades in opening up access to education, but a greater degree of segmentation in terms of educational outcomes and the quality of instruction has also been noted (ECLAC, 2011). In the presence of unequal access to educational opportunities, it can be expected that social inequities may persist and even worsen during the transition from the classroom to the workplace. Measures designed to broaden and strengthen education in the early years of schooling and provide vocationally appropriate instruction could provide a way of smoothing the transition from the classroom to the workplace while ensuring that new entrants will be able to adapt to changes in production activities and technologies.

Another employment strategy would be to facilitate business start-ups or other independent production activities. Reducing the limitations that hinder unemployed persons from starting up a business or an economic activity of their own (by, for example, doing away with legal barriers and loan constraints) would be another way of assisting young people to make this transition.

All policies in this area should also take into account the differences in the employment opportunities and conditions of men and women and be crafted in such a way as to do away with discriminatory practices in the labour market.

In conclusion, improvements in the quality of young people's first experience in the labour market should be a priority. While it is true that the labour market's growing instability runs counter to young people's need for some degree of job continuity (Weller, 2006), policy measures that can strengthen young people's position in terms of job stability and job quality can have lasting positive effects on these people's working life cycles.

APPENDIX

TABLE A.1

Household surveys

Argentina	1980-2002 2003-2012	Permanent Household Survey - (Single survey) Permanent Household Survey - (Series)
Brazil	1981-2011	Permanent Household Survey
Chile	1987-2011	National Socioeconomic Survey
Costa Rica	1989-2009 2010	Multi-purpose Household Survey National Household Survey
El Salvador	1991-2010	Multi-purpose Household Survey
Honduras	1990-2011	Multi-purpose Permanent Household Survey
Mexico	1989-2010	National Household Income and Expenditure Survey
Panama	1989-1991 1995-2012	Household Labour-force Survey Household Survey
Uruguay	1989-2011	Continuous Household Survey
Venezuela (Bolivarian Republic of)	1989-2011	Sample Household Survey

Source: prepared by the author on the basis of the Socio-Economic Database for Latin America and the Caribbean (SEDLAC) of the Center for Distributive, Labor and Social Studies (CEDLAS) and the World Bank.

TABLE A.2

Years used to compute weightings
(Early 1980-late 2000s)

Period	Argentina	Brazil	Chile	Costa Rica	El Salvador	Honduras	Mexico	Panama	Uruguay	Venezuela (Bolivarian Republic of)
Early 1980s	1980	1981	…	…	…	…	…	…	…	…
Late 1980s	1989	1989	1987	1989	…	…	1989	1989	1989	1989
Early 1990s	1992	1992	1992	1992	1991	1992	1992	1991	1992	1992
Late 1990s	1998	1998	1998	1998	1998	1998	1998	1998	1998	1998
Early 2000s	2003	2003	2003	2003	2003	2003	2002	2003	2003	2003
Late 2000s	2009	2009	2009	2009	2009	2009	2008	2009	2009	2009

Source: prepared by the author on the basis of the Socio-Economic Database for Latin America and the Caribbean (SEDLAC) of the Center for Distributive, Labor and Social Studies (CEDLAS) and the World Bank.

TABLE A.3

Labour indicators, by age group.
Early 1980s-late 2000s
(Percentages unless otherwise indicated)

	Weighted average						Simple average					
	Early 1980s	Late 1980s	Early 1990s	Late 1990s	Early 2000s	Late 2000s	Early 1980s	Late 1980s	Early 1990s	Late 1990s	Early 2000s	Late 2000s
Labour-force participation rate												
Youth	63.06	62.26	60.50	60.12	57.09	56.76	59.59	51.06	50.91	53.05	49.92	48.80
Adults	64.99	66.74	69.71	72.69	74.05	75.17	63.05	64.96	66.80	70.51	72.21	74.11
Employment rate												
Youth	56.88	57.20	54.00	51.40	47.18	47.85	55.07	43.37	44.17	44.73	40.43	41.22
Adults	62.91	64.97	66.91	68.69	69.25	71.36	61.55	61.82	63.46	66.34	67.01	70.36
Unemployment rate												
Youth	9.80	8.33	11.09	14.43	17.06	15.64	7.44	15.40	13.17	15.69	18.86	15.63
Adults	3.20	2.67	3.89	5.40	6.26	5.06	2.35	4.80	4.53	5.85	7.04	5.02
Duration of unemployment[a]												
Youth	4.89	3.46	7.45	9.38	9.62	9.26	3.70	6.09	6.08	5.59	5.84	5.15
Adults	4.77	3.41	10.11	14.88	16.75	16.73	3.57	7.56	7.69	7.42	7.89	7.40
Desire to change jobs												
Youth	27.36	29.79	9.60	12.40	16.37	16.26	27.36	26.78	21.06	25.96	34.45	25.09
Adults	21.67	24.72	7.15	9.12	11.41	10.65	21.67	20.66	18.02	23.21	31.18	21.14
Informality rate												
Youth	48.45	47.11	49.07	52.41	55.50	53.55	38.76	44.05	49.12	51.95	53.93	57.22
Adults	28.26	26.51	27.95	32.15	35.41	38.09	22.26	24.77	30.35	33.49	32.36	41.40
Hourly wage[b]												
Youth	1.36	1.64	1.74	2.01	1.97	2.30	1.38	2.34	2.11	2.25	2.23	2.60
Adults	3.12	3.61	3.42	4.14	3.78	4.17	3.17	4.19	3.79	4.15	3.98	4.31
Average hours of work per week												
Youth	44.61	41.66	42.67	41.19	39.76	38.88	40.54	36.34	43.84	42.44	40.75	39.36
Adults	45.27	42.53	43.40	42.51	41.93	40.95	43.44	37.28	44.51	43.74	43.03	41.71

Source: prepared by the author on the basis of the Socio-Economic Database for Latin America and the Caribbean (SEDLAC) of the Center for Distributive, Labor and Social Studies (CEDLAS) and the World Bank.

[a] In months.
[b] Purchasing power parity (PPP) dollars at 2005 prices.

TABLE A.4

Labour indicators, by age groups and sex
Early 1980s-Late 2000s
(Weighted average by size of population in percentages, unless otherwise indicated)

	Men						Women					
	Early 1980s	Late 1980s	Early 1990s	Late 1990s	Early 2000s	Late 2000s	Early 1980s	Late 1980s	Early 1990s	Late 1990s	Early 2000s	Late 2000s
Labour-force participation rate												
Youth	81.20	79.71	75.90	72.88	68.77	67.26	45.23	45.24	45.28	47.37	45,55	46.19
Adults	91.14	91.45	91.66	90.91	91.11	90.60	40.13	43.79	49.60	56.06	58,55	61.26
Employment rate												
Youth	73.97	74.16	68.90	63.97	58.80	58.60	40.07	40.66	39.27	38.83	35,69	37.04
Adults	88.61	89.35	88.36	86.70	86.10	86.94	38.48	42.31	47.25	52.25	53,93	57.31
Unemployment rate												
Youth	8.89	7.21	9.67	12.31	14.44	13.08	11.41	10.27	13.49	17.72	20,99	19.37
Adults	2.77	2.29	3.50	4.57	5.31	4.07	4.12	3.42	4.56	6.65	7,62	6.41
Duration of unemployment[a]												
Youth	4.95	3.28	6.92	8.60	8.82	8.43	4.80	3.71	8.04	10.16	10,33	9.94
Adults	4.61	3.25	8.24	12.19	14.28	14.08	5.02	3.68	12.38	17.50	18,88	18.54
Desire to change jobs												
Youth	31.34	30.75	10.07	12.94	16.67	15.99	21.59	28.30	8.79	11.50	15,90	16.65
Adults	22.64	25.72	7.75	9.88	12.13	10.91	19.63	22.79	6.17	8.00	10,41	10.30
Informality rate												
Youth	48.84	47.22	48.96	53.32	57.17	55.30	47.80	46.82	49.26	51.02	52,94	50.88
Adults	28.32	26.03	26.85	31.43	35.68	37.93	28.14	27.44	29.82	33.22	35,00	38.32
Hourly wage[b]												
Youth	1.46	1.76	1.78	2.00	1.94	2.32	1.19	1.43	1.70	2.04	2,01	2.28
Adults	3.47	4.05	3.66	4.37	4.00	4.42	2.29	2.75	2.98	3.73	3,42	3.80
Hours worked per week												
Youth	45.89	43.52	44.33	42.90	41.59	40.68	42.28	38.46	39.62	38,35	36,77	35.96
Adults	48.45	46.14	47.17	46.61	45.93	44.62	38.44	35.79	36.77	36,20	36,06	35.82

Source: prepared by the author on the basis of the Socio-Economic Database for Latin America and the Caribbean (SEDLAC) of the Center for Distributive, Labor and Social Studies (CEDLAS) and the World Bank.

[a] In months.
[b] Purchasing power parity (PPP) dollars at 2005 prices.

TABLE A.5

Labour indicators, by age group and sex.
Early 1980s-late 2000s

(People not attending a formal-sector educational institution; weighted average by size of population, in percentages, unless otherwise indicated)

	All						Men						Women					
	Early 1980s	Late 1980s	Early 1990s	Late 1990s	Early 2000s	Late 2000s	Early 1980s	Late 1980s	Early 1990s	Late 1990s	Early 2000s	Late 2000s	Early 1980s	Late 1980s	Early 1990s	Late 1990s	Early 2000s	Late 2000s
Labour-force participation rate																		
Youth	71.87	73.10	72.26	72.66	72.48	73.83	93.83	93.56	91.54	89.68	89.20	88.34	49.95	52.24	52.39	55.32	56.02	58.91
Adults	64.63	66.67	69.44	72.25	71.97	74.57	91.13	91.26	91.81	91.22	89.27	90.45	39.48	43.79	48.85	54.85	56.15	59.93
Employment rate																		
Youth	65.48	67.49	64.96	63.18	61.42	63.08	86.19	87.35	83.49	79.94	78.16	77.98	44.79	47.22	45.85	46.10	44.94	47.71
Adults	62.59	64.84	66.70	68.40	67.91	71.01	88.64	89.10	88.54	87.12	85.02	87.04	37.89	42.27	46.60	51.24	52.27	56.21
Unemployment rate																		
Youth	8.91	7.77	9.97	12.85	14.94	14.52	8.14	6.73	8.74	10.83	12.27	11.82	10.35	9.66	12.24	16.29	19.10	18.69
Adults	3.15	2.78	3.82	5.25	5.46	4.75	2.74	2.39	3.46	4.43	4.61	3.77	4.04	3.53	4.44	6.50	6.72	6.12
Duration of unemployment[a]																		
Youth	4.60	3.51	7.54	10.30	10.69	10.22	4.72	3.48	6.65	8.88	9.22	8.94	4.43	3.57	8.59	11.68	11.87	11.17
Adults	4.72	3.43	9.88	14.83	16.82	16.78	4.57	3.29	8.09	12.15	14.36	14.12	4.95	3.67	12.13	17.51	19.04	18.64
Desire to change jobs																		
Youth	27.86	30.57	9.76	12.81	17.00	18.13	32.53	31.98	10.31	13.57	17.39	18.03	21.08	28.34	8.74	11.45	16.29	18.26
Adults	21.74	24.68	7.27	9.29	11.50	11.28	22.71	25.57	7.88	10.13	12.30	11.73	19.65	22.93	6.23	8.00	10.37	10.66
Informality rate																		
Youth	49.92	47.75	49.47	51.21	53.05	50.01	50.58	48.32	49.95	52.76	55.22	52.05	48.70	46.64	48.63	48.70	49.60	46.87
Adults	28.87	26.96	28.67	33.02	36.42	38.44	28.84	26.39	27.52	32.22	36.47	37.94	28.94	28.09	30.67	34.22	36.29	39.17
Hourly wage[b]																		
Youth	1.33	1.55	1.69	1.94	1.91	2.23	1.42	1.66	1.72	1.94	1.90	2.25	1.15	1.35	1.64	1.94	1.94	2.21
Adults	3.08	3.54	3.38	4.11	3.80	4.25	3.42	3.98	3.61	4.34	4.04	4.47	2.26	2.68	2.93	3.69	3.43	3.85
Hours worked per week																		
Youth	46.15	43.89	43.94	43.21	42.44	41.57	47.45	45.74	45.70	45.18	44.50	43.47	43.65	40.48	40.52	39.75	38.91	38.27
Adults	45.67	43.44	43.35	42.64	41.91	41.05	48.81	47.08	47.17	46.81	45.83	44.49	38.70	36.45	36.57	36.13	36.01	35.71

Source: prepared by the author on the basis of the Socio-Economic Database for Latin America and the Caribbean (SEDLAC) of the Center for Distributive, Labor and Social Studies (CEDLAS) and the World Bank.

[a] In months.
[b] Purchasing power parity (PPP) dollars at 2005 prices.

TABLE A.6

Labour indicators, by age group and sex.
Early 1980s-late 2000s
(Weighted average by size of population, in percentages, unless otherwise indicated)

	Primary						Secondary						Higher					
	Early 1980s	Late 1980s	Early 1990s	Late 1990s	Early 2000s	Late 2000s	Early 1980s	Late 1980s	Early 1990s	Late 1990s	Early 2000s	Late 2000s	Early 1980s	Late 1980s	Early 1990s	Late 1990s	Early 2000s	Late 2000s
Labour-force participation rate																		
Youth	63.97	64.66	64.95	63.72	60.71	58.87	59.67	54.39	51.71	54.95	53.57	53.96	60.63	58.33	55.05	56.48	54.62	57.51
Adults	62.00	62.89	66.18	69.06	69.37	69.35	74.56	73.40	73.29	76.22	77.34	78.31	87.52	87.21	85.59	86.12	86.43	86.09
Employment rate																		
Youth	58.20	59.77	58.49	55.27	51.47	50.87	52.05	48.54	44.75	45.82	43.53	44.84	53.73	53.55	48.89	48.40	45.36	49.17
Adults	60.06	61.28	63.67	65.32	64.88	66.08	71.44	70.79	69.68	71.47	71.87	73.76	85.16	85.35	82.85	82.39	82.00	82.22
Unemployment rate																		
Youth	9.04	7.49	10.04	12.94	14.70	13.66	12.76	10.91	13.50	16.77	18.99	16.98	11.33	8.25	11.10	14.08	16.50	14.39
Adults	3.13	2.55	3.79	5.28	6.08	4.71	4.22	3.58	4.76	6.33	7.14	5.92	2.70	2.12	2.91	4.33	5.14	4.48
Duration of unemployment[a]																		
Youth	4.47	3.19	7.49	9.62	10.26	9.99	5.82	4.05	6.87	8.89	9.15	8.82	6.30	4.50	7.21	8.81	9.13	9.32
Adults	4.36	3.39	9.75	14.50	16.56	16.86	6.05	3.49	10.04	15.25	17.16	16.73	6.61	4.52	10.61	15.71	16.15	16.22
Desire to change jobs																		
Youth	31.29	31.79	8.40	11.05	14.66	15.62	26.02	28.56	12.80	15.04	18.53	16.59	19.40	28.57	12.05	15.20	17.92	16.71
Adults	24.85	27.55	6.17	8.13	10.63	10.19	18.19	22.54	9.92	11.49	12.93	11.61	16.34	21.12	8.78	10.52	11.73	10.18
Informality rate																		
Youth	58.41	57.00	59.35	63.80	70.34	71.45	21.52	27.60	33.59	42.12	51.00	50.97	15.14	16.96	22.97	30.48	38.21	37.10
Adults	35.72	34.64	37.13	42.46	48.66	53.85	7.49	11.47	15.37	21.72	28.56	32.67	5.47	6.26	8.77	12.67	15.39	17.30
Hourly wage[b]																		
Youth	1.04	1.21	1.28	1.46	1.41	1.63	1.95	2.15	2.16	2.20	1.95	2.21	3.56	4.17	3.65	4.19	3.62	3.74
Adults	2.02	2.29	2.12	2.45	2.17	2.47	4.93	4.66	4.14	4.44	3.65	3.75	9.83	10.23	8.41	10.37	8.95	8.54
Hours worked per week																		
Youth	46.08	44.43	43.54	41.90	40.19	38.95	42.63	39.43	42.70	41.59	40.60	40.10	36.61	34.89	36.86	36.22	35.85	36.07
Adults	46.64	44.71	43.64	42.51	41.64	40.33	42.57	40.42	44.27	43.87	43.50	42.76	39.64	38.31	40.55	40.31	40.09	39.62

Source: prepared by the author on the basis of the Socio-Economic Database for Latin America and the Caribbean (SEDLAC) of the Center for Distributive, Labor and Social Studies (CEDLAS) and the World Bank.

[a] In months.
[b] Purchasing power parity (PPP) dollars at 2005 prices.

TABLE A.7

Labour indicators, by age group and level of education.
Early 1980s-late 2000s

(People not attending a formal-sector educational institution: weighted average by size of population, in percentages, unless otherwise indicated)

	Primary						Secondary						Higher					
	Early 1980s	Late 1980s	Early 1990s	Late 1990s	Early 2000s	Late 2000s	Early 1980s	Late 1980s	Early 1990s	Late 1990s	Early 2000s	Late 2000s	Early 1980s	Late 1980s	Early 1990s	Late 1990s	Early 2000s	Late 2000s
Labour-force participation rate																		
Youth	70.50	71.38	70.15	69.80	67.57	67.48	79.73	79.01	76.08	77.16	75.95	76.38	85.18	87.93	85.42	87.40	86.27	85.69
Adults	61.95	63.24	66.09	68.76	67.67	68.69	74.47	74.37	73.67	76.02	75.18	77.21	88.26	88.06	86.57	86.85	86.65	86.34
Employment rate																		
Youth	64.52	66.22	63.66	61.45	58.31	58.74	70.66	70.86	66.62	65.40	63.28	64.48	77.39	81.78	76.59	76.40	74.21	73.83
Adults	60.02	61.54	63.59	65.15	63.78	65.54	71.46	71.53	70.05	71.35	70.54	72.86	86.17	86.33	83.96	83.31	83.15	83.05
Unemployment rate																		
Youth	8.50	7.16	9.13	11.68	13.31	12.89	11.40	10.37	12.23	15.09	16.49	15.54	9.11	7.05	10.35	12.64	13.97	13.91
Adults	3.11	2.66	3.73	5.15	5.53	4.54	4.04	3.81	4.67	6.13	6.03	5.57	2.38	1.96	2.75	4.07	4.03	3.81
Duration of unemployment[a]																		
Youth	4.33	3.19	7.79	10.45	11.25	10.84	5.74	4.15	7.04	9.88	10.16	9.79	5.97	3.33	6.54	9.36	9.29	10.17
Adults	4.35	3.44	9.76	14.47	16.51	16.78	5.99	3.42	9.93	15.13	17.30	16.74	6.70	4.12	10.82	16.24	17.03	16.73
Desire to change jobs																		
Youth	31.41	31.71	8.49	11.35	15.33	17.15	25.25	29.14	13.30	16.01	19.07	18.89	19.42	30.81	12.93	16.66	18.95	19.29
Adults	24.82	27.55	6.34	8.33	10.80	10.69	18.29	22.49	10.36	12.16	13.11	12.71	16.03	20.57	8.44	10.28	11.72	10.50
Informality rate																		
Youth	57.46	55.87	57.86	61.17	67.46	67.86	16.41	22.82	29.08	36.11	44.80	44.04	14.07	11.63	17.66	22.13	29.63	28.05
Adults	35.80	34.71	37.28	42.81	48.74	53.24	7.23	11.30	15.81	22.05	28.30	31.41	5.16	5.84	8.50	12.53	15.75	17.41
Hourly wage[b]																		
Youth	1.08	1.22	1.30	1.51	1.44	1.67	2.25	2.33	2.32	2.38	2.08	2.29	4.39	5.36	4.29	4.78	4.56	4.49
Adults	2.03	2.26	2.12	2.45	2.17	2.48	5.01	4.71	4.20	4.53	3.79	3.85	10.45	10.97	8.72	11.02	9.99	9.55
Hours worked per week																		
Youth	46.78	45.46	44.16	43.10	41.98	40.64	43.26	39.95	43.79	43.73	43.34	42.56	39.07	36.40	39.20	40.15	39.11	39.54
Adults	46.65	45.15	43.53	42.51	41.58	40.23	42.59	40.26	44.12	44.10	43.27	42.46	39.83	38.28	40.69	40.70	40.54	39.87

Source: prepared by the author on the basis of the Socio-Economic Database for Latin America and the Caribbean (SEDLAC) of the Center for Distributive, Labor and Social Studies (CEDLAS) and the World Bank.

[a] In months.
[b] Purchasing power parity (PPP) dollars at 2005 prices.

TABLE A.8

Labour indicators, by birth cohort and age group

(Whole population, in percentages, unless otherwise indicated)

Intervals by age	Weighted average							Simple average						
	(15-19)	(20-24)	(25-29)	(30-34)	(35-39)	(40-44)	(45-49)	(15-19)	(20-24)	(25-29)	(30-34)	(35-39)	(40-44)	(45-49)
Cohorts/Participation rate														
1960-1964	63.79	71.51	72.43	75.60	78.80	79.72	78.02	53.13	68.76	70.36	73.46	76.83	78.34	77.37
1965-1969	57.62	70.86	75.14	78.35	81.17	81.33	79.52	44.76	66.30	72.34	76.53	78.71	79.86	79.23
1970-1974	52.08	71.56	76.70	80.51	81.72	81.00		42.15	67.26	75.07	78.37	79.93	80.25	
1975-1979	51.66	71.65	79.19	81.47	81.74			40.87	68.07	76.53	79.49	80.96		
1980-1984	47.31	72.46	79.86	80.68				38.44	67.53	77.31	79.74			
1985-1989	44.76	71.11	78.93					34.30	66.34	76.44				
Employment rate														
1960-1964	56.57	65.79	68.74	72.15	74.76	75.70	74.74	48.19	62.76	65.14	69.32	72.40	73.83	73.89
1965-1969	52.10	65.15	70.11	73.23	76.70	78.00	76.83	37.81	58.47	66.66	71.30	73.97	76.60	76.54
1970-1974	46.79	64.21	70.09	75.28	77.80	77.44		35.58	59.06	68.08	72.73	76.24	77.17	
1975-1979	43.84	62.29	72.10	76.55	78.02			33.16	57.98	69.00	74.94	77.12		
1980-1984	38.54	62.29	72.89	75.74				30.70	56.65	70.98	75.36			
1985-1989	35.78	61.48	71.50					27.15	57.16	69.37				
Unemployment rate														
1960-1964	11.31	8.00	5.08	4.52	5.12	5.04	4.20	8.71	8.93	7.24	5.43	5.64	5.64	4.42
1965-1969	9.58	8.04	6.65	6.54	5.50	4.11	3.38	17.32	11.75	7.63	6.70	5.89	4.05	3.39
1970-1974	10.14	10.25	8.62	6.50	4.81	4.40		16.38	11.97	9.11	7.03	4.59	3.80	
1975-1979	15.13	13.06	8.97	6.05	4.55			19.33	14.55	9.62	5.68	4.72		
1980-1984	18.54	14.04	8.74	6.13				21.51	15.79	8.15	5.47			
1985-1989	20.07	13.55	9.41					21.73	13.80	9.24				
Hourly wage[a]														
1960-1964	1.16	1.94	2.87	3.56	4.03	4.16	4.52	1.16	1.42	2.93	3.59	4.06	4.22	4.46
1965-1969	1.01	2.00	2.97	3.58	3.63	4.36	5.07	0.91	2.23	3.14	3.72	3.77	4.46	4.39
1970-1974	1.14	2.15	3.01	3.38	3.99	4.86		1.57	2.37	3.19	3.55	4.14	4.57	
1975-1979	1.28	2.22	2.88	3.78	4.69			1.53	2.40	3.10	3.96	4.20		
1980-1984	1.33	2.13	3.35	4.41				1.58	2.31	3.50	4.07			
1985-1989	1.42	2.51	3.54					1.61	2.74	3.40				
Informality rate														
1960-1964	53.98	34.23	26.76	27.06	30.05	32.79	35.17	47.40	31.42	29.19	31.70	29.41	37.46	39.40
1965-1969	64.15	35.85	31.88	32.84	34.57	36.56	37.61	60.54	38.60	33.98	30.13	38.80	39.58	41.73
1970-1974	62.86	40.35	36.19	35.93	37.47	39.77		65.42	41.58	33.03	39.76	40.07	43.20	
1975-1979	65.09	44.58	38.11	36.41	36.12			65.95	41.99	42.31	39.65	41.76		
1980-1984	68.31	46.63	36.78	36.93				70.72	51.89	41.15	40.56			
1985-1989	71.04	45.95	36.61					75.16	49.71	41.56				

Source: prepared by the author on the basis of the Socio-Economic Database for Latin America and the Caribbean (SEDLAC) of the Center for Distributive, Labor and Social Studies (CEDLAS) and the World Bank.

[a] Purchasing power parity (PPP) dollars at 2005 prices.

TABLE A.9

Labour indicators, by birth cohort, age group and sex

(Weighted average by size of population, in percentages, unless otherwise indicated)

Intervals by age	Men							Women						
	(15-19)	(20-24)	(25-29)	(30-34)	(35-39)	(40-44)	(45-49)	(15-19)	(20-24)	(25-29)	(30-34)	(35-39)	(40-44)	(45-49)
Cohorts/Participation rate														
1960-1964	80.53	93.27	96.47	96.93	96.23	95.33	93.41	46.90	50.76	50.25	55.96	62.76	65.62	64.19
1965-1969	72.86	90.47	95.38	95.94	96.14	95.24	94.40	42.40	51.86	56.59	62.30	67.50	68.75	66.40
1970-1974	67.04	88.68	94.33	96.08	96.03	95.34		37.16	55.00	60.39	66.23	68.74	67.52	
1975-1979	64.75	86.61	94.37	95.75	96.17			38.35	57.27	65.16	68.42	68.78		
1980-1984	58.10	86.00	93.53	95.05				36.35	59.36	67.05	67.52			
1985-1989	54.85	83.64	91.50					34.52	58.77	66.81				
Employment rate														
1960-1964	72.28	86.77	92.35	93.33	92.16	91.34	89.99	40.72	45.78	46.95	52.65	58.72	61.59	61.05
1965-1969	66.58	84.24	90.23	91.03	92.14	92.22	91.78	37.65	46.65	51.68	56.98	62.62	65.13	63.65
1970-1974	61.10	80.97	87.92	91.42	92.64	91.98		32.53	48.00	53.60	60.48	64.33	63.77	
1975-1979	56.20	77.24	87.81	91.59	92.84			31.27	47.92	57.57	62.81	64.71		
1980-1984	48.83	76.17	87.39	90.92				28.08	48.85	59.31	61.82			
1985-1989	45.50	74.46	84.89					25.92	48.70	58.59				
Unemployment rate														
1960-1964	10.25	6.96	4.26	3.69	4.22	4.19	3.67	13.16	9.82	6.54	5.83	6.40	6.15	4.90
1965-1969	8.62	6.87	5.38	5.12	4.16	3.18	2.78	11.22	10.03	8.62	8.55	7.25	5.27	4.14
1970-1974	8.86	8.67	6.80	4.85	3.54	3.53		12.44	12.71	11.26	8.68	6.42	5.55	
1975-1979	13.21	10.81	6.96	4.36	3.46			18.44	16.33	11.65	8.20	5.91		
1980-1984	15.95	11.43	6.58	4.35				22.75	17.70	11.56	8.44			
1985-1989	17.06	10.99	7.22					24.93	17.15	12.30				
Hourly wage[a]														
1960-1964	1.21	2.06	3.04	3.80	4.30	4.48	4.93	1.06	1.72	2.55	3.14	3.60	3.69	3.95
1965-1969	1.09	2.10	3.05	3.75	3.85	4.69	5.41	0.88	1.81	2.82	3.31	3.33	3.91	4.62
1970-1974	1.21	2.19	3.07	3.48	4.21	5.25		1.03	2.08	2.90	3.24	3.69	4.31	
1975-1979	1.32	2.24	2.92	3.89	4.98			1.22	2.20	2.81	3.63	4.31		
1980-1984	1.32	2.13	3.38	4.57				1.35	2.12	3.31	4.18			
1985-1989	1.44	2.55	3.60					1.40	2.45	3.46				
Informality rate														
1960-1964	56.10	34.91	26.92	25.92	28.85	32.08	34.43	50.40	33.06	26.48	28.89	31.75	33.70	36.11
1965-1969	64.23	35.92	31.35	32.29	33.90	35.85	36.36	64.01	35.74	32.71	33.66	35.46	37.44	39.17
1970-1974	62.53	40.35	36.89	35.72	36.73	39.48		63.38	40.34	35.10	36.23	38.43	40.16	
1975-1979	65.16	45.87	38.85	36.29	35.79			64.98	42.59	37.05	36.56	36.53		
1980-1984	69.81	47.70	37.23	37.74				65.85	45.01	36.14	35.86			
1985-1989	71.96	46.99	37.83					69.47	44.38	34.93				

Source: prepared by the author on the basis of the Socio-Economic Database for Latin America and the Caribbean (SEDLAC) of the Center for Distributive, Labor and Social Studies (CEDLAS) and the World Bank.

[a] Purchasing power parity (PPP) dollars at 2005 prices.

TABLE A.10

Labour indicators, by birth cohort, age group and level of education

(Weighted average, by size of population, in percentages, unless otherwise indicated)

Intervals by age	Primary							Secondary							Higher					
	(15-19)	(20-24)	(25-29)	(30-34)	(35-39)	(40-44)	(45-49)	(15-19)	(20-24)	(25-29)	(30-34)	(35-39)	(40-44)	(45-49)	(20-24)	(25-29)	(30-34)	(35-39)	(40-44)	(45-49)
Cohorts/ Participation rate																				
1960-1964	68.24	69.53	68.14	71.84	75.37	75.44	73.41	53.37	78.27	77.48	77.68	80.35	81.98	80.35	69.89	85.69	89.45	90.73	91.70	90.01
1965-1969	61.20	70.38	71.88	74.75	77.49	76.74	73.71	44.72	74.92	77.07	79.47	81.73	82.60	81.64	62.26	85.12	89.44	91.84	90.35	88.28
1970-1974	59.98	71.90	72.96	76.39	77.21	76.09		36.96	74.93	78.22	81.08	82.55	81.84		62.18	85.28	90.67	91.27	90.54	
1975-1979	60.99	71.57	74.16	76.35	76.08			39.67	76.26	80.82	81.74	82.17			61.43	86.65	90.84	90.66		
1980-1984	54.84	71.04	73.09	73.96				41.11	77.92	81.27	80.44				63.09	86.19	89.31			
1985-1989	52.02	70.17	72.08					41.48	77.49	80.71					60.30	82.08				
Employment rate																				
1960-1964	61.42	64.48	64.77	68.49	71.33	71.36	70.12	44.60	70.51	72.94	73.73	75.85	77.61	76.70	63.75	81.95	86.49	87.58	88.64	87.42
1965-1969	55.82	65.32	67.18	69.50	72.92	73.45	70.72	38.54	67.72	71.45	74.00	77.02	78.86	79.17	56.96	80.04	85.68	88.36	87.61	85.86
1970-1974	54.60	65.26	66.83	71.20	73.33	72.66		31.88	66.40	71.03	75.60	78.24	77.80		54.95	78.54	86.07	87.99	87.63	
1975-1979	53.27	63.31	67.91	71.58	72.21			31.50	65.30	73.08	76.38	78.21			52.82	79.15	86.49	87.60		
1980-1984	45.93	62.55	67.24	69.57				32.44	65.97	73.60	74.85				54.13	79.05	84.67			
1985-1989	43.27	61.95	66.50					32.18	66.40	72.60					51.99	74.12				
Unemployment rate																				
1960-1964	9.99	7.26	4.95	4.65	5.36	5.41	4.48	16.44	9.91	5.83	4.98	5.58	5.33	4.54	8.79	4.33	3.19	3.42	3.35	2.88
1965-1969	8.79	7.18	6.52	7.02	5.90	4.29	4.06	13.82	9.57	7.22	6.90	5.76	4.53	3.03	8.47	5.88	4.22	3.79	3.03	2.75
1970-1974	8.96	9.22	8.41	6.80	5.02	4.51		13.70	11.35	9.19	6.76	5.22	4.94		11.59	7.92	5.07	3.60	3.21	
1975-1979	12.65	11.54	8.44	6.26	5.09			20.59	14.36	9.58	6.57	4.82			14.01	8.65	4.80	3.37		
1980-1984	16.25	11.96	8.02	5.94				21.11	15.34	9.44	6.95				14.21	8.30	5.19			
1985-1989	16.82	11.73	7.74					22.42	14.33	10.05					13.79	9.70				
Hourly wage[a]																				
1960-1964	1.00	1.39	1.77	2.04	2.24	2.24	2.44	1.61	2.51	3.49	3.97	4.33	4.22	4.43	4.34	6.42	8.38	9.62	10.10	10.32
1965-1969	0.87	1.40	1.87	2.07	2.08	2.53	2.92	1.53	2.46	3.19	3.50	3.48	3.95	4.51	4.08	6.34	8.23	8.31	8.71	9.51
1970-1974	0.94	1.51	1.85	1.96	2.38	2.88		1.71	2.40	2.98	3.08	3.67	4.47		4.22	6.13	7.44	7.87	9.22	
1975-1979	1.02	1.55	1.77	2.22	3.10			1.69	2.26	2.59	3.27	3.78			4.16	5.61	7.07	8.33		
1980-1984	1.05	1.47	2.01	2.70				1.57	2.03	2.81	3.92				3.60	5.66	6.81			
1985-1989	1.09	1.75	2.25					1.56	2.34	3.08					3.77	5.23				
Informality rate																				
1960-1964	61.66	44.97	37.56	38.02	42.01	45.55	48.79	30.16	15.52	12.34	15.19	21.13	25.73	28.28	13.66	8.21	9.09	10.14	13.41	14.26
1965-1969	70.64	45.69	43.30	45.77	48.15	51.84	54.35	37.13	21.49	21.63	25.71	30.50	31.86	31.53	17.65	13.85	13.43	13.53	16.68	18.19
1970-1974	68.27	50.62	49.31	50.13	53.84	56.67		42.30	29.58	29.91	32.54	33.27	34.62		24.88	19.27	16.50	14.77	16.35	
1975-1979	72.60	57.02	53.90	54.52	55.40			49.83	37.36	34.07	33.04	32.99			31.18	22.28	16.39	13.95		
1980-1984	78.30	62.85	58.70	60.31				58.93	41.32	33.35	34.48				36.50	20.92	17.35			
1985-1989	83.71	65.35	61.72					65.33	42.05	34.52					34.29	21.01				

Source: prepared by the author on the basis of the Socio-Economic Database for Latin America and the Caribbean (SEDLAC) of the Center for Distributive, Labor and Social Studies (CEDLAS) and the World Bank.

[a] Purchasing power parity (PPP) dollars at 2005 prices.

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Jamaica: Employer size and worker remuneration in the private sector

Allister Mounsey

ABSTRACT

Evidence suggests that labour markets do not clear as posited by conventional microeconomics. The enduring inter-industry wage differentials (IIWD) and employer-size wage differentials (ESWD) present a challenge. Data from the Jamaican private sector reveal that ESWD could be the impetus for IIWD. After accounting for labour quality and other characteristics, employers with 10 to 49 employees and 50 or more employees pay estimated premiums of 14.3% and 22.9%, respectively. After estimating the differences in tenure profiles, the premium associated with the largest employer size was reduced to 15.9%, while the premium associated with establishments of 10 to 49 workers was unchanged. Notwithstanding the partial explanation provided by tenure profile differences, the bulk of the ESWD appears to be explained by other theoretical constructs.

KEYWORDS Employment, labour market, wages, size of enterprise, statistical data, private sector, Jamaica

JEL CLASSIFICATION J01, J31, D22

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I
Introduction

The existence of positive relationships between the number of workers employed in an establishment and the wages they are paid —the so-called firm-size or employer-size wage differential (ESWD)— is a well documented labour market feature in advanced economies. Lester (1967) was one of the first researchers to comprehensively document the existence of such differentials in the United States. He found that firms with 2,500 workers or more had a combined wage and benefit level that was at least 20% higher, on average, than businesses with 20 to 100 employees. Masters (1969) demonstrated that the firm-size wage differentials remain after controlling for market competition and unionization. Other authors confirm this phenomenon in the United States (Antos, 1983; Mellow, 1982; Oi, 1983). Winter-Ebmer and Zweimüller (1999) provide evidence of the same phenomenon among small and medium-sized firms in Switzerland, while Fakhfakh and Fitzroy (2006), Oosterbeek and van Praag (1995) and Main and Reilly (1993) find supportive evidence in France, the Netherlands and the United Kingdom, respectively.

Equally as puzzling is the existence of time-invariant inter-industry wage differentials. Slichter (1950, as cited in Krueger and Summers, 1987) has been credited as the first to observe this phenomenon. Slichter found an inter-temporal rank correlation coefficient of 0.73 in the industrial wages of 20 manufacturing industries in the United States over the period 1923 to 1946. Similar findings have been documented both in the United States and internationally (for example, Krueger and Summers, 1987; Gittleman and Wolff, 1993; Arbache, 2001).

The pervasiveness of ESWD and inter-industry wage differentials (IIWD) calls into question the fundamental neoclassical assumption of the existence of market-clearing wages. ESWD, in particular, presents a significant challenge to the conventional theory of the firm, which cannot explain why, according to Lester, would "buyers of labor with the most monopoly power generally pay the highest rates of wage and benefit compensation." For many, these challenges to conventional understandings of labour markets and how firms operate remain unanswered despite attempts to explain them within the competitive profit-maximizing framework of neoclassical economics.

The persistently high levels of unemployment in the Caribbean intensify the need for investigating such phenomena in the region.[1] While inter-industrial wage differentials have received some attention in the English-speaking Caribbean (Mounsey and Polius, 2011), the phenomenon of firm-size wage differential has not been investigated. This paper aims to provide a base for further investigation by presenting evidence for the existence of ESWD and IIWD in Jamaica. It demonstrates that the observed IIWD could, in principle, be explained by the share of the total industry labour force employed by large or small establishments, which raises the possibility that ESWD is the cause of IIWD.[2] It also examines the extent to which explanations based on labour quality and differences in tenure profiles can account for the estimated firm-size wage premiums.

The remainder of paper is divided into five sections. Section II provides a review of some of the theoretical explanations for employer-size wage differentials (ESWD). The data used are outlined in the following section. Section III presents evidence for the interrelatedness of ESWD and IIWD; the estimation and results are presented in section IV; and section V concludes the paper.

[1] Data from the International Labour Organization (ILO) reveal that the unemployment rate in Barbados, Jamaica and Trinidad and Tobago averaged 8.6%, 10.8% and 6.5% per year, respectively, in 2004-2008 (countries selected based on data availability).

[2] The paper does not examine the temporal stability of either IIWD or ESWD in Jamaica, because of time series limitations in the data set.

II
Theoretical explanations of ESWD

Explanations of ESWD belong to one of two broad categories: competitive and non-competitive explanations. The latter holds that institutional characteristics endogenous to firms of a particular size result in workers of comparable skill and experience being remunerated at different rates based on the size of the employer. In the case of the former, the firms of differing sizes are posited as offering differing working conditions and/or requiring differing worker quality. Workers must be compensated for these differences (working conditions and/or worker quality), resulting in observed firm-size wage differentials.

1. Competitive explanations: compensating differentials

The quintessential summary of the theory of compensating differentials is found in Smith (1904), who had made the point in the first edition published in 1776: "The wages of labour vary with the ease or hardship, the cleanliness or dirtiness, the honourableness or dishonourableness of the employment." The theory of compensating differentials therefore posits that firm-size wage differentials exist because of size differentials in working conditions or labour quality.

Working conditions explanations, which are not pursued in this paper because of data limitations, focus on the undesirable aspect of working in large firms, such as the rules-oriented environment and the lack of control over one's action and schedule (Master, 1969; Duncan and Stafford, 1980). The labour quality explanation holds that larger firms actively seek higher quality workers compared with other firms. A possible motivation for this is that larger firms tend to adopt more capital-intensive technologies, and highly skilled labour is complementary to capital (Hamermesh and Grant, 1979). Capital-skill complementarities therefore cause larger, more capital intensive firms to disproportionately employ more highly skilled workers who command a market-determined premium.

Rosen (1982) advanced an alternative motivation based not so much on the skill of the typical worker, but rather on the talent resident in top positions in large firms vis-à-vis smaller firms. Rosen posits that the increase in productivity that results from assigning persons of superior talent to top positions is greater than the increment of their abilities because talent filters through the entire command chain below them. In such a situation, the competitive market for managers and supervisors will equilibrate in the top positions in large firms being filled with highly talented individuals who are also highly rewarded, while the top positions in smaller firms are filled by less talented, lower-paid individuals.

Yet another motivation is provided by the monitoring cost hypothesis of Oi (1983). Entrepreneurs have identical abilities in terms of monitoring workers; they differ, however, in their capacity to coordinate production. Time constraints therefore result in a relatively high shadow cost associated with monitoring by more talented entrepreneurs, who are assumed to head larger firms. Entrepreneurs in large firms seek to minimize the high shadow cost of monitoring workers by employing higher-quality workers, who are more productive, require less monitoring per efficiency unit of labour and command a market-determined wage premium based their superior quality.

Proponents of labour quality explanations to ESWD are quick to point out that quality is composed of both measured characteristics, such as education and experience, and unmeasured qualities. The former is easily tested using widely available cross-sectional data sets, whereas testing the importance of unmeasured quality typically requires more expensive, less available longitudinal data (Brown and Medoff, 1989).

2. Non-competitive explanations

There are several non-competitive explanations of ESWD. Broadly speaking, they can be divided into those that are consistent with the assumption of profit-maximizing (cost-minimizing) firms and those that are not. With respect to the latter, probably the best known of these is the product market power hypothesis (PMPH), which states that firms with monopoly power (namely, larger firms) use some of their excess profit to engage in some degree of rent sharing with their workers (Brown and Medoff, 1989). One of the major challenges faced by the PMPH is its inability to explain why competition for these preferred jobs does not create an overqualified but not overpaid workforce (Brown and Medoff, 1989).

Among the explanations consistent with profit maximization are efficiency wage models and explanations

based on differences in tenure-wage profiles between larger and smaller firms. The remainder of this subsection provides brief summaries of each of these non-competitive explanations.

Riveros and Bouton (1994) define efficiency wage models as "a family of conceptually distinct theories that, for the most part, seek to offer an [endogenously determined] explanation of persistent real wage rigidities in the presence of involuntary unemployment. The central assumption of these theories is that higher real wages can, through various mechanisms, result in higher labour productivity." There are three main efficiency wage models: (i) the monitoring and shirking model; (ii) the turnover cost model; and (iii) the sociological model. The next three paragraphs outline each of these in turn (adapted from Mounsey and Polius, 2011).

(i) Shapiro and Stiglitz (1984) demonstrated that under conditions of imperfect monitoring, the basic neo-classical competitive paradigm produces equilibrium where all workers will shirk. To illicit greater effort from employees, firms pay more than the market-clearing wage, thereby instituting a penalty for an employee who is caught shirking and is fired.[3] Bulow and Summers (1986) extended the basic Shapiro-Stiglitz framework to show how equally productive workers can, in equilibrium, be arbitrarily allocated between a high-wage and low-wage sector, where the high-wage firms are those for whom shirking is most costly and/or monitoring is most difficult. In the context of firm size, proponents argue that monitoring is more difficult and shirking is possibly more costly in larger firms.

(ii) The turnover cost model postulates that when workers quit, firms incur sunk costs associated with hiring replacements, training new workers and suffering a loss in productivity as new workers move along the learning curve. Firms try to minimize these turnover costs by paying a wage premium to encourage longer employment spells (Salop, 1979). Proponents argue that for any given occupation, turnover costs may vary positively with firm size, as larger firms tend to use more specialized production techniques and thus invest more per worker in training. This creates a wage distribution that also correlates positively with firm size.

(iii) Akerlof (1982 and 1984) argues that social conventions, or norms, at the work place have a strong effect on workers' attitudes. Workers are motivated to work hard because they acquire sentiment for each other and for the firm. In return for their commitment, workers expect to be reciprocated with fair wages. This fair wage depends on the wages of workers in the workers' reference group and past wages, among other things. According to the basic sociological model, "the loyalty of workers is exchanged for high wages, and this loyalty can be translated via effective management into high productivity" (Akerlof, 1984, p. 80). Inter-firm (inter-industry) wage differentials can be explained by the differing ability of firm (industries) to translate employee loyalty into higher productivity.

Another explanation for positive firm-size wage differentials is differences in the tenure profile of large versus small firms. Large firms, it is argued, make heavier investment in industry-specific training than do small firms. Large employers thus have a vested interest in retaining their employees. One way of retaining workers is through the use of seniority wage, where worker wages increase with years in the company (Lazear, 1979 and 1981). This creates a tenure profile (of wages) and introduces an element of deferred compensation, almost equivalent to the worker posting a bond with the firm. The workers' incentive structure is therefore altered, inducing them to work harder and remain honest with the firm in order to finally reach the pay-back period of the bond (Zwick, 2009).[4] The large firms' vested interest therefore results in steeper tenure profiles for larger firms and may explain firm-size wage differentials.

3. Study data

The data for this paper is sourced from the Jamaica Labour Force Survey (JLFS), conducted quarterly by the Statistical Institute of Jamaica (STATIN). The paper uses the JLFS for the second quarter of each year from 2004 to 2007. The selected variables were extracted for respondents indicating that they were employed in the private sector during the reference period of the respective survey.[5] These respondents amounted to 7,667 persons, representing approximately 74.7% of the employed persons in the survey. A breakdown of the pooled sample over the period under consideration is given in table 1.[6]

[3] The extent of the wage premium is dependent on the cost of shirking to the firm.

[4] The existence of tenure profiles can also be motivated from a monitoring perspective (see Pearce, 1990; Zwick, 2009).

[5] Own-account workers, unpaid family workers and employers were also excluded.

[6] The choice of the second quarter was entirely arbitrary; however, the same quarter was selected for several years rather than, say, four quarters in one year so as to mitigate the impact of seasonality in the regressors.

TABLE 1

Temporal breakdown of the sample

Sample	Period (second quarter)				Total
	2004	2005	2006	2007	
Number surveyed	2 131	1 765	2 016	1 755	7 667

Source: prepared by the author on the basis of data from the Jamaica Labour Force Survey, second quarter, 2004 to 2007, Statistical Institute of Jamaica (STATIN).

The variables used in this paper are the worker's main occupation group (OCC), main industry group (IND), tenure or time in the current job (TEN), log of gross annual earnings from main job (LAE), years of experience (EXP), years of effective schooling (YS), gender (GEN) and regular hours worked per week (HWKD). Additional information used includes whether or not the worker has received formal on-the-job training (OJT), whether or not her educational attainment allowed her to at least matriculate in tertiary studies (TMAT),[7] the size of the employer, measured as the number of persons employed at the worker's main workplace (ES) and whether the workplace is located in the capital Kingston, a rural area or an urban area (KRU).[8]

The variables *YS*, *LAE* and *EXP* were obtained from the following transformations to original *JLFS* variables. The transformations are described below:

$$YS = \begin{cases} 16, \textit{ if Hcert = Degree} \\ 13, \textit{ if Hcert = A'levels} \\ P + S, \textit{ otherwise} \end{cases}$$

where *Hcert* is the highest certification attained and *P* and *S* are years of primary and secondary school education, respectively.

$$EXP = AGE - YS - 5$$

where *AGE* is the individual's age in years, which is obtained from the *JLFS*.

$$LAE = lnGAE$$

where GAE is the worker's gross annual earnings from her main occupation, as computed from in the JLFS.[9]

Table 2 shows the distribution of survey respondents by industry and firm size. As can be expected of a service-oriented economy, the sample at the industrial level is heavily concentrated in the community, social and personal services sector and the wholesale and retail and hotel and restaurant sector. At the firm level, more than half of the private sector workers are employed in firms with nine people or fewer, which again is consistent with the country's service-oriented nature.

[7] That is, the worker has obtained at least five Ordinary Level (O Level) passes, which is the typical entry requirement for Advanced Level (A Level) studies. For those unfamiliar with the British based education system, A Level studies are roughly equivalent to a college diploma in the United States education system. The rationale for the inclusion of TMAT is to make a quality distinction among the 46.2% of the sample with 11 years of schooling (completed secondary school).

[8] Variables in italics represent those that have been transformed from original variables. ES was originally a five-category variable; for the sake of parsimony it was reduced to three categories by collapsing the first three categories. TEN is a three-category variable translating to less than two years, two to five years and more than five years in current job. The original categorical variable from which it is derived has seven categories (four of which relate to persons working with their current employer for less than one year.

[9] Each respondent's earnings were reported for one of three periodicities (weekly, monthly or yearly). Where earnings were reported on a weekly or monthly basis, they were multiplied by 52 and 12 respectively to convert to yearly earnings.

TABLE 2

Distribution of respondents by industry and firm size

Industry group (one digit)	Firm size *(number of workers)*			Total
	< 10	10-49	≥ 50	
Agriculture, forestry and fishing (1)	191	118	84	393
Construction and installation (2)	683	281	53	1 017
Community, social and personal services (3)	1 704	263	64	2 031
Electricity, gas and water (4)	2	12	17	31
Finance, insurance, real estate and business services (5)	106	313	225	644
Mining, quarrying and refining (6)	3	25	93	121
Manufacturing (7)	182	295	224	701
Transportation, storage and communications (8)	277	116	110	503
Wholesale, retail, hotels and restaurants (9)	748	782	342	1 872
Total	3 896	2 205	1 212	7 313

Source: prepared by the author on the basis of data from the Jamaica Labour Force Survey, second quarter, 2004 to 2007, Statistical Institute of Jamaica (STATIN).

Note: firm size was not stated in 354 responses.

III

The interrelatedness of employer-size wage differentials and inter-industry wage differential

This section presents a brief statistical investigation of inter-industry wage differentials and employer-size wage differentials. Let GAE_{ijkt} stand for the reported annual income of individual i in occupation j working in industry k at year t. The hourly wage received by this individual will be approximated as follows:[10]

$$w_{ijkt} = \frac{GAE_{ijkt}}{52\left(HWKD\right)}$$

Data on occupation is provided at the four-digit level. The mean hourly wage for each four-digit occupation code is calculated for each year using the following formula:

$$\overline{w_{jkt}} = \frac{\sum_{\forall i \, in \, t} w_{ijkt}}{n_{jt}}$$

where n_{jt} is the number of individuals in occupation j at year t.

Finally the worker's relative wage (rw) (relative to the average wage received by the occupational cohort) is calculated as follows:

$$rw_{ijkt} = {w_{ijkt}}\Big/{\overline{w_{jkt}}} \quad \forall i \, and \, t$$

Table 3 shows the distribution of mean relative wage ($\overline{rw_k}$) by industry group and employer size.[11] A mean relative wage ($\overline{rw_k}$) of less than one (say, 0.75) means that a randomly selected worker in industry k can expect to receive an hourly wage that is 25% less than the average for the occupation. If $\overline{rw_k} > 1$, then industry k on average pays [($\overline{rw_k}$ – 1) x 100] per cent more to its workers relative to their occupational averages.

[10] Information on actual weeks worked per year is not available in the data set, so for the purposes of estimating hourly wage, the number of weeks worked by each worker is assumed to be constant (at 52 weeks per year).

[11] The mean relative wage of industry k is given by:

$$\overline{rw_k} = {\sum_i rw_{ijkt}}\Big/{N_k} \quad \forall i \, in \, k$$

where N_k is the number of sample elements in industry k. A similar calculation is used to obtain the mean relative wage by employer size in industry group k.

TABLE 3

Mean relative wage ($\overline{rw_k}$) by industry group and firm size

Industry group (one-digit level)	Firm size *(number of workers)*			All firms
	< 10	10-49	≥ 50	
Agriculture, forestry and fishing (1)	0.951	1.011	0.972	0.973
Construction and installation (2)	0.951	1.062	1.206	0.995
Community, social and personal services (3)	0.966	1.011	1.059	0.974
Electricity, gas and water (4)	1.203	1.041	1.342	1.217
Finance, insurance, real estate and business services (5)	0.943	1.108	1.299	1.148
Mining, quarrying and refining (6)	0.695	0.879	1.363	1.247
Manufacturing (7)	0.874	1.037	1.134	1.026
Transportation, storage and communications (8)	0.909	1.028	1.229	1.007
Wholesale, retail, hotels and restaurants (9)	0.827	0.999	1.101	0.949
All industry groups	0.927	1.030	1.172	1.000

Source: prepared by the author on the basis of data from the Jamaica Labour Force Survey, second quarter, 2004 to 2007, Statistical Institute of Jamaica (STATIN).

The data in tables 2 and 3 raise the question of whether the percentage of the industry labour force employed in the largest or smallest firm-size category explains the industrial distribution of $\overline{rw_k}$. For all but one industrial group, $\overline{rw_k}$ is greater than one for the largest firm-size category and less than one for the smallest (see table 3). Furthermore, industries with $\overline{rw_k} > 1$ tend to have a greater concentration of its workforce employed by larger firms, and industries with $\overline{rw_k} < 1$ tend to a larger concentration of workers in smaller firms (see table 2 and table 3).

Table 4 provides strong support for this hypothesis, as measures of parametric and non-parametric correlation indicate a high positive correlation between workforce concentration in large firms and industry mean relative wages ($\overline{rw_k}$), while simultaneously finding a strong negative correlation between small-firm workforce concentration and industry mean relative wages.

TABLE 4

Pearson's and Spearman's rank correlation between $\overline{rw_k}$ and concentration of workers in select firm sizes

Industry group	Share of workers by firm size *(Percentages)*		Rank (A)	Rank (B)	Industry $\overline{rw_k}$	Rank ($\overline{rw_k}$)
	50 or more workers (A)	10 or fewer workers (B)				
Agriculture, forestry and fishing (1)	21.4	48.60	4	6	0.973	2
Construction and installation (2)	5.2	67.16	2	8	0.995	4
Community, social and personal services (3)	3.2	83.90	1	9	0.974	3
Electricity, gas and water (4)	54.8	6.45	8	2	1.217	8
Finance, insurance, real estate and business services (5)	34.9	16.46	7	3	1.148	7
Mining, quarrying and refining (6)	76.9	2.48	9	1	1.247	9
Manufacturing (7)	32.0	25.96	6	4	1.026	6
Transportation, storage and communications (8)	21.9	55.07	5	7	1.007	5
Wholesale, retail, hotels and restaurants (9)	18.3	39.96	3	5	0.949	1
Pearson's correlation with $\overline{rw_k}$	0.908	-0.828				
Spearman's correlation with $\overline{rw_k}$			0.867	-0.733		

Source: prepared by the author on the basis of data from the Jamaica Labour Force Survey, second quarter, 2004 to 2007, Statistical Institute of Jamaica (STATIN).

The size of the positive (negative) correlation between the workforce concentration in the largest (smallest) employer-size category and industry mean relative wage ($\overline{rw_k}$), suggests an interrelation between employer-size wage differentials and inter-industry wage differentials. Furthermore, the fact that $\overline{rw_k}$ is greater than one (less than one) for large firms (small firms) in all but one industry group suggests that causality runs from ESWD to IIWD and not the other way around.

IV

Estimation and results: explaining ESWD

Table 3 suggests that after controlling for occupational characteristics, workers in establishments with fewer than 10 workers receive an hourly wage that is 24.6% less, on average, than the average wage of workers in firms with 50 or more employees. This analysis, while useful, is somewhat limited, in that it does not control for other worker characteristics, such as experience and years of schooling, and it does not provide an explanation for the ESWD phenomenon. Both shortcomings can to some extent be overcome by examining the magnitude and statistical significance of the employer size (ES) coefficients, α_k in the augmented human capital equation (1):

$$\begin{aligned} LAE = {} & \alpha + \sum_{h=1}^{4} \alpha_h YEAR_h + b_2 HWKD + b_3 HWKD^2 + \\ & b_4 EXP + b_5 EXP^2 + b_6 YS + b_7 YS^2 + b_8 TMAT \times YS + \\ & b_9 TMAT \times YS^2 + \alpha_1 TMAT + \sum_{i=1}^{8} \alpha_i OCC_i + \\ & \sum_{i=1}^{8} \alpha_{i,1} OCC_i OJT + \sum_{i=1}^{8} \alpha_{i,2} OCC_i GEN + \\ & \sum_{j=1}^{8} \alpha_j IND_j + \sum_{k=1}^{2} \alpha_k ES_k + \sum_{l=1}^{2} \alpha_l TEN_l + \\ & \sum_{m=1}^{2} \alpha_m KRU_m \end{aligned} \qquad (1)$$

where α is the main intercept parameter; α_j is the intercept-shift parameter of the *j*th dummy variable in the associated dummy variable group, $\forall h,i,j,m$; α_{jl} is a further shift parameter resulting from the interaction of the *j*th and *l*th dummy variables in their respective dummy groups, $\forall j,l$; and b_i is the slope parameter for its associated variable, $\forall I = 1, 2,\ldots, 9$.

Equation (1) includes several variables that provide an indication of worker quality, namely, experience (EXP), years of schooling (YS), whether the worker matriculated or could have matriculated in a tertiary educational institution (TMAT), and whether the worker received formal on the job training (OJT).

If it is determined that both firm-size intercept-shift parameters are individually equal to zero ($\alpha_k = 0$), then it can be inferred that (measured) labour quality explanations (LQE) can account the estimated ESWD (see table 3). However, should it be determined that at least one $\alpha_k \neq 0$ (an employer-size premium, or ESP), a modification of equation (1) will be estimated to determine the appropriateness of incorporating firm-size differences in tenure profiles as a supporting explanation of ESWDS. This involves incorporating a size-tenure interaction dummy variable, that is, adding $\sum_{l=1}^{2} \sum_{k=1}^{2} \alpha_{lk} TEN_l ES_k$ to equation (1).

All estimations used the STATA-12.1 statistical software. When equation (1) is estimated using ordinary least squares (OLS), the test for the presence of influential outliers suggests that 338 such observations exist in the data set (of 7,186 complete sets of observations), possibly contributing to the relatively low explanatory power of the model (*R* squared of 0.397).[12] There are two available courses of actions: (i) use a robust or high-breakdown estimation technique (values to outliers); or (ii) eliminate some or all of the observations identified as influential outliers. The latter course of action is advisable if the outliers are clearly the result of a spurious activity (Cousineau and Chartier, 2010; Osborne and Overbay, 2004). While robust estimation techniques in principle protect parameter estimates from being distorted in the presence of outliers without the risk associated with eliminating outlying observations, it does not give equal weight to each observation in the regression, thereby introducing some degree of value judgement.[13]

The results presented in this paper are based on the original sample of 7,186 observations minus 36 of the

[12] Influential outliers were identified using Cook's distance influence statistic with the conventional cut off (4/n).

[13] See Verardi and Croux (2009) for a technical exposition on the various types of robust regression techniques.

338 influential outliers. The process involved in selecting these 36 outliers is briefly outlined below.

Figure 1 plots the log of gross annual earnings from main job (LAE) and *rw* for the 338 influential outliers in the model.[14] I refer to these outliers, identified both by the regression model (influential outliers) and by the distribution of *rw*, as double outliers. Eight of the 36 double outliers are low outliers, while 28 are high outliers.

All 36 double outliers were taken to be "illegitimately included in the data" (Osborne and Overbay, 2004) and were therefore removed. In total, 36 influential outliers were dropped.[15] The remainder of the original 338 influential outliers were retained in the data set.

Table 5 shows the estimation results of equation (1). The estimation is based 7,150 observations following removal of the 36 double outliers. Approximately 46.8% of the variation in the log annual earnings is explained by the model. When the 36 double outliers are included in the data set (7,186 observations), the regressions results (not shown is this paper) were quite similar to table 5, with an R squared of 39.7%. The robust regression (not shown) also produces similar results.

[14] The high and low outlier marks of the *rw* sample distribution were identified by first transforming *rw* using the modified square root transformation, as proposed by Cousineau and Chartier (2010):

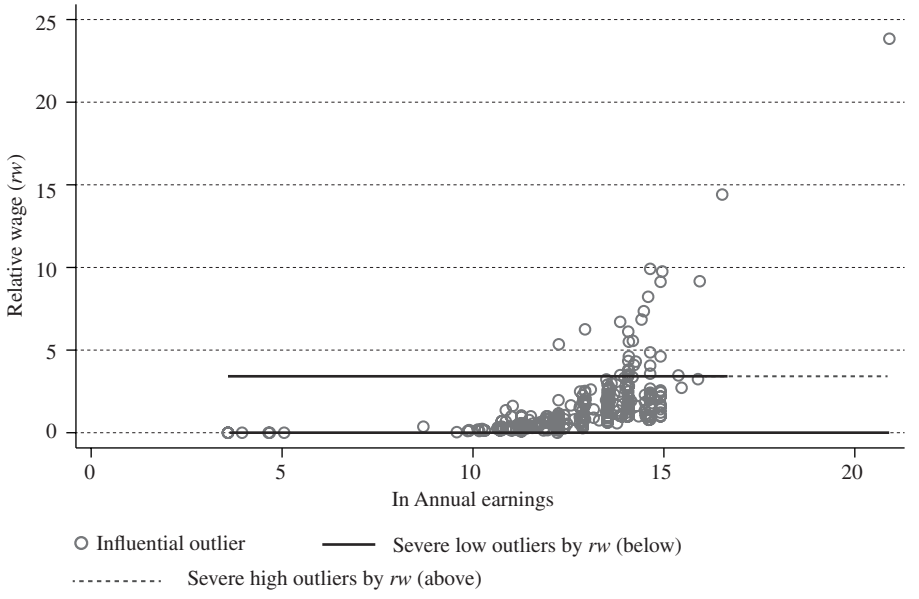
$$rw' = \sqrt{\frac{rw - rw_l}{rw_h - rw_l}}$$

where rw_h and rw_l are the highest and lowest values of *rw*. This transformation converted the right-skewed distribution (*rw*) to a symmetric distribution (*rw'*). A conventional boxplot was used to identify severe outlier boundaries for the *rw'* distribution. Appropriate transformations were made to convert these *rw'* outlier boundaries to outlier boundaries for the original *rw* distribution.

[15] The outlier cut-offs for *rw* are 0.004068 on the low end and 3.416260 on the high end. Double outliers are those outliers that have been identified by the model as being highly influential and whose hourly wage is either less than 0.4% of their occupational averages or more than 242% over the mean earnings for their four-digit occupation code. On the low end, seven of the eight individuals reported earnings of less than US$ 3 per year. Of the 28 high double outliers, the individuals earn, on average, 5.7 times the mean wages for their respective four-digit occupation group, with the first quartile earning between 3.5 and 3.6 times their occupation mean earnings and the last quartile earning over 7.8 times their occupational mean, with one person reportedly making an annual income of over US$ 21 million (23.8 times the average wage for the occupation). In these observations, either the reported income or the occupational code is likely to be misrepresented (deliberately or otherwise).

FIGURE 1

Plot of *rw* and LAE for influential outliers



Source: prepared by the author on the basis of data from the Jamaica Labour Force Survey, second quarter, 2004 to 2007, Statistical Institute of Jamaica (STATIN).

Note: points below the solid line indicate relative wages (*rw*) that are lower than the low outlier mark in the *rw* distribution; points above the dashed line represent relative wages (*rw*) that are higher than the high outlier mark in the *rw* distribution.
LAE: log of gross annual earnings from main job.

The coefficients are generally of the expected sign. The returns on experience is concave (increasing at a decreasing rate), as is the return on hours worked. People who have worked for five or more years with their current firm earn a premium of 9.1% over workers with tenure of two years or less.

TABLE 5

Estimation output: equation (1)

Explanatory variable	Coefficient	Std. Error	*t* statistic	$P > \|t\|$	95% Conf. Interval	
YEAR						
2005	0.0906	0.0148	6.14	0.0000	0.0616	0.1195
2006	0.1824	0.0143	12.74	0.0000	0.1543	0.2104
2007	0.2343	0.0158	14.84	0.0000	0.2033	0.2652
IND						
2	0.3073	0.0325	9.45	0.0000	0.2435	0.3711
3	0.0538	0.0310	1.74	0.0820	-0.0069	0.1146
4	0.5445	0.1054	5.17	0.0000	0.3380	0.7510
5	0.2609	0.0363	7.19	0.0000	0.1898	0.3321
6	0.6126	0.0544	11.26	0.0000	0.5060	0.7192
7	0.1364	0.0341	4.00	0.0000	0.0696	0.2033
8	0.1892	0.0374	5.06	0.0000	0.1160	0.2625
9	0.0700	0.0303	2.31	0.0210	0.0105	0.1295
OCC [a]						
3	0.1373	0.0526	2.61	0.0090	0.0342	0.2404
4	-0.0988	0.0503	-1.97	0.0490	-0.1974	-0.0003
5	0.3066	0.0921	3.33	0.0010	0.1262	0.4871
6	-0.1336	0.0609	-2.19	0.0280	-0.2529	-0.0143
7	0.4889	0.1095	4.46	0.0000	0.2742	0.7037
8	-0.2415	0.1506	-1.60	0.1090	-0.5368	0.0537
9	-0.0249	0.0510	-0.49	0.6250	-0.1248	0.0750
10	0.1150	0.0665	1.73	0.0840	-0.0153	0.2453
HWKD	0.0226	0.0051	4.41	0.0000	0.0126	0.0326
$HWKD^2$	-0.0002	0.0001	-3.55	0.0000	-0.0003	-0.0001
ES						
10-49 workers	0.1432	0.0133	10.73	0.0000	0.1170	0.1693
≥ 50 workers	0.2285	0.0183	12.48	0.0000	0.1926	0.2643
EXP	0.0119	0.0017	7.13	0.0000	0.0086	0.0151
EXP^2	-0.0001	0.0000	-5.08	0.0000	-0.0002	-0.0001
TMAT	-0.8870	1.9454	-0.46	0.6480	-4.7006	2.9265
YS	0.0343	0.0224	1.53	0.1260	-0.0097	0.0783
TMAT#YS [b]	0.1623	0.2998	0.54	0.5880	-0.4253	0.7499
YS^2	0.0002	0.0013	0.12	0.9010	-0.0024	0.0027
TMAT#YS^2	-0.0053	0.0112	-0.47	0.6360	-0.0273	0.0167
OCC#OJT [b]						
2#1	0.0742	0.0289	2.57	0.0100	0.0176	0.1309
3#1	0.1522	0.0343	4.44	0.0000	0.0850	0.2194
4#1	0.1777	0.0576	3.08	0.0020	0.0647	0.2907
5#1	0.3549	0.1063	3.34	0.0010	0.1464	0.5633
6#1	-0.0127	0.0643	-0.20	0.8430	-0.1388	0.1133
7#1	-0.0137	0.0993	-0.14	0.8910	-0.2084	0.1811
8#1	0.2617	0.0843	3.11	0.0020	0.0965	0.4268
9#1	0.1057	0.0244	4.33	0.0000	0.0578	0.1537
10#1	0.2370	0.0558	4.25	0.0000	0.1277	0.3463
TEN						
2-5 years	0.0269	0.0168	1.60	0.1100	-0.0061	0.0599
≥ 5 years	0.0909	0.0162	5.60	0.0000	0.0591	0.1227
KRU [c]						
Rural	-0.1673	0.0132	-12.69	0.0000	-0.1931	-0.1414
Urban	-0.1472	0.0142	-10.34	0.0000	-0.1752	-0.1193
OCC#GEN [b]						
2 #1	0.2448	0.0496	4.94	0.0000	0.1476	0.3420
3# 1	0.1131	0.0380	2.98	0.0030	0.0387	0.1876

Table 5 (*conclusion*)

Explanatory variable	Coefficient	Std. Error	*t* statistic	$P > \|t\|$	95% Conf. Interval	
4# 1	0.0637	0.0227	2.81	0.0050	0.0193	0.1081
5 #1	0.0903	0.1024	0.88	0.3770	-0.1103	0.2910
6 #1	0.4443	0.0474	9.37	0.0000	0.3514	0.5373
7# 1	0.0272	0.0750	0.36	0.7170	-0.1198	0.1742
8 #1	0.2998	0.1470	2.04	0.0410	0.0116	0.5880
9# 1	0.1124	0.0214	5.24	0.0000	0.0704	0.1544
10#1	0.1963	0.0571	3.43	0.0010	0.0842	0.3083
Constant	10.8079	0.1639	65.96	0.0000	10.4867	11.1291
Summary statistics						
No. observations	7.150					
F(52, 7 097)	99.04					
Prob > *F*	0.0000					
R^2	0.4675					
Adjusted R^2	0.4636					
Root mean square error	0.4435					
Akaike information criterion	8 716.73					

Source: prepared by the author on the basis of data from the Jamaica Labour Force Survey, second quarter, 2004 to 2007, Statistical Institute of Jamaica (STATIN).

Notes: the dependent variable is the log of gross annual earnings from the worker's main job (LAE). Explanatory variables are the year; the main industry group (IND); the worker's main occupation group (OCC); regular hours worked per week (HWKD); the size of the employer, measured as the number of persons employed at the worker's main workplace (ES); years of experience (EXP); whether the worker's educational attainment was sufficient for matriculation in tertiary studies (TMAT); years of effective schooling (YS); whether the worker has received formal on-the-job training (OJT); tenure or time in the current job (TEN); whether the workplace is located in the capital Kingston, a rural area or an urban area (KRU); and interaction dummy variables.

[a] The first major occupation group– armed forces– has no private sector observations.
[b] The # sign represents the interaction between the variables in question.
[c] Kingston Metropolitan Area (KMA) is the excluded category.

1. Assessing the validity of labour quality explanation

Table 5 shows that after accounting for measured human capital and other worker characteristics, both of the firm-size intercept-shift parameters are significant and greater than zero ($\alpha_k > 0$). Firms with 10 to 49 employees and firms with 50 or more employees are estimated to pay a premium (ESP) of 14.3% and 22.9%, respectively, relative to the wages paid by firms with fewer than 10 employees (excluded category). The predicted ESPs are similar to the average differentials of 10.3% (10-49 workers) and 24.6% (50 workers or more) in table 3, where hours worked and occupation (four-digit code) were the only controls.

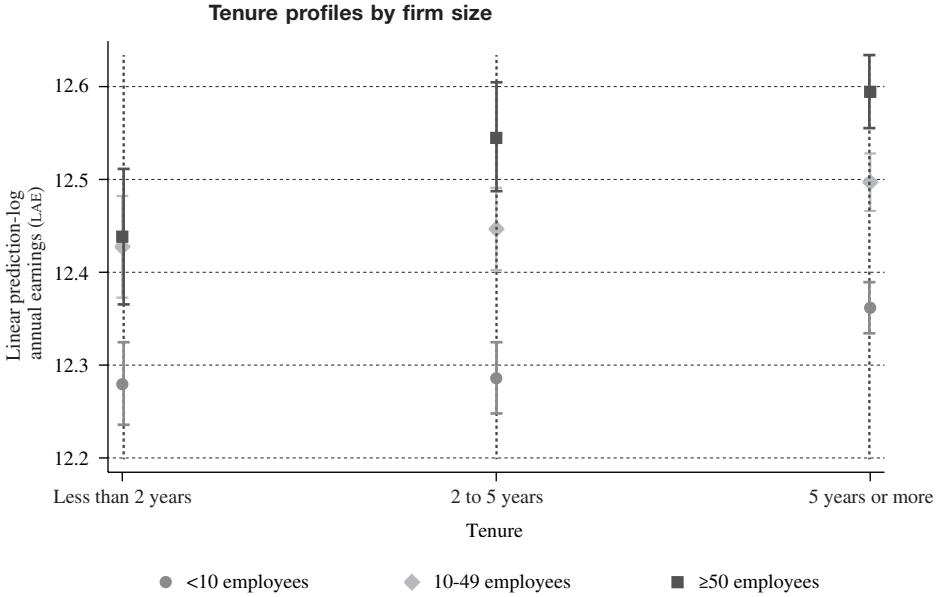
Accounting for labour quality therefore does not eliminate the ESWD. The source of ESWD cannot be explained by the observed measures of labour quality.

2. Tenure profiles

The seeming inability of the labour quality explanation (LQE) to account for the ESWD necessitates the evaluation of alternative explanations. One alternative that is testable within the context of the variables collected in the JLFS is the difference in tenure profiles. To assess the validity of the hypothesis that firm-size differences in tenure profiles are the cause of the observed firm-size wage premium (ESP), equation (1) was modified by interacting employer size (ES_k) with the categorical variable (TEN_l), after which the size and significance of the employer-size (ES_k) intercept-shift parameter α_k was reassessed. Figure 2 shows the estimated tenure profiles for firms with fewer than 10 employees, 10-49 employees and 50 or more employees.[16] The location of the predicted return for the average worker in each of the three employer-size categories is indicated by the respective shapes, with the extensions at either end indicating the range of the 95% confidence interval. As figure 2 shows, the employer sizes have differing estimated tenure profiles over the ranges under consideration, and workers' remuneration increases with tenure.[17] The

[16] The estimated tenure profiles were derived from the estimates of the modified equation (1).
[17] For each employer size, statistical tests suggest (at the 2% level) that the predicted return at five years or more is higher than at two years or less.

FIGURE 2



Source: prepared by the author on the basis of data from the Jamaica Labour Force Survey, second quarter, 2004 to 2007, Statistical Institute of Jamaica (STATIN).

Note: 95% confidence intervals.

difference in worker remuneration (returns) between a firm with 50 workers or more and one with fewer than 10 workers is smallest at the lowest measured tenure level and increases over this amount at higher tenure levels.[18] This observation is to some extent consistent with the main thesis of the tenure profile explanation of ESWD. However, the fact that the returns for small firms at the lowest tenure level is statistically distinct from the returns for large firms may suggests that tenure profiles alone do not fully explain the ESP.

Table 6 examines whether average tenure differs by employer size. The average number of years in the current job is calculated by using midpoints in the bounded categories and the lower bound in the case of the unbounded category.[19] The table suggests that workers in the smallest and the largest ES categories have stayed longer, on average, with their current employers than those in establishments with 10 to 49 workers.[20] The tenure profiles observed in figure 2 are not sufficient to explain the phenomenon shown in table 6. Why would workers, on average, stay longest with employers that reward them the least (small firms) for their years of service? The condition of work hypothesis may possibly provide an explanation for this anomaly.

Having established that tenure profiles differ by employer size, is it possible that size differentiated tenure profiles explain the employer size premiums (ESP) estimated previously? Table 7 presents the estimated α_k (the intercept-shift parameter associated with employer size k) for the size-tenure augmented model as well as those estimated in the original model. While accounting for tenure profiles reduced the wage premium to workers in establishments with 50 or more employees from approximately 22.8% to 15.9%, it has not resulted in a reduction in premium paid to workers in firms with 10 to 49 employees.

The returns to education, experience and hours worked have not changed in a qualitative sense compared to the results from the original model.

[18] The differences in the range between predicted returns for 50 workers or more and for fewer than 10 workers at the lowest level of tenure is statistically smaller than the range at the other tenure levels.

[19] The original seven-category variable was used for this calculation.

[20] Approximately 63% of the sample is contained in the last tenure category (five years or more). The accuracy of the mean years of tenure may be somewhat compromised by not being able to observe the distribution of such a large percentage of the sample.

TABLE 6

Mean years in current job by employer size

Firm size	Average years in current job		Statistically different from (one-tailed *p* value)		
	Mean	Std. Error	<10 employees	10-49 employees	≥50 employees
<10 employees	4.159204	0.0213201		0.0130	0.2951
10-49 employees	4.079413	0.0290760	0.0130		0.1237
≥50 employees	4.135558	0.0386143	0.2951	0.1237	

Source: prepared by the author on the basis of data from the Jamaica Labour Force Survey, second quarter, 2004 to 2007, Statistical Institute of Jamaica (STATIN).

TABLE 7

Size-tenure impact on firm-size wage differentials

Firm size (ES_k)	Model II: Size-tenure profile (α_k)	Model I: Original (α_k)	H0: II = I (*one-tailed p value*)
10 to 49 employees	0.1479 [a]	0.1432 [a]	0.8735
50 or more employees	0.1588 [a]	0.2285 [a]	0.0690
Summary statistic			
R^2	0.4679	0.4675	
Adjusted R^2	0.4637	0.4636	
Akaike information criterion	8 719.68	8 716.73	

Source: prepared by the author on the basis of data from the Jamaica Labour Force Survey, second quarter, 2004 to 2007, Statistical Institute of Jamaica (STATIN).

[a] Statistically significant at the 1% level or lower.

V
Conclusions

The positive correlation between wages and firm size and its implications for labour market theory and the theory of the firm take on added practical significance in the context of the high unemployment and the highly skewed income distribution that characterize Jamaica and much of the Caribbean. This paper estimates that after controlling for measured human capital and other characteristics, premiums of 14.3% and 22.8% are paid to workers in establishments with 10 to 49 employees and with 50 or more employees, respectively, relative to employees in firms with fewer than 10 employees.

The paper also indicates that worker remuneration may, on average, differ by as much as 29.8% across industry groups (one-digit level). However, the positive (negative) correlations between the largest (smallest) employer size category and industry wage premium suggest the possibility that employer-size wage differentials (ESWD) may be causal to inter-industry wage differentials in Jamaica.

The available evidence seems to suggest that employer-size premiums (ESP) persist after accounting for measured aspects of labour quality. Firm-size differences in tenure profiles, however, seem to provide a partial explanation to the estimated ESP in Jamaica. The ESP associated with the largest employers is reduced to 15.9%, while there is no reduction in the premium paid by the mid-sized firms. There is no statistical difference in the average years of tenure between the largest and smallest size categories. This phenomenon, along with size of the unexplained premiums, opens the door to other theoretical explanations for the firm-size wage premiums, such as work conditions, union avoidance and efficiency wage, none of which can be tested with the currently available data.

In addition to the data limitation identified above, the manner in which existing variables in the JLFS data set are measured may affect the exploration of the ESWD phenomenon. The tenure variable (TEN), for example, is measured in a categorical manner in the JLFS, with over 60% of private sector workers belonging to the last category (that is, tenure of five years or more), which limits the variability that may be captured. Further exploration of

the tenure profile hypothesis would therefore require a more continuous measure of worker tenure, specifically an expansion of what is currently the last category.

Finally, the implication of the ESWD phenomenon for the income distribution is a major motivator for its further investigation. Beyond this, the exploration of ESWD is fundamental to understanding how labour markets function. The motivations that determine firms' wage and employment decisions affect the nature of the labour market interventions that should be devised to tackle the persistently high levels of unemployment that are characteristic of Jamaica and much of the Caribbean.

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Wage differentials between the public and private sectors in Chile: Evidence from longitudinal data

Lucas Navarro and Javiera Selman

ABSTRACT

Despite its importance, the literature on wage differentials between public- and private-sectors employees in Latin America is sparse. This article analyses the wage gap between the two sectors in Chile, based on monthly longitudinal data obtained from the Social Protection Survey (EPS) for the period 2002-2009. The study takes advantage of the panel structure of the data to control for time-invariant observable and unobservable factors that determine the self-selection of workers between sectors and wages. The results show that the wage differential between workers in the public and private sectors disappears when these factors are controlled for.

KEYWORDS

Wages, public sector, private sector, labour mobility, economic analysis, statistical data, econometric models, Chile

JEL CLASSIFICATION

J31, J45, D31

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I
Introduction

A large proportion of the labour force throughout the world is employed in the public sector. According to data from the Organization for Economic Cooperation and Development (OECD, 2011), the public sector provides 30% of all jobs in Norway and Denmark, 22% in France and 16% in the United States. Although public employment accounts for roughly 15% of total employment across Latin America, and 10% in Chile specifically (Mizala, Romaguera and Gallegos, 2011), there has been very little comparative analysis of employment and wages in the two sectors in the region. The present study contributes to the literature by analysing the wage gap and mobility between the public and private sectors among wage-earners in Chile, using panel data from the Social Protection Survey (EPS) for the period 2002-2009.

Employment in the public and private sectors has specific features that may affect pay in each sector: (i) some productive activities are undertaken typically either by the public or by the private sector; (ii) public-sector hiring often obeys different rules than those of the private sector (political decisions for example); (iii) the public sector is regulated by specific legislation on employment conditions; and, in addition, compliance with general labour legislation is much stricter in the public sector than in the private sector in many countries. There is also evidence that public-sector workers are more risk-averse and display a greater preference for public services and non-profit institutions (Gregory and Borland, 1999).

The literature on wage differences between public- and private-sector workers comes mainly from developed countries. In general, studies provide evidence of a premium for working in the public sector, which is higher among women but declines over the wage distribution, and can even become negative.[1] The evidence also shows that the public-sector wage distribution is less dispersed than its private sector counterpart, even when observable characteristics are controlled for (Bender and Elliott, 1999).

An important methodological issue when analysing inter-sectoral wage differences is that workers have variable unobservable characteristics (innate abilities, motivation, risk aversion and others). These affect their wage and the decision to work in the private or public sector, thereby biasing the results. Using data from the United States, Krueger (1988) finds that, when using longitudinal data and correcting for selection bias, the unexplained wage gap between the sectors is substantially smaller than that obtained from ordinary least squares (OLS) estimations with cross-section data. More recent studies, such as Lee (2004) for the United States, have obtained similar results.

Among the most recent studies, Bargain and Melly (2008) use longitudinal data for France and estimate the average wage gap with a fixed-effects model and quantile regressions with fixed effects (Koenker, 2004). The results show that the average differential is not different from zero, there are no differences between men and women, and the gap does not vary over the wage distribution. The authors attributed the gap observed in earlier studies, and the smaller dispersion of wages in the public sector, exclusively to individual selection.[2] In another study, Siminski (2013) analyses whether there are differences in the return to skills between sectors, using a model of quasi-differences with the generalized

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[1] Lucifora and Meurs (2006), using quantile regressions, detect a premium for working in the public sector in France, Italy and the United Kingdom, which varies between 8% and 15% in the first deciles of the wage distribution, and then decreases until it vanishes in the ninth decile. Women always obtain a positive premium and men obtain higher returns from working in the private sector in most of the distribution. Melly (2005), using data from Germany and a quantile regression decomposition used by Machado and Mata (2005), finds that the public sector premium becomes negative in the 25th percentile for men and in the 75th percentile for women.

[2] These results are in line with those found by Disney and Gosling (2008) and by Postel-Vinay and Turon (2007) for Great Britain and Northern Ireland, respectively.

method of moments (GMM), and finds that there are no premia (penalties) across the distribution, but that the higher (lower) wages observed in the public sector are explained by individual selection. The author points out that if the public sector attracts the best workers among the least skilled and the worst among the higher skilled, the differential will reflect productivity and not state inefficiency.[3]

In the case of Latin America, there is little evidence of research analysing the wage public-private sector wage gap. The study by Mizala, Romaguera and Gallegos (2011) uses cross-section data for 11 countries in the region over the period 1992-2007 to estimate the mean and distribution of the differential between the two sectors (for both wage-earners and self-employed workers). The study finds that, after controlling for observable characteristics using a matching procedure, the gap shrinks although it remains positive in all countries. The data for Chile reported in Mizala, Romaguera and Gallegos (2011) show that the wage gap widened from 3% in 1996 to 13% in 2006, which is less than estimated for other countries in the region. This positive differential is mainly explained by wage differences between public-sector workers and self-employed workers in the private sector; because, when wage-earners in the private sector are compared with their public-sector counterparts, the unexplained gap disappears. Analysing the public-private wage gap across the distribution, the authors detected a premium of about 10% for working in the public sector in the first deciles of the distribution; but this becomes negative in the 75th percentile and reaches a maximum penalty of 34% in the 95th percentile.

The present study takes advantage of the panel structure of the data to estimate the average wage gap in Chile between wage-earners in the public and private sectors, and to characterize mobility between sectors. Longitudinal data make it possible to control for time-invariant observable and unobservable factors that affect wages and the workers' selection between sectors. It is also possible to consider the effect of employment-history variables on wages, which are normally omitted in cross-section surveys. This study estimates the unexplained wage gap between workers in the public and private sectors using a fixed effects model combined with matching techniques to control for selection. The results show that while public-sector workers have a higher observed average wage than their private-sector counterparts, the gap disappears when observable and unobservable factors that are constant through time are controlled for.

This article is structured as follows: section II presents the data used and makes a descriptive analysis of the wage gap and mobility between the public and private sectors. Section III describes the methodology and econometric results; and section IV sets forth the conclusions.

[3] Awarding a premium or a penalty not related to the worker's skill or productivity generates an inefficient allocation of resources.

II
Data and descriptive statistics

This study uses data from the Social Protection Survey (EPS) administered by the Office of the Under-Secretary for Social Protection of the Ministry of Employment and Social Protection of Chile. The EPS is the country's most important longitudinal survey, given its size and sample design representative of the population over 18 years of age, and the large amount of information it obtains from its interviewees. It has been applied in 2002, 2004, 2006, 2009 and 2012, although data from the most recent wave is not yet available.

For the purposes of this study, based on information from the employment histories contained in the EPS for 2004, 2006 and 2009,[4] a monthly panel was constructed between January 2002 and December 2009 to analyse the wage differential between wage-earners in the public and private sectors and the mobility of workers between these sectors. Initially, the monthly panel contained information on 12,225 individuals. Nonetheless, to perform

[4] The 2002 survey inquired into employment history between 1980 and 2002, for an exclusive sample of pension-system affiliates. Accordingly, only that database was used to construct some of the variables of employment history since 1980, which for the rest of the sample were obtained from the 2004 survey.

the analysis, persons who were unemployed, inactive, or both (2,739), throughout the period were eliminated, along with another 180 that presented inconsistencies in their data. Accordingly, the final database is an unbalanced panel containing information on 9,306 individuals over a period of 96 months.

In this article, public-sector workers are defined as individuals who work as white-collar employees or manual workers in that sector, excluding members of the armed forces. Although it would be interesting to distinguish between individuals working in public enterprises and those working in central or municipal government, the EPS data do not allow for this distinction.

Table 1 shows the sector composition of employed labour, distinguishing between wage earners and self-employed workers in the private sector. In general, the data show a relative increase in the size of the public sector relative from 10% to 12% of all employed workers, at the expense of the wage-earning private sector.[5]

As noted in the introduction, one of the advantages of using longitudinal data is that it becomes possible to detect the dynamics of individual employment histories. Table 2 shows the status transition matrix between 2002 and 2009, considering five alternative labour market statuses which may apply to a worker at a given moment in time: employed in the public sector, employed as a

[5] With the aim of validating the data in table 1, appendix table A.1 shows the distribution between sectors based on the National Socioeconomic Survey (CASEN) of the Ministry of Social Development, for various years within the period analysed here. The data show a sectoral employment structure that is similar to that of the EPS sample used in this study. The only difference is that there tends to be a lower weight for waged employment in the private sector and a higher weight for self-employment in the private sector in the EPS compared to the CASEN survey over the last few years.

TABLE 1

Distribution of the employed labour force by sectors
(Percentages)

Year	No. of observations	Public	Private wage-earning	Private self-employed	Total
		(*Percentages*)			
2002	6 755	10.0	65.4	24.6	100
2003	6 834	10.1	64.8	25.1	100
2004	6 849	10.1	64.6	25.3	100
2005	6 948	12.1	61.8	26.1	100
2006	6 985	12.1	61.3	26.6	100
2007	6 984	12.0	63.3	24.7	100
2008	7 029	12.0	63.0	25.0	100
2009	6 781	12.2	62.0	25.8	100

Source: prepared by the authors on the basis of data from the Social Protection Survey (EPS).

TABLE 2

Labour mobility: transition matrix in relation to 2002 and 2009
(Percentages)

2002	2009					
	Public	Private wage-earning	Self-employed	Unemployed	Inactive	Total
Public	64.5	18.1	3.9	3.9	9.6	100
Private wage-earning	4.5	63.7	10.6	9.4	11.8	100
Self-employed	2.5	18.2	52.6	7.7	19.0	100
Unemployed	5.6	41.7	15.6	16.4	20.7	100
Inactive	6.5	36.1	15.7	13.7	28.0	100

Source: prepared by the authors on the basis of data from the Social Protection Survey (EPS).

wage-earner in the private sector, self-employed in the private sector, unemployed, or inactive.

From a long-term perspective, considering only the years at the start and end of the period under analysis, the data show that roughly two thirds of individuals employed in the private sector, and a similar fraction of public-sector employees, remained in that situation. The most frequent movement is within the private sector (between private-sector wage-earning employment and self-employment); nonetheless, the transition from wage-earning private-sector employment to employment in the public sector is not negligible, given the larger number of employees in the wage-earning private sector. Moreover, of those who were initially in the public sector, 22% were private-sector employees in 2009, 18% as wage-earners and 4% as self-employed. These figures suggest that there is a turnover of jobs between the public and private sectors; and there is also significantly lower probability of becoming long-term unemployed or inactive from the public than from the private sector.

Table 3 shows the extent to which the individuals in the sample changed their employment status each year. The data show a degree of time volatility in the status-transition patterns, which may be reflecting the country's business and political cycle. Between the periods 2004-2005 and 2006-2007 there is greater mobility both between sectors and into unemployment or inactivity. In the case of public-sector employees, who mostly moved into wage-earning jobs in the private-sector, this coincides with the implementation of the Public Senior Management System and the New Treatment Law in 2004,[6] and with the change of government in 2006.

The hourly wage per month, which is the main variable of interest in this study, was calculated from information compiled in the survey on weekly hours worked, and monthly income from work.[7] Table 4 shows the trend of the average real hourly wage in the public and wage-earning private sector each year, expressed in terms of 2009 prices deflated by the consumer price index (IPC) calculated by the National Institute of Statistics (INE). The data show that the wage gap (public wage minus private wage) stayed in a range of 31% to 41%,

TABLE 3

Annual transition matrices, 2002-2009

(Percentages)

	2003				
2002	Public	Private	Self-employed	Unemployed	Inactive
Public	95.1	0.9	0.6	2.4	1.0
Private	0.4	91.2	1.1	4.7	2.6
Self-employed	0.0	1.1	96.7	1.1	1.1
Unemployed	1.2	16.8	3.8	76.9	1.3
Inactive	1.0	9.4	1.1	1.7	86.8
	2004				
2003	Public	Private	Self-employed	Unemployed	Inactive
Public	96.0	0.6	0.2	1.7	1.5
Private	0.2	92.1	0.9	4.3	2.6
Self-employed	0	1.8	95.6	1.3	1.3
Unemployed	1.4	18.8	3.5	74.9	1.3
Inactive	0.6	8.2	1.0	1.3	88.9
	2005				
2004	Public	Private	Self-employed	Unemployed	Inactive
Public	76.2	17.5	2.3	1.7	2.3
Private	5.0	72.9	9.9	7.2	5.0
Self-employed	2.0	16.2	57.5	10.8	13.5
Unemployed	2.9	36.3	14.2	27.3	19.3
Inactive	2.1	20.9	14.7	19.8	42.5
	2006				
2005	Public	Private	Self-employed	Unemployed	Inactive
Public	94.5	1.9	0.4	1.9	1.3
Private	0.4	91.8	0.9	4.4	2.5
Self-employed	0.1	1.8	95.9	1.4	0.8
Unemployed	1.7	18.5	4.2	74.6	1.0
Inactive	1.1	7.0	2.9	1.6	87.4
	2007				
2006	Public	Private	Self-employed	Unemployed	Inactive
Public	68.4	20.7	3.3	3.9	3.7
Private	3.9	75.6	7.5	6.0	7.0
Self-employed	1.8	21.6	55.9	5.7	15.0
Unemployed	3.0	35.2	14.5	23.8	23.5
Inactive	2.1	18.8	14.2	12.9	52.0
	2008				
2007	Public	Private	Self-employed	Unemployed	Inactive
Public	90.9	4.8	0.8	1.7	1.8
Private	0.9	91.6	1.9	3.5	2.1
Self-employed	0.3	4.1	92.6	1.3	1.7
Unemployed	2.8	21.6	3.7	67.8	4.1
Inactive	1.1	6.0	2.5	1.3	89.1
	2009				
2008	Public	Private	Self-employed	Unemployed	Inactive
Public	91.8	2.2	0.6	2.6	2.8
Private	0.4	88.6	1.4	7.3	2.3
Self-employed	0.2	2.2	93.3	2.4	1.9
Unemployed	3.5	20.8	3.9	70.5	1.3
Inactive	0.8	7.0	1.7	1.3	89.2

Source: prepared by the authors on the basis of data from the Social Protection Survey (EPS).

[6] The New Treatment Law established a group performance evaluation system that encourages employees to meet pre-defined targets. Prior to this law, evaluation was based on individual performance. The Public Senior Management System requires senior public positions to be appointed through public and transparent competitive processes.

[7] The calculation defines a month as consisting of 4.2 weeks.

TABLE 4

Average real hourly wage by sector
(Pesos at 2009 prices)

Year	Sector		Percentage difference between the public and private sectors
	Public	Private wage-earning	
2002	2 139	1 422	34
2003	2 150	1 423	34
2004	2 173	1 421	35
2005	2 536	1 509	41
2006	2 502	1 538	39
2007	2 221	1 540	31
2008	2 286	1 570	31
2009	2 366	1 593	33

Source: prepared by the authors on the basis of data from the Social Protection Survey (EPS).

Note: the wage differences are statistically significant at 1% in all years.

depending on the year, and is statistically significant at the 1% level.[8]

It should be noted that the analysis of the wage gap does not include self-employed workers, because the EPS reports very low pay rates in this sector compared to those obtained from the CASEN survey —possibly because of the way the income data is requested—.[9] Whereas the EPS reports that pay for self-employed workers is lower than that of public-sector workers in all deciles of the wage distribution, the CASEN survey shows a significant wage gap in favour of self-employed workers as from the middle deciles.

Another aspect that is interesting to analyse is the growth of the average hourly wage for different types of workers. The first two columns of table 5 show the growth in real hourly wages for individuals who were in the public sector or the wage-earning private sector in 2002, and who were either in the same sector in 2009 or had moved to the wage-earning private sector or the public sector, correspondingly. The third and fourth columns describe the increase in pay for those who remained in the same sector (workers without mobility) throughout the period (from January 2002 to December 2009). The fifth to eighth columns show the increase in wages for workers that move between these different states of employment (workers with mobility) in the period 2002-2009. The fifth and sixth columns show what happened with workers that rotated between sectors or who were unemployed or inactive in certain months; and the seventh and eighth columns show the growth in wages for workers with mobility who were employed throughout the period under analysis. This latter group therefore refers to workers who moved between the public and private sectors at some point in the period 2002-2009.

Firstly, the data in table 5 show less wage growth for workers employed in the public sector in 2002 and 2009, compared to those employed in the private sector in both years, or those who moved between sectors. Among workers without mobility, private-sector pay during the analysis period grew by 14% more (36% compared with 22%) than for those who remained in the public sector. This could be related to the more flexible wage-setting practices that exist in the private sector, while public-sector wages are established through a unified pay scale.[10]

[8] The hourly wage data reported by the CASEN survey in table A.2 of the appendix show some differences in wage levels compared to those of table 2, but a similar wage gap.

[9] In the EPS, self-employed workers report their net monthly income or wage and the value of withdrawals of business profits for personal consumption over the last 12 months; whereas the CASEN survey asks about money and the value of amounts withdrawn from the business in the month in question, and business profits over the last 12 months.

[10] The unified pay scale sets pay levels for public-sector workers according to their hierarchical level, which depends on their experience, training, performance appraisal and knowledge.

TABLE 5

Real wage growth, 2002-2009
(Percentages)

	2009							
Year	Total workers in the sample		Workers without mobility		Workers with mobility			
					Total		Employed continuously throughout the period	
2002	Public	Private	Public	Private	Public	Private	Public	Private
Public	23	39	22		50	38	25	39
Private	38	38		36	51	44	38	44

Source: prepared by the authors on the basis of data from the Social Protection Survey (EPS).

The analysis of wage growth for workers with mobility shows that the change in occupational status seems to be linked to larger wage increases. This is reflected in the lower growth seen among those who remained in employment throughout the period, particularly those who were working in the public sector in 2009 (see columns 5 and 7 of table 5). Those who remained employed throughout the period and were in the public sector in 2002 and 2009, but during those years moved between sectors, saw their wages rise by 25% on average. This is just half of the average increase in wages for public-sector workers in 2009, who at some point before were not employed. Accordingly, this larger wage increase affects individuals that entered and left the labour market, who, according to the data (not reported), are mainly women with fewer years of schooling and a lower hourly wage. This suggests that much of the growth in wages could be explained by composition effects and not necessarily increases in workers' productivity.

Lastly, it is interesting to analyse the different individual characteristics of workers in the public and private sectors, which can be related to individuals' decisions on which sector to work in. Table 6 shows characteristics of public-sector and private-sector wage-earning employees around 2009, many of which will be considered in the econometric analysis of section III. To test the statistical significance of the differences, the final column reports a difference-of-means test for each variable between the public and wage-earning private sectors.

The data show that public-sector workers display statistically significant differences with respect to wage-earning private-sector workers in most of the variables shown in table 6. Public-sector employees are characterized by mostly being women, having higher education, paying in to social security, and working in larger productive units. As many as 82% of public-sector employees work in the community, social and

TABLE 6

Characteristics of workers in the public and wage earning private sector is, 2009

Characteristic	Public sector (826 individuals)		Private sector (4 207 individuals)		Difference
	Mean	Standard deviation	Mean	Standard deviation	
Age	47.15	11.35	43.86	11.08	3.29 ***
Male[a]	43	49	61	49	-18 ***
Years of schooling	13.25	3.74	10.88	3.66	2.37 ***
Higher education[a]	50	50	22	41	28 ***
Married or cohabiting[a]	63	48	61	49	2
No. of children	1.64	1.20	1.60	1.29	0.04
No. of months employed (since 1980)	160.21	107.34	127.00	84.70	33.21 ***
No. of months unemployed (since 1980)	5.54	20.54	7.94	20.83	-2.40 ***
No. of months inactive (since 1980)	13	43.62	14.82	47.30	-1.82
Job tenure	89.99	108.80	54.37	68.28	35.62 ***
Signed contract[a]	91	29	83	37	7 ***
Social security contributor[a]	90	29	84	36	6 ***
Union membership	42	49	16	37	26 ***
Firm size (1 to 3 workers)[a]	3	18	16	36	-12 ***
Firm size (4 to 9 workers)[a]	4	19	9	29	-6 ***
Firm size (10 a 24 workers)[a]	10	31	11	31	0
Firm size (25 to 59 workers)[a]	13	33	11	32	1
Firm size (60 to 119 workers)[a]	9	28	7	26	1
Firm size (120 or more workers)	61	49	46	50	16 ***
Agriculture, hunting, forestry and fishing[a]	3	16	11	32	-9 ***
Mining and quarrying[a]	2	14	2	14	0
Manufacturing industries[a]	1	11	13	34	-12 ***
Electricity, gas and water[a]	0	0	1	10	-1 ***
Construction[a]	4	18	11	32	-8 ***
Commerce, restaurants and hotels[a]	1	12	18	39	-17 ***
Transport, storage and communications[a]	2	15	9	28	-7 ***
Financial establishments, insurance[a]	3	16	9	29	-7 ***
Community, social and personal services[a]	82	38	23	42	59 ***
Economic sector unknown[a]	2	13	2	13	0

Source: prepared by the authors on the basis of data from the Social Protection Survey (EPS).

Note:*** significant at 1%.
[a] Percentages.

personal services sector. In contrast, wage-earners in the private sector have a lower average education level than their public-sector counterparts, and in 2009 were mainly working in manufacturing (13%), commerce (18%), construction (11%) and community, social and personal services (23%). Moreover, public-sector employees are more likely than private-sector wage-earners to have a contract, and are more likely to be member of a labour union and display less job turnover. The latter point arises when considering the number of months' service in the job and the number of months employed, unemployed or inactive since 1980. These variables affect the wage dynamic and can be included in the analysis through the longitudinal structure of the data. Public-sector workers also display a longer time of service, more months employed and fewer months unemployed then private-sector wage-earners.

III
Econometric analysis

1. Methodology

The data described in the previous section reveal the existence of a positive average wage differential between public-sector workers and private-sector wage-earners, along with significant differences in their observable characteristics. In addition, there could be unobservable differences (in innate skills, motivation, risk aversion, among others) that affect the gap. For example, as the transition rate to unemployment is lower for public-sector than for private-sector workers, more risk-adverse individuals are likely to self-select in the public sector.

A correct estimation of the wage gap should be able to isolate the effect of observable and unobservable factors that explain the workers' pay and selection between sectors.[11] For this purpose, a fixed-effects model is estimated to control for unobserved heterogeneity between individuals that remains invariant through time.[12]

Following the literature that studies the wage gap between the public and private sectors, the following standard specification is estimated:

$$w_{it} = \alpha_i + \lambda_t + \beta\, Public_{it} + \gamma X_{it} + \varepsilon_{it} \qquad (1)$$

where w_{it} is the logarithm of the hourly wage per month of worker "i" on date "t"; α_i captures time-invariant factors affecting the wage; λ_t considers temporary factors by year; "Public" is a dummy variable equal to 1 if worker "i" is employed in the public sector at time "t", and equal to 0 if the worker is employed in the private sector; X_{it} is a matrix of individual controls typically used in the literature, relating to demographic characteristics and others related to the worker's productivity.[13] Lastly, ε_{it} it is the error term for which the fixed-effects model provides efficient estimations of the coefficients, provided the errors are not correlated with the other variables included in the estimation.

In estimations using cross-section data, if public-sector workers are more productive than those in the private sector due to unobservable characteristics, and they are rewarded for these characteristics, the unobservable factors will affect the coefficient of the dichotomous variable "Public", and hence the wage gap between the sectors would be overestimated. Nonetheless, working with longitudinal data makes it possible to control for unobservable effects that are constant through time. Thus, specification (1) is identified by comparing the income of individuals who switch sector, controlling for observable characteristics both before and after that change, and assuming that their unobservable characteristics (creativity, intelligence and preferences, for example) are time-invariant.

The fixed effects specification of equation (1) assumes that the unobservable factors are constant

[11] In other words, the decision to work in the public or private sector or to switch from one to the other.

[12] In terms of the validity of the specification, the Hausman test rejects the null hypothesis of a lack of correlation between α_i and ε_{it}, so the fixed-effects model allows consistent estimation of the parameters, unlike the random- effects model.

[13] The following individual controls are specifically included: age, education level, marital status, family composition, real employment experience, and length of service in the job calculated as the number of months that the person appears in the database in the same job. Characteristics related to working conditions include whether the individual contributes to social security, whether he or she has a contract, issues receipts for fees received, or is a member of a union, and the size of the firm in which he or she works.

through time. Although this assumption is technically impossible to prove, its validity is closely related to how similar the individuals who switch sector are, compared to those who remain in the same sector. It is therefore necessary to check that the variable "Public" is independent of the wage and that there is therefore no selection between those who decide to change their sector of work. Specifically, this entails verifying if the following condition holds:

$$E\left(w_{0,it} \mid \alpha_i, Public, X_{it}\right) = E\left(w_{0,it} \mid \alpha_i, X_{it}\right) \qquad (2)$$

in other words, equation (2) checks that the expected value of the wage before changing sector would have been the same between those who switched and those who did not. This assumption is hard to justify when the group of workers that change sector have very different characteristics from those of workers without inter-sectoral mobility,[14] which indicates the existence of a selection problem.

An effective way to deal with the selection problem described above requires controlling for differences in the distribution of individual characteristics among workers in the public and private sectors. For that purpose, a propensity-score matching (PSM) procedure is applied, combined with a differences-in-differences (DID) technique. This is used to estimate equation (1) using the common support of the distributions of individual characteristics. That is, the sample used includes workers with similar characteristics who switched sector and those who remained in the same sector.[15]

The PSM matching procedure requires a treatment group and a control group to be defined. For this study, the treatment group consists of workers who move from the private sector to the public sector, and the control group consists of workers who remain employed in the private sector throughout the period of analysis, that is, who never change sector.[16] Basically, the aim of this exercise is to gauge the extent to which switching from the private to the public sector involves wage changes not related to individual's characteristics.[17]

The following subsection presents the fixed effects estimations and explains and discusses the results of the matching procedure implemented.

2. Results

The estimations presented below are based on a small sample which excludes individuals that were self-employed workers at any time during the period analysed. This is due to the measurement problem described before in the dependent variable "income" and the fact that very few public-sector workers have ever been self-employed in the full sample.[18] Moreover, according to Panizza and Qiang (2005), all the models are estimated for men (women) who initially were between 18 and 65 (60) years old, because it is less common for people to work beyond retirement age in the public sector.[19]

The sample used corresponds, then, to an unbalanced panel of 5,478 individuals in the period spanning January 2002 to December 2009. The descriptive statistics for the complete sample (9,306 observations) and the reduced sample (5,478 observations) are shown in table A.3 of the appendix. In general, the reduced sample is quite similar to the full sample in terms of personal characteristics; nonetheless, the workers of the reduced sample have more time in the same job, and a larger proportion of them contribute to social security, have a contract, participate in a union and work in larger firms. These patterns are in line with the characteristics of public-sector workers shown in table 6.

Columns 1 and 2 of table 9 present the results of the estimations of the wage gap with the fixed-effects model under two specifications. The first corresponds to the estimation of equation (1) with the variables described above; and the second also includes the interaction

[14] Table 7 below shows the differences in observable characteristics between workers who switch from the private to the public sector, and those who remain in the private sector throughout the period of analysis. In most of the characteristics considered, these two groups display statistically significant differences. A similar pattern is observed between those workers who move from the public to the private sector, and those who remain in the public sector. The latter results are available upon request from the authors, but are not reported in this document because they will not be considered in the matching procedure.

[15] Similar matching procedures have been used in other studies in different fields. See for example, Arráiz, Henríquez and Stucchi (2013); Castillo and others (2013).

[16] The PSM procedure was also carried out by defining the treatment group as individuals who change from the public to the private sector, and the control group as those who remain in the public sector. The results are not shown because it was impossible to eliminate the pre-treatment heterogeneity between the groups based on observable characteristics. This is partly due to the small number of observations in the control group in the sample.

[17] Pratap and Quintin (2006) implement matching techniques to estimate the wage gap between the formal and informal sectors in Argentina.

[18] This implies that 3,329 individuals were dropped from the original sample.

[19] This implies that 499 individuals were dropped from the original sample.

between years and the public sector dummy variable to explore whether the average wage gap changed during the period analysed. The data show that the average wage disappears once observable and unobservable characteristics are controlled for.[20] This result is consistent with the findings of Bargain and Melly (2008) for France, who use longitudinal data; and it is also in line with the results reported by Mizala, Romaguera and Gallegos (2011) for Chile, comparing public- and private-sector employees, excluding self-employed workers. In addition, the estimated average wage gap seems constant in the period analysed, given that the marginal effect of the public-sector variable "Public" by year is not statistically different from zero (0).

Lastly, one of the advantages of using longitudinal data is the greater availability of information on employment history that could affect wages. The results show that job tenure (number of months), work experience, having a signed contract, issuing fee receipts, and participating in a labour union have a positive effect on the wage. This last result is consistent with the typical rent-seeking mechanisms of unions.

As noted at the start of this section, as the fixed-effects model is estimated using a sample of persons with different observable characteristics, this could bias the estimations through the selection of workers in the public and private sectors. To alleviate this problem, a PSM procedure was implemented, as described below, to calculate the average impact between a subsample of individuals who are matched according to their observable characteristics. Additionally, individuals in the common support of the PSM are considered in order to estimate the fixed-effects model, thereby reducing selection bias. In this exercise, the treatment is defined as the change of status from being employed in the private sector to being employed in the public sector. Application of the PSM procedure, combined with a DID technique, makes it possible to control for workers' observable and unobservable characteristics, which would affect their decision to switch from the private to the public sector (propensity score) and the trend of the result variable (in this case the wage) in the absence of treatment (Heckman and Hotz, 1989; Blundell and Costa Dias, 2000).

The main identification assumption of the DID estimator is that, in the absence of treatment, there are no wage differences between workers in the control group and those in the treatment group. In other words, there are no wage differences between those who change from the private to the public sector and those who stay in the private sector. Accordingly, PSM restricts the estimation sample to the common support of the distribution of the observable characteristics of the two groups.

The method applied consists firstly of estimating the probability of switching employment from the private sector to the public sector. In the next stage, observations from the treatment group (individuals who change sector) are matched with those from control group, to make the likelihood of changing sector as similar as possible. There are different ways of implementing the PSM model, and, in general, the results may depend on the matching assumption and the variables considered in the estimation of the probability of changing from the private sector to the public sector. This study matched the observations using the nearest-neighbour method.[21] According to Caliendo and Kopeinig (2008), this method is the most conservative and appropriate when there is a large number of observations to form part of the control group, as is the case in this study.[22] Nonetheless, while the nearest-neighbour method is the most appropriate in terms of reducing biases, this comes at a cost of less efficiency because it uses a control group that is the same size as the treatment group. Lastly, with matched observations, the effect on the average wage of changing from a private-sector job to employment in the public sector is estimated. The results of the different stages of the matching procedure are described in detail below.

Using the data on individuals who are always employed in the public or private sectors throughout the sample period, the probability of changing from the private sector to the public sector was estimated on the basis of personal characteristics not affected by the treatment, and year dummy variables. Table A.4 of the appendix shows the results of the Probit estimation of the likelihood of switching employment from the private sector the public sector. These show a low probability of changing sector in the case of men, which is consistent with the larger proportion of women working in the public sector. There is also a positive effect from the

[20] For comparison, the model was estimated using pooled OLS, and this found a significant premium of 0.4% in favour of public-sector workers.

[21] As a robustness exercise, the matching was performed using five nearest neighbours and also on the basis of minimization of the Mahalanobis distance. The results were very similar to those obtained from the matching based on one nearest neighbour.

[22] With a large number of observations in the control group, there is a greater chance of finding observations with a similar likelihood of changing sector between the treatment and control samples.

years of schooling variable, and from the fact that either the father or mother works and has higher education.[23]

Figure 1 shows the probability distribution of switching from the private to the public sector for the control group and treatment group in the common support. Both distributions are very similar after the matching. To test the general quality of the matching procedure, the pseudo R^2 of the Probit model was used —which falls from 0.1296 before the matching to 0.01 in the matched sample; and the likelihood ratio test, which rejects the null hypothesis of joint lack of significance of the Probit explanatory variables in the original sample at the 1% confidence level, but does not reject that hypothesis in the matched sample.

The quality of the matching procedure can be further tested by checking whether the characteristics included in the Probit estimation of table A.4 in the appendix are similar between the treatment and control groups after the PSM procedure. This test is usually referred to as the "balance test". Table 7 shows the average value of each variable for each group, and the result of a difference-in-means test on the original sample (the reduced sample described above) and in the matched sample. As can be seen, although there are significant differences in many of the variables before matching, after the matching procedure it is impossible to reject the null hypothesis of equal means in any of the variables considered, most of which display significant differences in the original sample. All of this suggests that the quality of the matching procedure implemented is acceptable.

Once the PSM procedure has been implemented, and having made sure that the sample contains similar workers in both groups, the next step is to test the fundamental assumption of the DID method, that in the absence of treatment (in this case, mobility from the private sector the public sector), the wage would be the same in the control group and in the treatment group. Although this counterfactual cannot be tested, Heckman and Hotz (1989) suggest evaluating the effect of treatment on the result variable before it is carried out. If the wages are the same for both groups before treatment, one can then assume that the wages of the two groups would remain the same in the absence of treatment. Lastly, the estimator of the average effect is calculated using the DID method.[24]

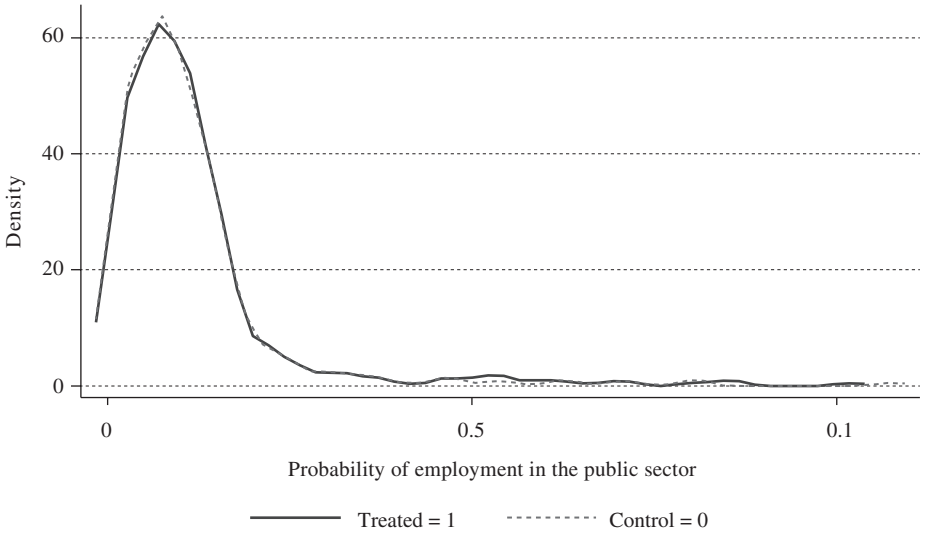
Table 8 presents the results. It firstly reports a difference-in-means test for wages between the groups before treatment (t-1), in the sample before and after matching. Lastly, it reports the average effect of the

[23] These two variables are not included in the fixed-effects model estimation because they do not vary across individuals through time.

[24] The average impact is calculated using the following formula: $E(Y_{T,1}-Y_{T,0}|T_1=1)-E(Y_{C,1}-Y_{C,0}|T_1=0)$, where T_1 denotes the treatment variable (in this case, moving from a wage-earning job in the private sector to employment in the public sector).

FIGURE 1

Probability distribution of changing from the private sector to the public sector after matching



Source: prepared by the authors.

TABLE 7

Observable differences in mean before and after matching

Variable	Sample	Mean		t-test	p>|t|
		Treatment	Control		
Male	Original	0.536	0.678	-6.21	0.00
	Matched	0.536	0.567	-0.90	0.37
Age	Original	41.552	42.245	-1.36	0.18
	Matched	41.552	41.717	-0.22	0.83
Married or cohabiting	Original	0.590	0.668	-3.39	0.00
	Matched	0.590	0.598	-0.21	0.83
Years of schooling	Original	12.043	10.631	7.96	0.00
	Matched	12.043	11.831	0.87	0.39
No of household members	Original	5.231	4.894	3.23	0.00
	Matched	5.231	5.102	0.80	0.43
Children between 0 and 2 years of age	Original	0.157	0.145	0.68	0.50
	Matched	0.157	0.195	-1.45	0.15
Children between 3 and 5 years of age	Original	0.181	0.175	0.31	0.75
	Matched	0.181	0.181	0.00	1.00
Father/mother works	Original	0.102	0.024	10.29	0.00
	Matched	0.102	0.102	0.00	1.00
Father/mother with higher education	Original	0.021	0.002	8.69	0.00
	Matched	0.021	0.031	-0.86	0.39
Year 2002	Original	0.007	0.131	-7.52	0.00
	Matched	0.007	0.017	-1.27	0.20
Year 2003	Original	0.021	0.133	-6.74	0.00
	Matched	0.021	0.017	0.50	0.61
Year 2004	Original	0.019	0.133	-6.88	0.00
	Matched	0.019	0.014	0.54	0.59
Year 2005	Original	0.464	0.133	19.93	0.00
	Matched	0.464	0.469	-0.14	0.89
Year 2006	Original	0.126	0.133	-0.41	0.68
	Matched	0.126	0.107	0.86	0.39
Year 2007	Original	0.317	0.132	11.10	0.00
	Matched	0.317	0.343	-0.81	0.42
Year 2008	Original	0.021	0.132	-6.71	0.00
	Matched	0.021	0.019	0.24	0.81
No. of individuals in the common support					
Treated			416		
Controls			1 522		

Source: prepared by the authors.

TABLE 8

Test of wage equality before treatment and the effect of treatment on the treated

Logarithm of the monthly hourly wage	Sample	Mean			t-test	p>|t|
		Treated	Control	Difference		
Before treatment (t-1)	Original	3 133	3 118	0.015	0.80	0.43
	Matched	3 133	3 157	-0.024	-0.90	0.37
Treatment month (t)	Original	3 165	3 119	0.046	3.20	0.00
	Matched	3 165	3 165	0.000	0.00	1.00
1 month after treatment (t+1)	Original	3 172	3 119	0.053	3.43	0.00
	Matched	3 172	3 168	0.003	0.16	0.87
6 months after treatment (t+6)	Original	3 168	3 118	0.050	3.03	0.00
	Matched	3 168	3 172	-0.004	-0.17	0.86

Source: prepared by the authors.

treatment on the treated in the treatment month (t), in the following month (t+1) and then six months later (t+6).

The results of the ex-ante equality-of-means test show that, both in the original and in the matched sample, there are no wage differences between individuals in the control group and those who move from the private to the public sector. This result strengthens the validity of the PSM procedure described, because it suggests that the assumption of equation (2) as specified above is satisfied. In terms of the effect of employment mobility towards the public sector, the results report a wage gain of around 5% for private-sector employees who take a job in the public sector in the original sample, but the gain falls to zero in the matched sample.

Lastly, table 9 uses the results of the matching model, and in columns 3 and 4 presents the results of the estimation of equation (1) in the common-support sample, obtained by estimating the probability of switching from the private to the public sector.[25] Columns 1 and 2 show the results of the model in the original sample, described above. In general terms, the results for different explanatory variables are similar in the two samples. In terms of the public-private wage differential, the results in the common support sample continue to show that the average wage difference between workers in the treatment group and those in the control group is not different from zero when selection and time-invariant unobservable characteristics are controlled for.[26]

In short, the different exercises described in this section consistently suggest that the unexplained wage gap between workers in the public and private sectors is not statistically different from zero (0), after controlling for the effect of observable and time-invariant unobservable factors and selection.

[25] Does not correspond to the matched observations but to all of the observations in the common support.

[26] Nonetheless, for 2005 and 2006 a significant gap appears of around 2.5% in favour of the public sector, at confidence levels of 90% and 95% respectively. As noted above, during those years transitions between the public sector and the private wage-earning sector increased considerably, which could be related to the implementation of the Public Senior Management Law and the change in government. From that standpoint, the results suggest the existence of a significant wage differential in favour of the public sector among individuals who switched sector in those years in particular; but they do not provide conclusive evidence of a gap in average wages between the sectors.

TABLE 9

Marginal effects of the fixed-effects model

	Original sample		Common support	
	(1)	(2)	(1)	(2)
Public sector (base model)	0.0082		0.0154	
	(0.0080)		(0.0125)	
Public sector 2002		0.0136		0.0154
		(0.0117)		(0.0363)
Public sector 2003		0.0109		0.0170
		(0.0120)		(0.0273)
Public sector 2004		0.0138		0.0258
		(0.0111)		(0.0183)
Public sector 2005		0.0083		0.0248*
		(0.0097)		(0.0136)
Public sector 2006		0.0059		0.0284**
		(0.0098)		(0.0138)
Public sector 2007		0.0053		0.0021
		(0.0086)		(0.0119)
Public sector 2008		0.0061		0.0060
		(0.0089)		(0.0124)
Public sector 2009		0.0052		0.0077
		(0.0088)		(0.0126)
Age	0.0160***	0.0159***	0.0122***	0.0121***
	(0.0021)	(0.0020)	(0.0031)	(0.0036)
Age^2	-0.0002***	-0.0002***	-0.0001***	-0.0001***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Married or cohabiting	-0.0009	-0.0008	0.0076	0.0077
	(0.0060)	(0.0061)	(0.0097)	(0.0094)
Years of schooling	0.0064***	0.0065***	0.0065**	0.0065**
	(0.0023)	(0.0024)	(0.0028)	(0.0026)
No. of household members	0.0033	0.0032	-0.0007	-0.0008
	(0.0025)	(0.0027)	(0.0041)	(0.0035)

Table 9 (*conclusion*)

	Original sample		Common support	
	(1)	(2)	(1)	(2)
Children between 0 and 2 years of age	0.0094*	0.0093	0.0181**	0.0181***
	(0.0051)	(0.0063)	(0.0086)	(0.0068)
Children between 3 and 5 years of age	0.0037	0.0036	0.0065	0.0064
	(0.0044)	(0.0049)	(0.0079)	(0.0080)
Work experience (since 1980)	0.0087***	0.0088***	0.0090***	0.0093***
	(0.0011)	(0.0012)	(0.0021)	(0.0016)
Work experience (since 1980)^2	-0.0001**	-0.0001**	-0.0001	-0.0001**
	(0.0000)	(0.0000)	(0.0001)	(0.0001)
Time in job	0.0046***	0.0046***	0.0022	0.0023
	(0.0013)	(0.0014)	(0.0019)	(0.0022)
Time in job^2	-0.0002***	-0.0002***	-0.0001	-0.0001
	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Contributes to social security	0.0124	0.0124	0.0149	0.0151
	(0.0078)	(0.0095)	(0.0148)	(0.0127)
Signed contract	0.0303***	0.0303***	0.0194	0.0192
	(0.0085)	(0.0097)	(0.0150)	(0.0122)
Fees	0.0228**	0.0228**	0.0223*	0.0225*
	(0.0089)	(0.0089)	(0.0123)	(0.0127)
Union membership	0.0210***	0.0213***	0.0246***	0.0244**
	(0.0074)	(0.0056)	(0.0091)	(0.0103)
No. of observations	351 277	351 277	161 796	161 796
No. of individuals	5 417	5 417	1 934	1 934
R^2	0.1828	0.1829	0.1697	0.1715

Source: prepared by the authors.

Note: standard errors calculated through the bootstrap method in parentheses.
All specifications include dummies by year and by firm size. The specifications of columns 2 and 4 include interactions of the "public sector" variable and the annual dummy variables. The table only reports the marginal effects of the "public sector" variable in each specification, and not the interaction coefficients.
* p<0,10; ** p<0,05; *** p<0,01.

IV
Conclusions

The key objective of this paper was to study wage differences and worker mobility among wage-earners in the public and private sectors in Chile, using longitudinal data obtained from the Social Protection Survey (EPS) for the period 2002-2009.

The descriptive analysis of the data show that, during the period analysed, between 10% and 12% of employed workers were working in the public sector; and, depending on the year, the average hourly wage in the public sector was between 31% and 41% higher than in wage-earning employment in the private sector. Moreover the most common turnover of workers occurred within the private sector (between wage-earning jobs in the private sector and self-employment); nonetheless, between 5% and 30% of public-sector workers changed status in any given year, moving mainly into wage-earning jobs in the private sector. There is also significantly less chance of becoming unemployed or inactive in the long-term from the public than from the private sector.

Taking advantage of the longitudinal structure of the data, the average wage differential between the public sector and the wage-earning private sector was estimated using a fixed-effects model and including employment history variables that are usually omitted in cross-section databases. In addition, a matching technique was implemented between public and private sector workers, to estimate the fixed-effects model for a sample of individuals that have a distribution of similar observable characteristics, and thus reduce the selection bias that could be present in the original

fixed-effects estimation. The results show that the average wage differential observed in the descriptive statistics is caused by worker selection in the private or public sectors, because when the comparison is restricted to a subsample of workers with similar characteristics, the premium disappears. These results are consistent with those found in other international studies that use panel data; and they highlight the importance of correcting for selection in terms of time-invariant observable and unobservable factors to measure the inter-sectoral wage differential.

As a future extension of the analysis presented here, it would be interesting to use these panel data to estimate the distribution of the wage gap between the public and private sectors in Chile, controlling for workers' observable and unobservable characteristics.

APPENDIX

TABLE A.1

Distribution of the employed labour force by sector, 2000-2009
(*Percentages*)

Year	Sector			Total
	Public	Private wage-earning	Private self-employed	
2000	12.0	63.8	24.2	100
2003	10.8	64.8	24.4	100
2006	9.9	66.5	23.6	100
2009	11.7	65.0	23.3	100

Source: prepared by the authors on the basis of data from the National Socioeconomic Survey (CASEN) of the Ministry of Social Development of Chile.

TABLE A.2

Real hourly wage by sector, 2000-2009
(Pesos at 2009 prices)

Year	Sector		Percentage difference between public and private sector
	Public	Private wage-earning	
2000	2 526	1 717	32
2003	2 704	1 695	37
2006	2 481	1 600	35
2009	3 175	2 019	36

Source: prepared by the authors on the basis of data from the National Socioeconomic Survey (CASEN) of the Ministry of Social Development of Chile.

Note: the wage differences are statistically significant at 1% in all years.

TABLE A.3

Descriptive statistics: complete sample and reduced sample

	Complete sample (No. of observations: 9 306)		Reduced sample (No. of observations: 5 748)	
	Mean	Standard deviation	Mean	Standard deviation
Age	43.53	13.12	41.34	11.65
Male[a]	56	50	50	50
Years of schooling	10.08	4.02	10.63	3.88
Higher education[a]	19	39	22	42
Married or cohabiting[a]	62	49	61	49
No. of children	1.55	1.30	1.57	1.27
Public sector[a]	8	28	13	33
Private sector[a]	47	50	63	48
Self-employed sector[a]	19	39	0	0
Unemployed[a]	10	30	11	31
Not in the labour forcea	15	36	14	35
No. of months employed (since 1980)	125.16	98.19	122.78	94.58
No. of months unemployed (since 1980)	10.65	25.85	11.14	25.49
No. of months inactive (since 1980)	25.64	59.69	23.82	56.92
Job tenure	78.63	89.01	85.16	90.23
Signed contract[a]	62	48	86	34
Logarithm of hourly wage	3.06	0.32	3.09	0.29
Contributes to social security[a]	53	50	66	47
Union membership[a]	15	36	20	40
Firm size (1 to 3 workers)[a]	22	42	10	30
Firm size (4 to 9 workers)[a]	7	25	6	25
Firm size (10 to 24 workers)[a]	7	25	8	28
Firm size (25 to 59 workers)[a]	7	26	9	29
Firm size (60 to 119 workers)[a]	5	21	6	24%
Firm size (120 or more workers)[a]	20	40	26	44
Agriculture, hunting, forestry and fishing[a]	13	33	11	31
Mining and quarrying[a]	1	12	2	13
Manufacturing industries[a]	13	33	13	34
Electricity, gas and water[a]	1	8	1	9
Construction[a]	10	30	8	28
Commerce, restaurants and hotels[a]	20	40	16	36
Transport, storage and communications[a]	8	26	7	25
Financial establishments, insurance[a]	6	25	7	26
Community, social and personal services[a]	27	45	34	47
Economic sector unknown[a]	1	10	1	10

Source: prepared by the authors.

[a] Percentages.

TABLE A.4

Probit of the probability of switching employment from the private sector to the public sector

	Coefficient	Standard error	z	P>|z|
Male	-0.1600	0.0378	-4.23	0.00
Age	0.0023	0.0019	1.22	0.22
Married or cohabiting	-0.0589	0.0392	-1.50	0.13
Years of schooling	0.0378	0.0054	6.99	0.00
No. of household members	0.0264	0.0083	3.17	0.00
Children between 0 and 2 years of age	0.0149	0.0517	0.29	0.77
Children between 3 and 5 years of age	0.0169	0.0480	0.35	0.73
Father/mother works	0.5623	0.0738	7.61	0.00
Father/mother with higher education	0.3352	0.1741	1.93	0.05
Year 2002	-0.4480	0.1804	-2.48	0.01
Year 2003	-0.1725	0.1379	-1.25	0.21
Year 2004	-0.2048	0.1406	-1.46	0.15
Year 2005	0.8332	0.1007	8.27	0.00
Year 2006	0.3541	0.1071	3.31	0.00
Year 2007	0.6658	0.1017	6.55	0.00
Year 2008	-0.1955	0.1354	-1.44	0.15
Constant	-3.6835	0.1683	-21.88	0.00
No. of observations		137 613		
Pseudo R^2		0.1296		

Source: prepared by the authors.

Note: the dependent variable is a dummy variable that takes the value 1 if the individual changes from the private sector to the public sector, and 0 otherwise. The sample includes employed workers who change from the private sector to the public sector and workers who are employed throughout the sample period and do not change sector.

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Income inequality in Brazil: What has changed in recent years?

Helder Ferreira de Mendonça and Diogo Martins Esteves

ABSTRACT

This paper provides empirical evidence to assess the impact of socioeconomic and political variables on different measures of income inequality based on the 27 units of the Brazilian federation in the period from 1999 to 2008. The Brazilian experience is a good example for understanding the income inequality policies in developing countries. The findings suggest that the improvement observed along the period under analysis is a result of the combination of increased trade openness, technological and financial development, a reduction in the unemployment rate, the adoption of social policies that imply a direct effect on the poorest families and the adoption of mechanisms against corruption.

KEYWORDS

Economic conditions, income, income distribution, economic aspects, social policy, measurement, econometric models, Brazil

JEL CLASSIFICATION

D31, I32, R10

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I
Introduction

Analysing the main causes of income inequality is essential for uncovering ways to mitigate it. A traditional question in the literature on income inequality is how an increase in trade openness affects the income distribution. In developing economies, where inequality is high and unskilled labour is predominant, an increase in trade openness may induce an increase in exports, which, in turn, reduces income inequality (Easterly, 2005). As suggested by Nissanke and Thorbecke (2006), an increase in openness is usually accompanied by an increase in foreign direct investment (FDI) and the diffusion of new technologies and know-how. This should generate an increase in productivity and output that would be capable of increasing wages and employment.[1]

The globalization process also affects the income distribution. According to Adams (2008), the use of patents as a mechanism for the defence of intellectual property rights and for stimulating innovations in developing economies should imply a reduction in inequality. The same result is observed by Acemoglu and Newman (2002). According to this view, in developing economies, unskilled labour is abundant, and technological progress thus improves productivity. As a result, knowledge spillovers could increase the income of unskilled workers (see Fang, Huang and Wang, 2008), fostering a better income distribution.

Unemployment is undoubtedly the main cause of poverty. Blinder and Esaki (1978) first described the relation between unemployment and income inequality. The basic idea is that unemployment tends to affect the less skilled and the low-paid more than other groups. Thus, unemployed people tend to be concentrated in the lower end of the income distribution (Martínez, Ayala and Ruiz-Huerta, 2001).

The success of social polices is controversial in literature. There is empirical evidence that increases in the minimum wage are an important tool for combating income inequality (Lemos, 2009). Moreover, as pointed out by Engel, Galetovic and Raddatz (1999) and Goñi, López and Servén (2011), government transfers are an efficient mechanism for reducing inequality. In contrast, Feldstein (1974) argues that social spending (welfare, social security and so forth) increases income inequality, to the extent that high income families receive a disproportionately large percentage of the benefits (Forteza and Rossi, 2006).

Another relevant issue is the effect of political competition. The study of the relationship between social and political variables goes back to Adelman and Morris (1965). As observed by Rupasingha and Goetz (2007), greater political competition leads to a lower level of poverty. Corruption is also connected to income inequality: an increase in corruption causes greater income inequality (Gupta, Davoodi and Alonso-Terme, 2002; Dincer and Gunalp, 2008; Apergis, Dincer and Payne, 2010).

This paper addresses the above issues in the context of the Brazilian case. Brazil is a leading emerging economy, with the seventh largest economy in the world, and it has recently been successful in decreasing income inequality. The recent period has been marked by a combination of consolidated democracy, a stable macroeconomic environment and the adoption of several anti-poverty initiatives by the government (for example, the implementation of the *Bolsa Família* conditional cash transfer programme and successive real increases in the minimum wage).

Like the United States, Brazil is characterized by vast geographical differences. Hence, the first step in this study is to observe the behaviour of the main factors that can explain income inequality for each region, identifying where each factor is most effective. The second step is to present empirical evidence using a dynamic panel data framework that covers the 27 units of the Brazilian federation in the period from 1999 to 2008. In short, the main objective of this research is to provide empirical evidence to assess the impact of socioeconomic and political variables on different measures of income inequality.

The remainder of this paper is organized as follows. Section II describes the data used in this research and provides a regional analysis for the Brazilian case. Section III presents empirical evidence, based on panel data analysis, on the impact of socioeconomic and political variables on different measures of income inequality for the 27 units of the federation in the period from 1999 to 2008. Section IV presents our conclusions.

[1] For an empirical analysis contrary to the argument that trade openness reduces income inequality, see Meschi and Vivarelli (2009).

II

Income inequality: regional analyses

In 1999, Brazil adopted a flexible exchange rate regime, inflation targeting and a primary fiscal surplus. The resulting macroeconomic stabilization has fostered an improvement in the income distribution. In this study, we follow the literature on income inequality in considering a number of socioeconomic variables (Roine, Vlachos and Waldenström, 2009; Easterly, 2005; Acemoglu, 2002) and political variables (Gupta, Davoodi and Alonso-Terme, 2002; Alt and Lassen, 2010). The fact that Brazil has a continental dimension implies that regional differences must also be taken into account. Hence, this section shows the regional behaviour of the variables used in the empirical model for the period from 1999 to 2008.[2]

For decades, income inequality in Brazil was very high in comparison with other countries (Gasparini, 2003). Inequality began decreasing, however, in the late 1990s. To delineate this trend and test for robustness, we consider three indicators:

- The Gini inequality index, which measures the inequality of a distribution on a scale of zero (total equality) to one (maximum inequality). This coefficient is calculated using information available from the Monthly Employment Survey carried out by the Brazilian Geographical and Statistical Institute (IBGE).
- The Theil index, which measures economic inequality on a scale of zero (total equality) to one (maximum inequality). This index is calculated based on information from the IBGE Monthly Employment Survey.
- The ratio of the income of the richest 10% of the total population to the income of the poorest 40% (the 10:40 ratio). This index is calculated based on information from the IBGE National Household Survey. This ratio is readily interpretable as expressing the income of the rich as multiples of that of the poor.

[2] The period under analysis ends in 2008 due to the lack of data after that date.

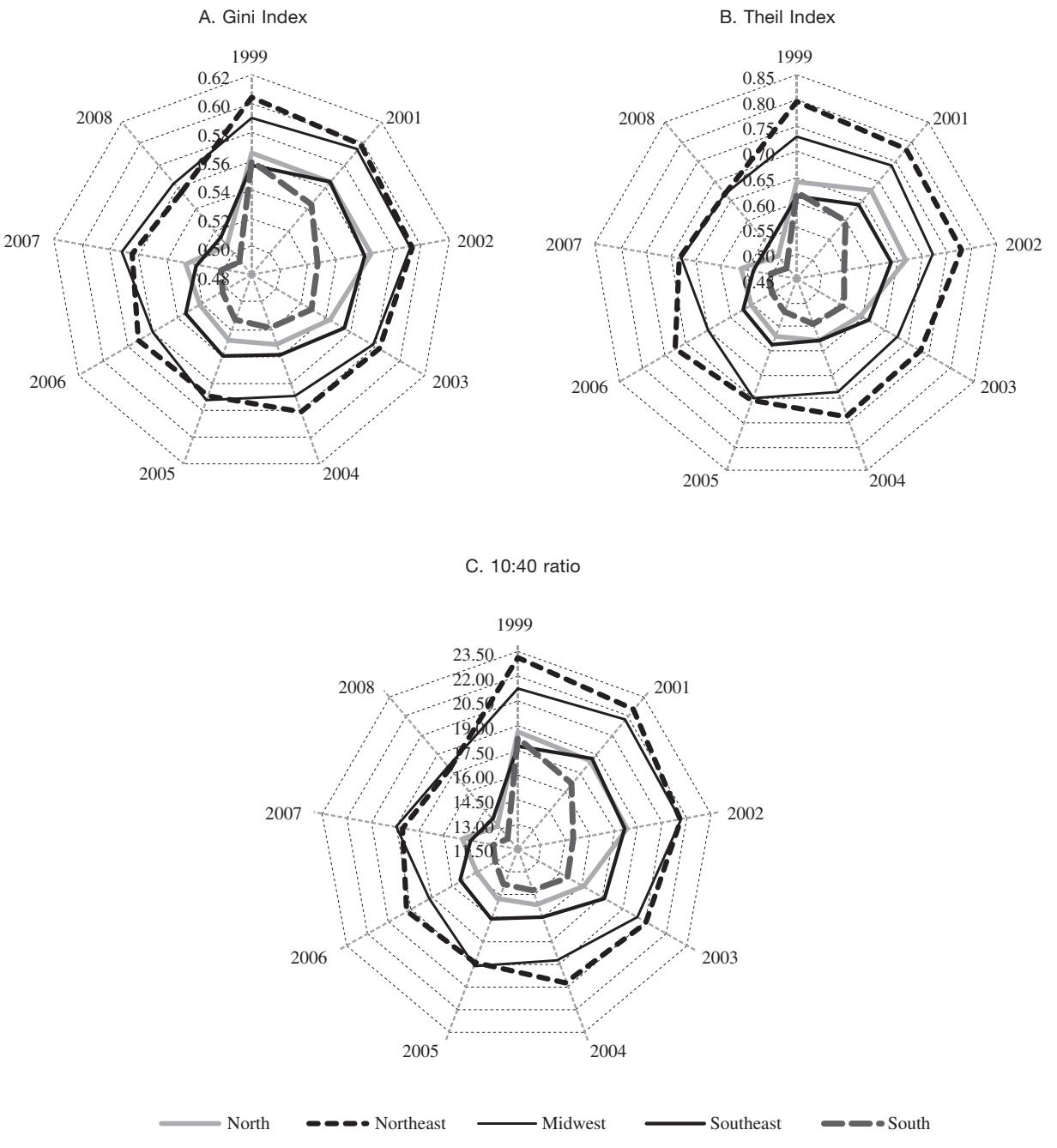
The behaviour of these indicators over time shows that living standards have improved in all regions, with all indicators falling at the end of the period. Figure 1 shows that the northeast region has the worst level of inequality for all indices throughout most of the period (that is, the line corresponding to this region is the farthest from the centre in all three panels of the figure), but the region recorded an improvement at the end of the period, when the midwest region moved into the worst position. The midwest region had the worst performance in reducing inequality over time. Between 1999 and 2008, the Gini index fell by only 4.3%, the Theil index by 8.1%, and the 10:40 ratio by 15.3%. The region with the best performance is the south, which not only recorded the lowest levels of inequality throughout the period, but also saw the steepest decline in inequality (12% decrease in the Gini index, 22.8% in the Theil index, and 32.4% in the 10:40 ratio).

With regard to economic variables, trade openness is often cited as being relevant for analysing income inequality (Rodrik, 1997; Easterly, 2005; Nissanke and Thorbecke, 2006). One reason is that the relation between the distributional framework and trade openness depends partly on the extent that productive factors are used in the production of a country's main products. Differences among countries can be magnified by differences in tax and labour laws, but this effect is negligible in the analysis of the states of the Brazilian federation, since they are all subject to the same legal code. This paper therefore uses the following indicator of trade openness between the states and foreign nations, based on data from the Ministry of Development, Industry and Foreign Trade (MDIC) and the Central Bank of Brazil (CBB): OPEN = (total imports + total exports)/GDP.

As shown in figure 2, the midwest region again had the worst performance over time, but its trade openness improved considerably after 2002, and the region surpassed the northeast in 2008. The southeast region recorded the most stable performance among the regions, consistently holding an intermediate position. The north was the most openness, but the south has approached this level over time.

FIGURE 1

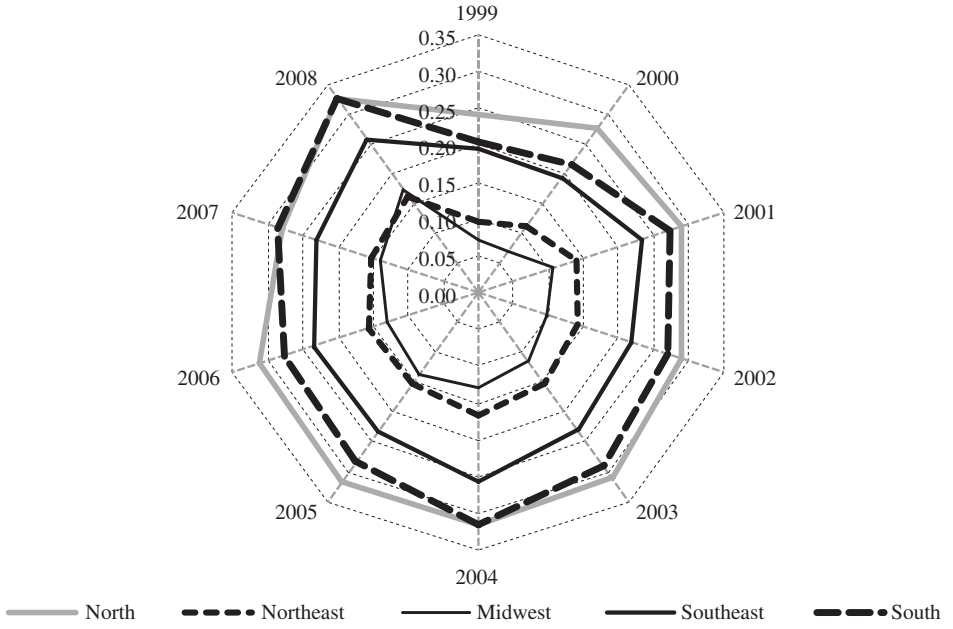
Brazil, five regions: inequality indicators, 1999-2008



Source: Brazilian Geographical and Statistical Institute (IBGE).

FIGURE 2

Brazil, five regions: trade openness (OPEN), 1999-2008



Source: Ministry of Development, Industry and Foreign Trade (MDIC) and Central Bank of Brazil.

Note: OPEN is the sum of imports and exports divided by gross domestic product (GDP).

Another key variable in the analysis of income inequality is technological development (Acemoglu and Newman, 2002; Madsen, 2007; Fang, Huang and Wang, 2008). In this analysis, we us a proxy for technological development, namely, the ratio of patents granted in each state to total patents granted by Brazil in a given year (PAT), based on data from the National Institute of Industrial Property.[3] This proxy makes it possible to observe the average technological growth of the country. However, because the variable is a ratio, it could decrease even if the number of patents increases in a given state, whenever the state's growth rate is lower than the average growth rate for the country as a whole. To facilitate the interpretation of the results, the proxy is normalized to a range from 0 to 1. Figure 3 shows that a large share of technological development is concentrated in the southeast region, whereas the north and midwest regions are negligible. The path of this indicator did not change considerably among the regions during the period.

Another relevant variable for income inequality is financial development (Greenwood and Jovanovic, 1990; Galor and Zeira, 1993; Aghion and Bolton, 1997; Claessens and Perotti, 2005). As observed by Kumar (2005), individuals with access to financial services can safeguard against periods of low income or unexpected fluctuations in income, which improves resource allocation. Furthermore, a developed financial system implies that people living in poverty have access to financial services. In Brazil, an overwhelming majority of clients in the banking system use passbook savings accounts.[4] Therefore, the proxy used here for financial development (FD) is the total balance of savings in a given state in December of each year divided by the state's gross domestic product (GDP) (in real 2000 terms), based on banking statistics provided by the Central Bank of Brazil. Figure 4 shows that this indicator fell in all regions in the early years of the sample. The southeast had the best performance over time, but the south and northeast regions posted a strong recovery toward the end of the period.

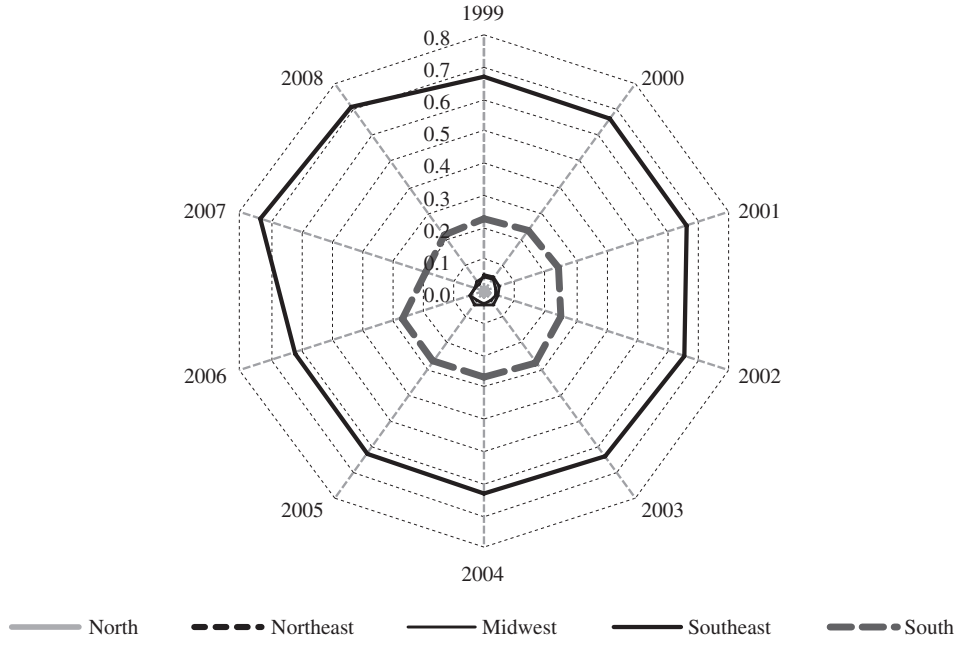
Between 1999 and 2008, the Brazilian government adopted several initiatives that, together with a good macroeconomic environment, generated a significant impact on the inequality level and the labour market. Key measures included successive real increases in the

[3] In 2007 and 2008, we excluded total patents issued from abroad from those attributed to Rio de Janeiro.

[4] According to Kumar (2005), 97% of all clients in Brazil hold their money in the form of passbook savings accounts.

FIGURE 3

Brazil, five regions: technological development (PAT), 1999-2008

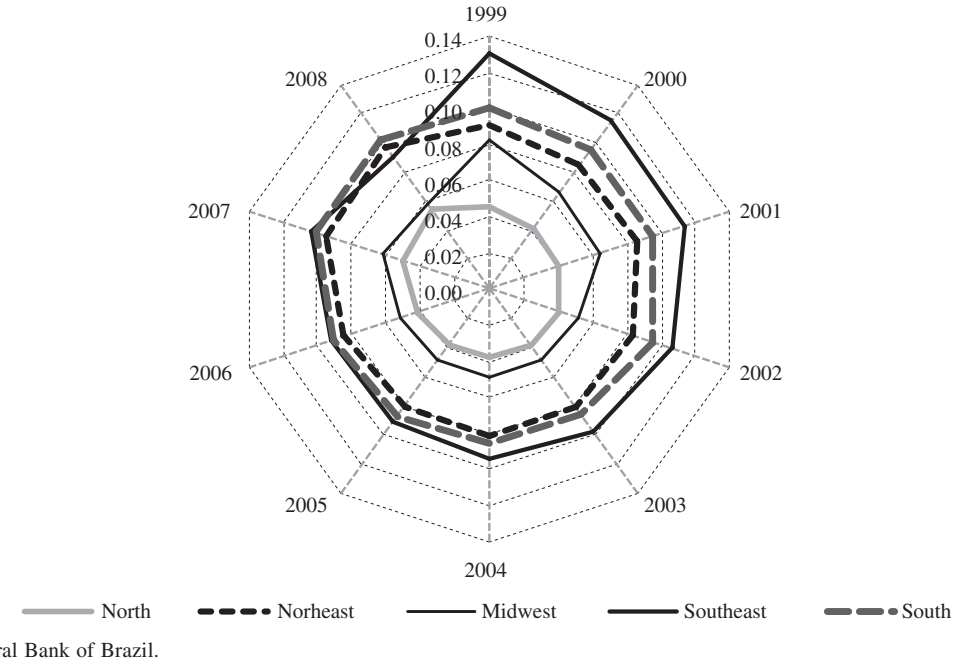


Source: National Institute of Industrial Property.

Note*:* PAT is the ratio of patents granted in each state to total patents granted by Brazil.

FIGURE 4

Brazil, five regions: financial development (FD), 1999-2008



Source: Central Bank of Brazil.

Note*:* FD is total savings divided by gross domestic product (GDP).

minimum wage and the implementation of the *Bolsa Família* conditional cash transfer programme. With regard to the minimum wage, a federal law sets the floor, and each state can then set its minimum wage at or above the floor. Increases in the minimum wage not only affect minimum wage workers, but also pass through to a range around it in both the formal and informal sectors of the economy (without increasing the unemployment rate) (Lemos, 2009). Moreover, the effects of the increase are not limited to wages, but also influence pension benefits and unemployment insurance.[5] A change of this variable thus has a considerable impact on the population's income. To capture these effects, we look at the annual variation of the minimum wage (MW) in each state (in real 2000 terms). Figure 5 shows the path for the variation in the minimum wage floor defined by the federal government and the effective minimum wage in states that adopted a different value. In general, after a state adopts a minimum wage above the national floor, the trend is for the state to follow the behaviour of the national minimum wage.

Unemployment is another critical variable in the analysis of inequality. We therefore include the unemployment rate by state (UNE) in both the formal and informal sectors, using data from the Institute of Applied Economic Research (IPEA). Figure 6 shows that all regions recorded a decline in the unemployment rate in the sample period, but with significant differences. The unemployment rate in the northeast region declined only 3.5% in 10 years, representing the worst performance. In contrast, the unemployment rate declined 38% in the south. The southeast region continued to have the highest unemployment rate in the country, but it ended the period near the levels observed in the northeast and idwest regions (down 27.4%, for the second best performance).

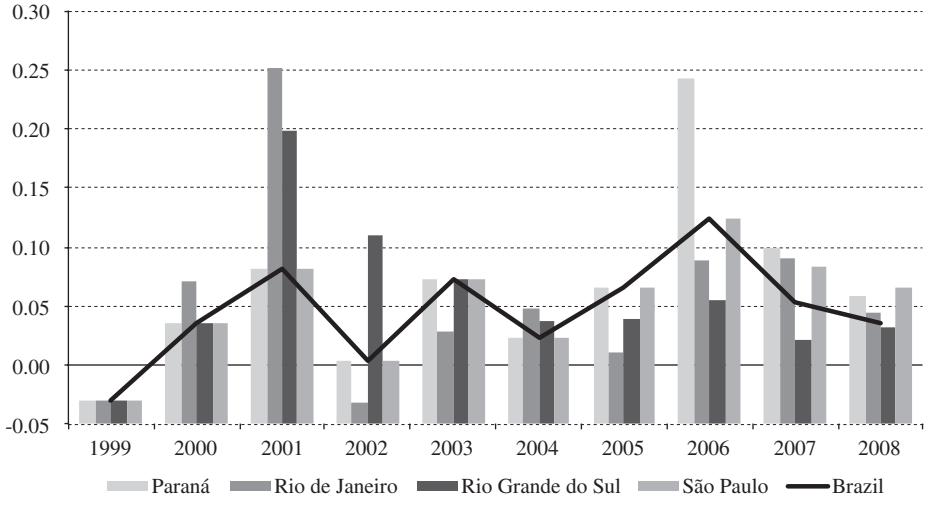
A centrepiece of the Brazilian government's anti-poverty policies in the period under analysis was the *Bolsa Família* conditional cash transfer programme, initiated in 2004. Under the programme, poor families with children receive an average of R$ 70.00 (about US$ 40.00) in direct transfers, on the condition that they commit to keeping their children in school and taking them for regular health checks. Through this social initiative, the Ministry of Social Development and Hunger Alleviation (MSD) reached a major portion of the country's low-income population (more than 46 million people).

The *Bolsa Família* programme reaches only a share of the population that has a per capita income of less than R$ 140.00 per month. Therefore, the ratio of *Bolsa Família* beneficiaries to the total population can be used to capture the real weight of the programme on the total population. In contrast, other possible measures, such

[5] According to Ministry of Labour and Employment, these categories had a direct impact on over 8.4% of the population in 2003.

FIGURE 5

Brazil, four states: annual variation in the minimum wage (MW), 1999-2008

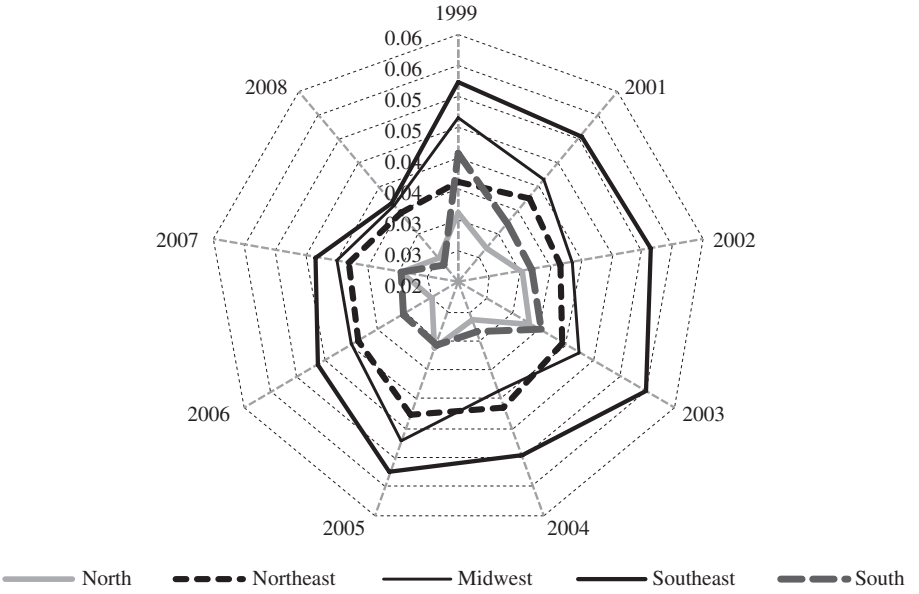


Source: Ministry of Labour and Employment and state laws.

Note: MW is the annual variation of the minimum wage divided by the minimum wage.

FIGURE 6

Brazil, five regions: unemployment rate (UNE), 1999-2008



Source: Institute of Applied Economic Research (IPEA).

Note: UNE is the unemployment rate (formal and informal).

as the ratio of *Bolsa Família* beneficiaries to the poor population, contain some distortions. In regions where there are fewer poor, an increase in the number of *Bolsa Família* recipients will create a huge impact on the ratio of programme beneficiaries to the poor population, while it falls short in capturing the effect on the income distribution of the total population. Hence, to capture the inequality effect, we use the ratio of the number of *Bolsa Família* beneficiaries to the total population of each state (BF), based on data from the Institute of Applied Economic Research (IPEA).

As shown in figure 7, the first three years of the programme indicate growth in all regions. Since the programme targets poor families, it is not surprising that the south had the lowest growth in the period (18%). In contrast, the north recorded an increase of 93.5%, and the northeast had the largest BF.

We included some political variables in this analysis to address the possibility that political factors influence the income distribution. According to Levitt and Poterba (1999) and Rupasingha and Goetz (2007), a democratic system correlates with a lower poverty level. We therefore look at changes in political power in the Brazilian states. In the period from 1999 to 2008, there were three electoral mandates in the states (1999-2002, 2003-2006 and 2007-2010). Our political change indicator (PC) is a dummy variable that takes a value of one (1) if the previous government's party is different from the current government's party and zero (0) otherwise.

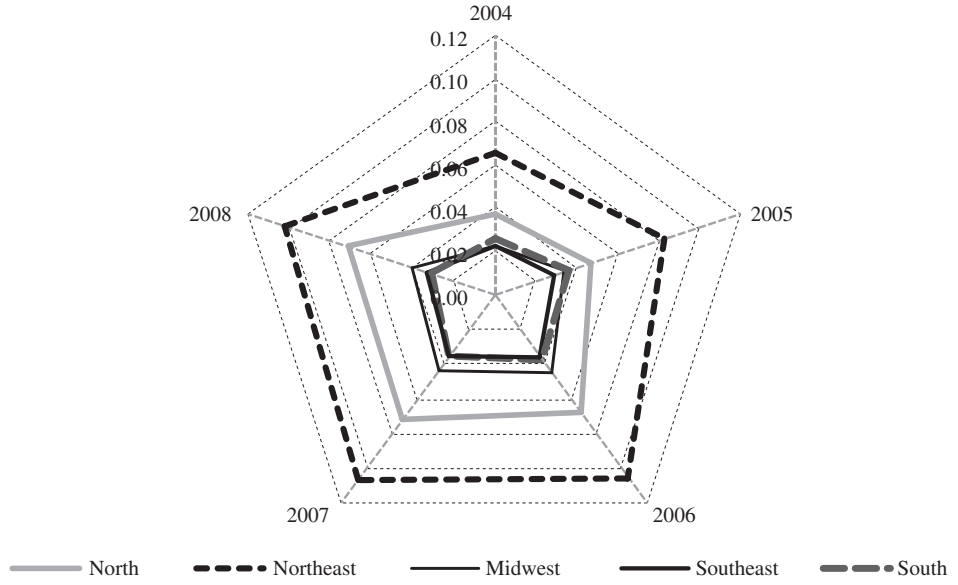
Table 1 shows that it is common for a political party to stay in power for two or more consecutive mandates. Only six states deviated from this phenomenon. In particular, the states in the south underwent two (Paraná and Santa Catarina) and three (Rio Grande do Sul) political changes in the period. Since the south has the best indices of income inequality, this trend could support the argument that democracy reduces inequality. However, it is not possible to confirm this trend for the other regions.

To assess the impact of a state's social spending (that is, welfare and social security), we calculated the ratio between direct transfers to citizens and the state's GDP (SOC), based on data from the Ministry of Finance. With the exception of the northeast region, all regions recorded a decline in social spending in the period (see figure 8). One reason for this trend is the Fiscal Responsibility Act approved by the Brazilian Congress in 2000, which limits states' expenses to 60% of current net revenue for its personnel.

Finally, we look at the effect of corruption on income inequality (Gupta, Davoodi and Alonso-Terme, 2002; Alt and Lassen, 2010). According

FIGURE 7

Brazil, five regions: ratio of *Bolsa Família* beneficiaries to the regional population (BF), 1999-2008



Source: Ministry of Social Development and Hunger Alleviation.

Note: BF is the ratio of the number of *Bolsa Família* beneficiaries to the total population.

TABLE 1

Brazil, five regions: episodes of political change (PC), 1999-2008

No. of changes	States and Federal District
0	São Paulo (SE)
1	Acre (N), Amapá (N), Bahia (NE), Ceará (NE), Maranhão (NE), Pará (N), Paraíba (NE), Piauí (NE), Rio Grande do Norte (NE)
2	Alagoas (NE), Distrito Federal (MW), Goiás (MW), Minas Gerais (SE), Mato Grosso (MW), Pernambuco (NE), Paraná (S), Santa Catarina (S), Sergipe (NE), Tocantins (MW)
3	Amazonas (N), Espírito Santo (SE), Rio de Janeiro (SE), Rondônia (N), Roraima (N), Rio Grande do Sul (S)

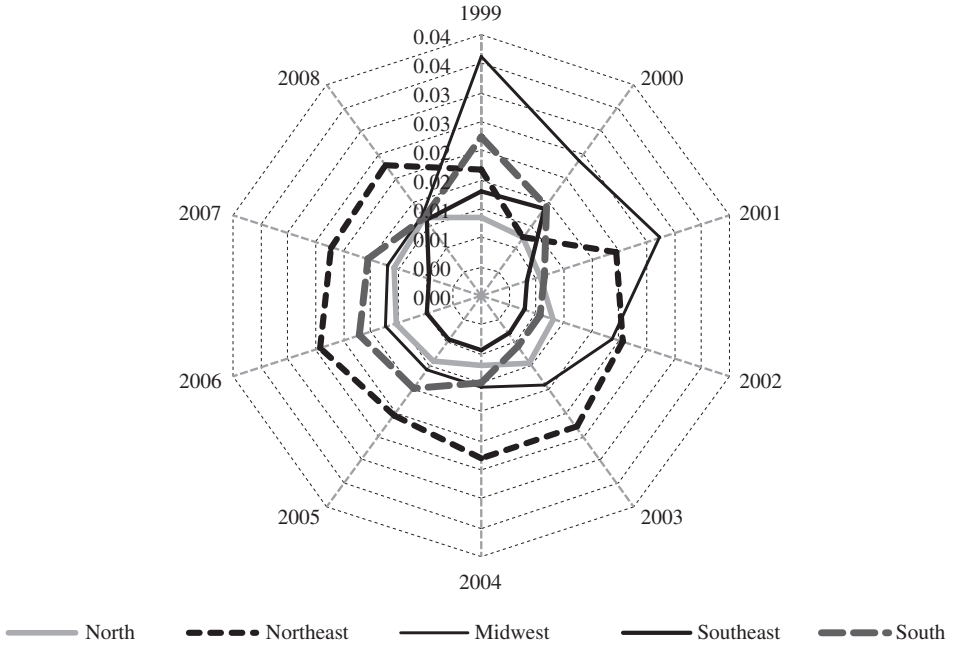
Source: Institute of Applied Economic Research (IPEA).

Note: SE = Southeast; S = South; N = North; NE = Northeast; MW = Midwest.

to the corruption perceptions index published by Transparency International, Brazil's index worsened considerably from 1999 to 2008, falling from 45th to 80th in the least corruption ranking. For this study, we consider the variation of the corruption index (CORR) built by Boll (2009), based on the weighted average of socioeconomic variables (state population and GDP = 0.33) and the number of processes deemed illegal by the Brazilian Court of Audit (0.66) according to the Annual Budget Law. The index ranges from zero (0) (least corrupt) to one (1) (most corrupt). Figure 9 depicts the average corruption by state in the period. The three highest indices were all in the northeast region (Maranhão, Piauí and Bahia), while the two lowest indices were in the south (Rio Grande do Sul and Santa Catarina).

FIGURE 8

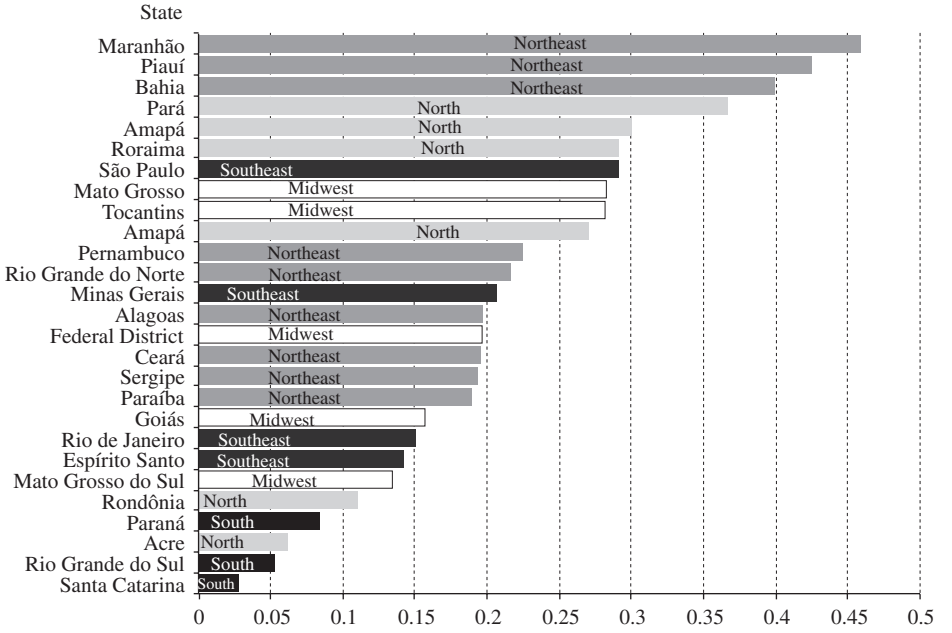
Brazil, five regions: social spending (SOC), 1999-2008



Source: Ministry of Finance.
Note*:* SOC is the ratio between direct transfers to citizens and the state's GDP.

FIGURE 9

Brazil: average state and Federal District corruption (CORR), 1999–2008



Source: J.L.S. Boll, "A corrupção governamental no Brasil: construção de indicadores e análise da sua incidência relativa nos estados brasileiros", Brasilia, 2010 [online] http://www.cgu.gov.br/concursos/Arquivos/5_ConcursoMonografias/MH-profissionais-jose-luis-serafini-boll.pdf.

Note*:* horizontal axis is the average of the corruption index.

III
Empirical evidence

The variables presented in the previous section provide a total of 270 observations (annual frequency) for the 26 Brazilian states plus the Federal district in the period 1999-2008. This section presents empirical evidence using a generalized method of moments (GMM) estimator for panel data analysis (table 2 shows the descriptive statistics). According to Arellano and Bond (1991), one advantage of using the GMM dynamic panel data method is that in addition to eliminating the non-observable effects on the regressions, the estimates are reliable even in the case of omitted variables. In particular, the use of instrumental variables allows a more consistent estimation of parameters, even in the case of endogeneity in explanatory variables and in the presence of measurement errors (Bond, Hoeffler and Temple, 2001).

Traditional econometric models hypothesize that the error term is not correlated with its estimators. In cases where the estimators are correlated with the error term, there is an endogeneity problem, and the regression results are inconsistent. Wooldridge (2001) identifies three hypotheses for the existence of endogenous variables: omitted variables, measurement error and simultaneity problems. The empirical model developed in this study is subject to those problems. For example, trade openness can reduce income inequality, which, in turn, can induce an increase in imports, thereby changing trade openness.

TABLE 2

Descriptive statistics

Variable	Mean	Median	Maximum	Minimum	Std. deviation
Gini index	0.5538	0.5545	0.6545	0.4486	0.0375
Theil index	0.1788	0.1739	0.3266	0.0954	0.0412
10:40 ratio	0.6376	0.6262	1.0369	0.3875	0.1106
OPEN	0.1707	0.1270	0.6051	0.0023	0.1446
PAT	0.0370	0.0043	0.6000	0.0000	0.0940
FD	0.0751	0.0795	0.1419	0.0282	0.0264
MW	0.0493	0.0535	0.2511	-0.1411	0.0543
UNE	0.0419	0.0406	0.0801	0.0180	0.0126
BF	0.0338	0.0237	0.1208	0.0000	0.0375
SOC	0.0196	0.0195	0.0737	0.0017	0.0103
CORR	1.0955	-0.0074	40.5000	-1.0000	4.1627

Source: prepared by the authors.

A general solution to the problem of endogeneity is the use of instrumental variables. GMM models permit the use of instruments that are sequentially exogenous, which avoids the endogeneity problem. Arellano and Bond (1991) proposed the use of a first-differenced GMM estimator for panel data as a way of eliminating non-observable effects. However, Alonso-Borrego and Arellano (1998) and Blundell and Bond (1998) show that the first-differenced GMM estimator is biased for large and small samples and has low accuracy. Furthermore, the use of lags can create weak instruments (Staiger and Stock, 1997). Blundell and Bond (1998) therefore recommend the use of the system GMM panel data estimation method instead of first-differenced GMM. As

proposed by Arellano and Bover (1995) and Blundell and Bond (1998), we combine regressions in levels and first differences (see Bond, Hoeffler and Temple, 2001).

To check the instruments in the models, we performed the Sargan test of overidentifying restrictions, as suggested by Arellano (2003). We also applied White's heteroskedasticity-consistent covariance matrix on the regressions, as well as the test for second-order serial correlation (m2) proposed by Arellano and Bond (1991). We did not perform unit root tests, as one premise of system GMM models is the non-correlation of the first difference of endogenous regressors.

For the purpose of finding empirical evidence of the effect of the variables described in the previous section on inequality indices (the Gini index, the Theil index and the 10:40 ratio), we considered two sets of system GMM models using panel data. The first set —equations (1) to (4)— includes the traditional variables (OPEN, PAT and FD) and socioeconomic variables (MW, UNE and BF). The second set —equations (5) to (7)— also considers OPEN, PAT and FD, but includes variables that are subject to some political interference (PC, SOC and CORR). Hence,

$$X_{i,t} = \beta_0 X_{i,t-1} + \beta_1 OPEN_{i,t} + \beta_2 PAT_{i,t} + \beta_3 FD_{i,t} + \mu_{i,t}^{X,1}; \quad (1)$$

$$X_{i,t} = \beta_4 X_{i,t-1} + \beta_5 OPEN_{i,t} + \beta_6 PAT_{i,t} + \beta_7 FD_{i,t} + \beta_8 MW_{i,t} + \mu_{i,t}^{X,2}; \quad (2)$$

$$X_{i,t} = \beta_9 X_{i,t-1} + \beta_{10} OPEN_{i,t} + \beta_{11} PAT_{i,t} + \beta_{12} FD_{i,t} + \beta_{13} UNE_{i,t} + \mu_{i,t}^{X,3}; \quad (3)$$

$$X_{i,t} = \beta_{14} X_{i,t-1} + \beta_{15} OPEN_{i,t} + \beta_{16} PAT_{i,t} + \beta_{17} FD_{i,t} + \beta_{18} BF_{i,t} + \mu_{i,t}^{X,4}; \quad (4)$$

$$X_{i,t} = \beta_{19} X_{i,t-1} + \beta_{20} OPEN_{i,t} + \beta_{21} PAT_{i,t} + \beta_{22} FD_{i,t} + \beta_{23} PC_{i,t} + \mu_{i,t}^{X,5}; \quad (5)$$

$$X_{i,t} = \beta_{24} X_{i,t-1} + \beta_{25} OPEN_{i,t} + \beta_{26} PAT_{i,t} + \beta_{27} FD_{i,t} + \beta_{28} SOC_{i,t} + \mu_{i,t}^{X,6}; \quad (6)$$

$$X_{i,t} = \beta_{29} X_{i,t-1} + \beta_{30} OPEN_{i,t} + \beta_{31} PAT_{i,t} + \beta_{32} FD_{i,t} + \beta_{33} CORR_{i,t} + \mu_{i,t}^{X,7} \quad (7)$$

where $\mu_{i,t}^{X} \sim N(0, \sigma^2)$, and X is the inequality index (the Gini index, the Theil index or the 10:40 ratio).

Tables 3, 4 and 5 show the estimation results for the models. All regressions accept the null hypothesis in the Sargan tests, so the overidentifying restrictions are valid. Furthermore, serial autocorrelation tests reject the hypothesis of the presence of serial autocorrelation.

We find that independent of the inequality indicator used in the estimations, the coefficient on the variable OPEN is negative and statistically significant in all specifications. This result is consistent with the argument that an increase in openness is an important mechanism for reducing income inequality. The coefficients on PAT and FD are also negative, although they are not always statistically significant; this suggests that technological and financial development contribute to lowering income inequality.

The MW coefficients are negative and statistically significant in the three specifications. This result indicates that the government policy of implementing real increases in the minimum wage could be an appropriate mechanism for combating income inequality. All specifications show that the coefficient on UNE is statistically significant and has a positive sign. This implies that high unemployment is associated with high inequality. The negative and significant effect of the variable leaves no doubt about the relation between the variables.

The set of variables that incorporates the influence of political factors on inequality shows interesting results. The PC coefficients are contrary to the standard argument that a more frequent change in political power reduces inequality. A possible explanation for this result is that successive political changes can disrupt the continuity of social programmes. Another possible explanation is that when a political party successfully reduces income inequality, it has a higher chance of remaining in power. The positive sign of SOC may initially seem contrary to expectations. However, the result is in line with the idea that these resources may not be reaching the poorest families (Feldstein, 1974; Browning and Browning, 1994; Mazza, 2001; Perry and others, 2006). Finally, the CORR coefficients, which are positive and statistically significant in all three models, indicate that an increase in corruption correlates with a worsening in the inequality income.

TABLE 3

The Gini inequality index: system GMM estimator

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$Gini_{i,t-1}$	0.3661[b]	0.2312[c]	0.0311	0.1436	0.3959[b]	0.2413[c]	0.6734[a]
	(0.1542)	(0.1328)	(0.2349)	(0.1679)	(0.1888)	(0.1275)	(0.1583)
	[2.3728]	[1.7409]	[0.1323]	[0.8557]	[-2.0970]	[1.8922]	[4.2536]
$OPEN_{i,t-1}$	-0.3450[a]	-0.3036[a]	-0.2307[c]	-0.2586[b]	-0.2899[a]	-0.2735[a]	-0.2812[b]
	(0.0945)	(0.0970)	(0.1377)	(0.0818)	(0.1055)	(0.0801)	(0.1083)
	[-3.6483]	[-3.1281]	[-1.6747]	[-3.1578]	[-2.7472]	[-3.4104]	[-2.5960]
$PAT_{i,t-1}$	-0.1815[c]	-0.2217[b]	-0.1132	-0.1983[a]	-0.2195	-0.2194[b]	-0.1286
	(0.0998)	(0.1053)	(0.0861)	(0.0704)	(0.1685)	(0.0862)	(0.1211)
	[-1.8189]	[-2.1061]	[-1.3146]	[-2.8172]	[-1.3027]	[-2.5435]	[-1.0614]
$FD_{i,t-1}$	-0.5812[c]	-0.6857[b]	-0.6188[b]	-0.3778[c]	-0.6792[c]	-0.4910[c]	-0.2623
	(0.3196)	(0.3032)	(0.2503)	(0.2276)	(0.3718)	(0.2560)	(0.3304)
	[-1.8184]	[-2.2617]	[-2.4715]	[-1.6603]	[-1.8265]	[-1.9179]	[-0.7940]
$MW_{i,t-1}$		-0.0641[c]					
		(0.0383)					
		[-1.6697]					
$UNE_{i,t-1}$			1.1295[c]				
			(0.6403)				
			[1.7638]				
$BF_{i,t-1}$				-0.2502[a]			
				(0.0899)			
				[-2.7830]			
$PC_{i,t-1}$					0.0197[c]		
					(0.0114)		
					[1.7350]		
$SOC_{i,t-1}$						1.3791[b]	
						(0.5954)	
						[2.3162]	
$CORR_{i,t-1}$							0.0011[a]
							(0.0004)
							[2.8408]
J statistic	15.7519	16.8766	4.3807	17.8650	8.1331	23.1068	14.8607
	p>0.35	p>0.45	p>0.95	p>0.45	p>0.70	p>0.25	p>0.35
m^2	-0.0796	-0.1286	0.0789	-0.1100	-0.0444	-0.1144	-0.0325
p value	0.6703	0.4619	0.7726	0.5058	0.7956	0.4712	0.8362
Instruments	20	22	21	23	16	25	19

Source: prepared by the authors.

Note: standard errors are in parentheses; *t* statistics in brackets.
GMM: generalized method of moments.

[a] Significant at 1%
[b] Significant at 5%.
[c] Significant at 10%.

TABLE 4

The Theil index: system GMM estimator

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$Theil_{i,t-1}$	0.3181[a]	0.2255[c]	0.0226	0.3322[c]	0.1798	0.2365[c]	0.2186
	(0.1193)	(0.1356)	(0.2456)	(0.1735)	(0.1391)	(0.1378)	(0.2327)
	[2.6657]	[1.6626]	[0.0922]	[1.9143]	[1.2932]	[1.7151]	[0.9394]
$OPEN_{i,t-1}$	-0.4547[b]	-0.7298[b]	-0.7865[c]	-0.4683[c]	-1.1196[a]	-0.8191[a]	-0.6154[c]
	(0.2170)	(0.2897)	(0.4439)	(0.2640)	(0.2870)	(0.2673)	(0.3487)
	[-2.0950]	[-2.5188]	[-1.7717]	[-1.7740]	[-3.9001]	[-3.0640]	[-1.7649]
$PAT_{i,t-1}$	-0.3656[c]	-0.3671	-0.1386	-0.2108	-0.4275	-0.5312[c]	-0.2733
	(0.2069)	(0.2517)	(0.3377)	(0.1652)	(0.3680)	(0.3005)	(0.2936)
	[-1.7664]	[-1.4584]	[-0.4104]	[-1.2763]	[-1.1617]	[-1.7678]	[-0.9308]
$FD_{i,t-1}$	-1.4097[b]	-1.5366[b]	-1.4353[c]	-0.4021	-1.9878[a]	-1.4884[c]	-1.5142[c]
	(0.6760)	(0.5957)	(0.7599)	(0.6474)	(0.7372)	(0.7821)	(0.7964)
	[-2.0853]	[-2.5791]	[-1.8885]	[-0.6212]	[-2.6963]	[-1.9029]	[-1.9012]
$MW_{i,t-1}$		-0.1909[c]					
		(0.1065)					
		[-1.7914]					
$UNE_{i,t-1}$			3.4700[c]				
			(1.9531)				
			[1.7766]				
$BF_{i,t-1}$				-0.4888[c]			
				(0.2491)			
				[-1.9624]			
$PC_{i,t-1}$					0.0516[b]		
					(0.0254)		
					[2.0319]		
$SOC_{i,t-1}$						5.8652[c]	
						(3.2236)	
						[1.8194]	
$CORR_{i,t-1}$							0.0027[c]
							(0.0015)
							[1.7249]
J statistic	30.3120	23.3662	14.6388	25.4334	12.1678	14.0110	9.0667
	p>0.14	p>0.35	p>0.45	p>0.14	p>0.80	p>0.80	p>0.75
m^2	-0.1610	-0.1606	0.3007	-0.1500	-0.1108	-0.1755	-0.1149
p value	0.5785	0.6079	0.2603	0.6011	0.6855	0.4884	0.6647
Instruments	27	27	20	24	23	25	18

Source: prepared by the authors.

Note: standard errors are in parentheses; *t* statistics in brackets.
GMM: generalized method of moments.

[a] Significant at 1%.
[b] Significant at 5%.
[c] Significant at 10%.

TABLE 5

The 10:40 ratio: system GMM estimator

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$10{:}40_{i,t-1}$	0.3202 [c]	0.2761	0.0840	0.1089	0.1584	0.3354 [b]	0.4430 [b]
	(0.1651)	(0.1570)	(0.2000)	(0.1408)	(0.1581)	(0.1337)	(0.1869)
	[1.9388]	[1.7577]	[0.4203]	[0.7733]	[1.0015]	[2.5085]	[2.3695]
$OPEN_{i,t-1}$	-0.2878 [a]	-0.3318 [b]	-0.2465 [b]	-0.1607 [b]	-0.3259 [a]	-0.1482 [b]	-0.3721 [a]
	(0.0856)	(0.0881)	(0.1201)	(0.0636)	(0.0932)	(0.0659)	(0.0840)
	[-3.3601]	[-3.7663]	[-2.0519]	[-2.5247]	[-3.4957]	[-2.2482]	[-4.4301]
$PAT_{i,t-1}$	-0.1512 [c]	-0.1893 [b]	-0.1182	-0.1827 [a]	-0.2285 [c]	-0.1670 [c]	-0.1368
	(0.0771)	(0.1081)	(0.1070)	(0.0639)	(0.1332)	(0.0865)	(0.1076)
	[-1.9609]	[-1.7511]	[-1.1051]	[-2.8562]	[-1.7145]	[-1.9301]	[-1.2707]
$FD_{i,t-1}$	-0.3983 [c]	-0.7164 [b]	-0.6747 [b]	-0.1495	-0.6786 [b]	-0.4622 [c]	-0.1130
	(0.2289)	(0.3438)	(0.3047)	(0.1864)	(0.2797)	(0.2485)	(0.2864)
	[-1.7399]	[-2.0838]	[-2.2141]	[-0.8020]	[-2.4257]	[-1.8600]	[-0.3946]
$MW_{i,t-1}$		-0.0684 [c]					
		(0.0365)					
		[-1.8727]					
$UNE_{i,t-1}$			0.9448 [c]				
			(0.5678)				
			[1.6639]				
$BF_{i,t-1}$				-0.2582 [a]			
				(0.0820)			
				[-3.1482]			
$PC_{i,t-1}$					0.0219 [b]		
					(0.0105)		
					[2.0787]		
$SOC_{i,t-1}$						0.0568	
						(0.7209)	
						[0.0788]	
$CORR_{i,t-1}$							0.0012 [a]
							(0.0004)
							[2.9981]
J statistic	21.5093	13.7063	11.1198	26.5805	14.5990	27.1170	8.7405
	p>0.25	p>0.80	p>0.85	p>0.14	p>0.65	p>0.15	p>0.80
m^2	-0.0359	-0.0637	0.1127	-0.0800	-0.0119	-0.0573	0.0274
p value	0.8297	0.7042	0.6239	0.5891	0.9375	0.7123	0.8536
Instruments	23	24	22	25	23	26	19

Source: prepared by the authors.

Note: standard errors are in parentheses; *t* statistics in brackets.
GMM: generalized method of moments.

[a] Significant at 1%.
[b] Significant at 5%.
[c] Significant at 10%.

IV
Conclusion

This study has presented empirical evidence regarding income inequality in the Brazilian economy. The regional analysis showed that there are considerable differences across the country. In general, the south has the lowest income inequality and best indicators. In contrast, the northeast recorded the worst performance over time. However, the introduction of social policies, such as *Bolsa Família*, is associated with an improvement in all regions.

The results of the empirical analysis indicate that there are several factors that can explain the recent fall in inequality in Brazil. An example is trade openness. As highlighted by Rodrik (2007), Easterly (2005) and Nissanke and Thorbecke (2006), in economies that have a labour-intensive export sector, such as Brazil, an increase in the trade openness contributes to an improvement in income inequality. Consequently, expanding trade agreements and enhancing tax harmonization to improve trade openness could provide a mechanism for addressing inequality. The results further indicate that an increase in technological progress implies lower income inequality, in line with Acemoglu's (2002) argument. Greater financial development is also correlated with reductions in inequality (Liang, 2006; Ang, 2010). Hence, recommended policies include increasing partnerships between companies and universities and fostering a legal environment capable of stimulating private sector investment in technology.

The Government of Brazil's strategy of implementing real increases in the minimum wage over time is negatively correlated with inequality. In contrast, unemployment increases inequality, so the adoption of policies for eliminating unemployment is crucial. In addition, the results show that the *Bolsa Família* programme is associated with decreases in income inequality.

The empirical evidence on the effect of political factors on inequality indicates that a change in political power does not contribute to an improvement in the social condition. Similarly, an increase in social spending does not decrease income inequality. One possible explanation is that these resources do not reach the poorest families (Feldstein, 1974; Browning and Browning, 1994; Mazza, 2001; Perry and others, 2006). The use of specific tools against poverty could produce better results. Finally, the Brazilian case confirms the assumption that higher corruption correlates with an increase in inequality (Gupta, Davoodi and Alonso-Terme, 2002).

In short, the empirical evidence in this study allows one to observe that it is possible to improve the fight against inequality through a combination of increased trade openness, technological and financial development, the reduction of the unemployment rate, the adoption of social policies that have a direct effect on the poorest families and the adoption of mechanisms that restrict corruption.

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Deprivation viewed from a multidimensional perspective: The case of Brazil

Ana Flavia Machado, Andre Braz Golgher and Mariangela Furlan Antigo

ABSTRACT

This study uses the capability approach to undertake a multidimensional analysis of deprivation in urban areas of Brazil between 2003 and 2008 based on a four-dimensional index (living conditions, health, level of education and participation in the labour market) constructed out of 13 different indicators. Its findings indicate that a majority of the population is living in households that are not experiencing deprivation and that, of those that are, the instance of deprivation is confined to a single indicator. When the results were then compared with the income-poverty index for the different states in Brazil, the outcome confirmed that regional inequalities show up in both types of measurements. Finally, synthetic cohort data and ordinary least squares (OLS) models were used to study the relationship between personal attributes and a propensity to lapse into poverty and/or to remain poor.

KEYWORDS Urban areas, living conditions, poverty, economic indicators, comparative analysis, regional inequalities, Brazil

JEL CLASSIFICATION I31, I32

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I
Introduction

The introduction of the capability approach placed a range of new welfare-related concepts on the research agenda (Sen, 1999). These concepts, which include functionings, capabilities and agency, have broadened the field of poverty studies and have allowed researchers to overcome the limitations of traditional indicators, which are based primarily on such concepts as assets, consumption, income and utility.

A number of recent studies have undertaken multidimensional analyses of the data for Brazil based on the capability approach. For example, D'Ambrosio and Rodrigues (2008) used a non-monetary system of measurement that draws on various indicators of individual well-being, while Neri (2008) constructed a human development index out of variables relating to health, diet, income, the prevailing economic and political situation, the labour market and other factors. Bagolin and Ávila (2006) and Lopes, Macedo and Machado (2003 and 2004) measured deprivation from a multidimensional standpoint based on fuzzy clustering theory. Silva and Barros (2006) and Rocha, Moreira and Santos (2008) have also built a multidimensional index to measure deprivation in households, regions and specific sectors of the population. Golgher (2010a) analysed Brazilian households' perceived deprivation and found that deprivation profiles differed markedly between urban and rural areas. He also found very little correlation between deprivation and income for most of the dimensions covered in his study (Golgher, 2010b).

While this study will also look at poverty in Brazil from a multidimensional perspective using the capability approach, its objectives and the methodology it uses are different. It is based on a multidimensional deprivation index (MDI) inspired by the methodology proposed by Alkire and Foster (2007) and applied in 104 developing countries, including Brazil, by Alkire and Santos (2010). The MDI has four dimensions (housing conditions, health, education and the labour market) that are captured by 13 non-monetary indicators (see table 2). The measurements using this index indicate that a majority of the population lives in households that are not experiencing deprivation and that, of those that are, the instance of deprivation is confined to a single indicator. Households shown to be lacking in respect of numerous indicators represent only a small proportion of the total.

Income poverty levels will be compared with the MDI measurements taken in 2003 and 2008. Regional data mapping points to a considerable degree of spatial heterogeneity across the states of Brazil. The existence of markedly different geographic profiles shows that, as noted by Baulch and Masset (2003), monetary and non-monetary poverty indicators in developing countries do not tell the same story. These initial results provide a broader picture of poverty in Brazil from both a monetary and a multidimensional perspective.

The common features and relationships among the 13 MDI indicators were taken into account. The indicator for sanitation services or sewerage systems was the most significant one for Brazil from both a one-dimensional and multidimensional standpoint. Some aspects of deprivation can show up in two or more indicators, as in the case of water and sewerage systems, child labour and school non-attendance, and the presence of working adults, unemployed adults and functional illiterates in the home. These results are confirmed by a factor analysis.

This article is divided into seven sections, including this introduction, which seeks to provide the context for this analysis. The second section describes the methodology that was used to construct the multidimensional deprivation index (MDI), the database that was employed and the different dimensions of deprivation that were studied. The results obtained using the MDI are discussed in the four following sections, each of which has a specific focus. The third section provides an overview of the index and of how it compares with monetary poverty measurements, while the others deal with different facets of the MDI. The fourth section discusses the results for the different states in Brazil, which reveal regional differences with very little correlation to one another. The fifth section analyses some of the specific aspects of each dimension of deprivation as well as common features and relationships. The sixth section looks at patterns of deprivation using synthetic cohort data and an ordinary least squares (OLS) model in order to provide an overarching picture of deprivation in urban areas of Brazil from a dynamic, multidimensional vantage point. The final section presents a number of considerations and conclusions.

II

The multidimensional deprivation index (MDI), data and indicators

The capability approach posits that individual differences determine the degree to which each person will be able to transform the resources at his or her command into capabilities and that those capabilities cannot be measured on the basis of available resources but rather on the basis of what people can become and can do with them. As proposed by Sen (2001), the incompleteness of the capability approach is what allows its basic objective to be preserved, since that incompleteness gives researchers the freedom to choose and describe the functionings and capabilities that they feel are relevant.

Starting from this premise, data were drawn from the Brazilian national household survey results for 2003 and 2008 and their special supplements. These datasets are very complete, but they were not created for the purpose of describing people's perceptions of deprivation. We therefore decided to use a methodology similar to the one proposed by Alkire and Foster (2007). A brief discussion of the methodology and the deprivation index used in this analysis follows, along with an outline of the database and the dimensions and indicators used to construct it.

1. Review of the multidimensional deprivation index (MDI)

The deprivation index for Brazil was constructed using the methodology proposed by Alkire and Foster (2007), which was applied to a number of developing countries by Alkire and Santos (2010). The first step was to define the main dimensions of the functionings and capabilities to be studied: housing conditions, health, education and participation in the labour market.[1] These dimensions were then divided into 13 indicators, as shown in table 1.

Housing conditions include access to sanitation services and running water, the disposal of household

[1] Alkire and Santos (2010) defined these dimensions in terms of the Millennium Development Goals and used a secondary database such as the one used in this study.

TABLE 1

MDI dimensions, indicators and their weightings

Housing: ¼
Sanitation services or sewerage systems: 1/28
Running water in the home: 1/28
Main material used in the construction of exterior walls: 1/28
Disposal of household waste: 1/28
Type of fuel used for cooking: 1/28
Overcrowding: 1/28
Assets: 1/28
Health: ¼
Self-evaluation of health status: 1/8
Number of live-born children of either sex who have died: 1/8
Education: ¼
Functional illiteracy: 1/8
School attendance: 1/8
Employment: ¼
Child labour: 1/8
Unemployed adults: 1/8

Source: prepared by the authors.

MDI: multidimensional deprivation index.

waste, the type of fuel used for cooking, the presence of household goods (assets), the material that the walls in the dwelling are made of and an overcrowding indicator. The health indicators used were a self-evaluation of health status and deaths of live-born children. Functional illiteracy and school attendance were the education indicators. Two indicators were used to measure the employment dimension: child labour and unemployed adults in the household. These indicators will be described in greater detail in the following section.

Once the MDI dimensions and indicators had been defined, the next step was to establish the relative importance of each one. Decancq and Lugo (2010) compared eight different approaches to the weighting of multidimensional indices. These approaches can be categorized as being based on data-driven, normative or hybrid weightings. Following along these lines, Alkire and Foster (2007) argue that each dimension should be weighted on the basis of normative criteria (human rights, international conventions, national legislation, political consensus, etc.) and that, within each dimension, the ranking can be based on a data-driven normative approach. Within that normative framework, equal or arbitrary weightings can be assigned (Decancq and Lugo, 2010).

Alkire and Santos (2010) opted for equal weightings of the various dimensions and, within each dimension, used a database that had been created for applications other than the application of the capability approach in a strict sense. Following these authors, we chose to use equal weightings for each dimension (1/4) and equal weightings for the indicators included in each dimension (see table 1).

Estimates for each indicator were prepared at the household level. When the value of an indicator drops below a set threshold, the people living in that household are classified as poor; otherwise, they are classified as non-poor. Thus, households are classified either as non-poor or as being subject to deprivation in terms of at least one of the 13 indicators used in the study.

Alkire and Foster (2007) have sought to calibrate the percentage of poor persons classified as being deprived in terms of each indicator (H) by measuring the extent of deprivation. They defined the standardized distance (A) as the distance between the observed value and an arbitrary limit defined for each indicator. If the observed value is equal to or higher than the deprivation threshold, the standardized differential takes a value of zero (0). This type of standardization provides a means of ordering the indicators and comparing them.

Thus, the MDI as defined by Alkire and Santos (2010) is given by:

$$\text{MDI} = H * A$$

2. Data sources and indicators

The data were drawn from the 2003 and 2008 national household surveys and their special supplements, which include information on living conditions and health. Data on individuals and households were used, and the indicators were estimated at the household level.

The data are for urban areas only, since the indicators for some of the dimensions differ sharply depending on whether they refer to urban or rural areas, which would make it difficult to use a single definition of deprivation for both. For example, a rural dwelling that does not have running water may not be classified as poor, whereas this would not be the case of a dwelling in an urban area. For the purposes of collecting data on household deprivation, pensioners, domestic workers and family members of domestic workers were excluded. The unexpanded sample was composed of 289,766 people in 2003 and 312,872 people in 2008.

As can be seen from table 1, the MDI has four dimensions: housing conditions, health, education and employment. The first three bear a direct relationship to the index proposed by Alkire and Santos (2010) that has been adapted for the data used in this study, while the fourth dimension was included to take account of specific features of the situation in Brazil.

As detailed in table 2, the first dimension (housing conditions) is covered by seven indicators. A value of (0) is assigned to people living in households that are not experiencing deprivation in respect of this indicator, and a value of (1) is assigned to those who do. Access to public utilities for sewerage systems, running water and the disposal of household waste helps to increase a dwelling's value, but the greatest impact of the presence of these utilities is felt in a reduction in morbidity and mortality. Housing conditions are also measured in terms of the presence of a gas or electric stove, access to private goods (mobile telephone, radio, colour television, a one- or two-door refrigerator) and wall coverings/surfaces. These variables were used to measure the extent of residents' ability to meet their basic needs, including the need for information, and the extent to which their dwellings are protected from the elements. The number of people who sleep in rooms that are designated as bedrooms (the overcrowding indicator) is another important variable for

TABLE 2

Description of MDI indicators, by dimension

A. Housing conditions
- A.1 Sanitation services or sewerage systems
  - (1) Septic tank not connected to the sewerage or storm drain systems, rudimentary pit, ditch, direct disposal into a river, lake, sea or other body of water
  - (0) Sewerage or storm drain system, septic tank connected to the sewerage or storm drain system
- A.2 Running water
  - (1) Well, spring or other
  - (0) General distribution network
- A.3 Disposal of household waste
  - (1) Indirect collection, burning, burying on property, disposal in empty lots or public areas, dumping into rivers, lakes, seas or other areas
  - (0) Direct collection
- A.4 Type of fuel used for cooking
  - (1) Firewood, coal, electricity or other fuel
  - (0) Bottled gas or piped-in natural gas
- A.5 Assets
  - (1) None or only one of the following assets in the household: mobile telephone, radio, colour television set, one- or two-door refrigerator
  - (0) At least two such assets
- A.6 Main material used in external housing walls/surfaces
  - (1) Adobe, scrap wood, straw or other
  - (0) Bricks or lumber
- A.7 Overcrowding
  - (1) Three or more people per bedroom
  - (0) One or two persons per bedroom

B. Health
- B.1 Self-evaluation of health status
  - (1) At least one household member says that s/he is in poor or very poor health
  - (0) All household members say that their health status is very good, good or fair
- B.2 Number of live-born children of either sex who have died
  - (1) 1 or more
  - (0) None

C. Education
- C.1 Functional illiteracy
  - (1) 1 or more persons aged 14 or over have no more than 3 years of schooling
  - (0) No one in the household aged 14 or over has only 3 years of schooling or less
- C.2 School attendance
  - (1) 1 or more members of the household between the ages of 6 and 18 do not attend school
  - (0) No one in the household between the ages of 6 and 18 does not attend school

D. Labour market
- D.1 Child labour
  - (1) 1 or more members of the household between the ages of 5 and 17 is working
  - (0) No one in that age group is working
- D.2 Unemployed adults
  - (1) 1 or more members of the household are classified as: aged 18 years or older and unemployed; unemployed, not attending school and not receiving income of any sort; or under 18 years of age and employed
  - (0) No one in any of the above categories

Source: prepared by the authors.

MDI: multidimensional deprivation index.

measuring people's capabilities in terms of their health and self-esteem.

Health was included as a variable because a person's physical and psychological status is a fundamental determinant of their ability to develop capabilities and have freedom to choose different functionings. Two indicators are used for this purpose: a self-evaluation of health status, and the number of deaths of live-born children of either sex. The first indicator synthesizes individuals' perception of their own health. Answers of "very good", "good" and "fair" were grouped together into a single category (healthy), while the responses "very poor" and "poor" were grouped into another (unhealthy). According to Noronha (2005), the literature does not reflect any consensus as to the best approach to use in order to classify self-evaluations of health status,

so this fairly limited definition has been used in this case. The indicator of deaths of live-born children is an indirect measurement of premature death and general health standards.

The presence of functional illiterates in the household and children's and adolescent's rate of school attendance are the indicators used to gauge the educational dimension of the index. In addition to being important in and of itself, education is a vehicle for training as defined in the capability approach in that it facilitates the exercise of agency in a series of functionings, such as being in good health, having a decent job, exercising citizenship, appreciating works of art and cultural events, etc.

The fourth and last dimension is captured by the indicators for child labour and the presence of unemployed adults in the household. Participation in the labour market by persons in the age brackets in which such participation is compatible with the overall course of human development is a decisive factor in averting deprivation and having the ability to engage in many important functionings.

The following four sections will discuss the MDI results. Each focuses on a specific facet of what will, taken together, provide a fuller, multidimensional picture of the situation of deprivation in urban areas of Brazil. The following section will provide an overview of the index.

III

Overall results of the multidimensional deprivation index (MDI)

This section will cover the overall results of the MDI for urban areas of Brazil between 2003 and 2008 in order to provide an overview of recent changes in patterns of deprivation. As noted earlier, households may be classified as not experiencing deprivation of any sort or as exhibiting deprivation in terms of at least one of 13 different indicators. The number of people experiencing deprivation as measured by each of the indicators is shown in table 3.

The first point to be noted is that, although the urban population in Brazil rose from 132 million to 152 million during the period under study, the actual number of people living in poverty, as measured by the multidimensional index, only climbed from 91 million

TABLE 3

Distribution of people experiencing deprivation, by number of indicators

Number of indicators registering deprivation	Number of persons (*thousands*)		Percentage		Percentage of persons experiencing deprivation	
	2003	2008	2003	2008	2003	2008
0	41 104	57 489	31.1	38.0	-	-
1	46 363	51 021	35.0	33.6	50.9	54.2
2	27 330	27 232	20.7	18.0	30.0	28.9
3	11 866	10 992	9.0	7.2	13.0	11.7
4	4 085	3 671	3.1	2.4	4.5	3.9
5	1 173	1 028	0.9	0.7	1.3	1.1
6	244	197	0.2	0.1	0.3	0.2
7	23	21	0.0	0.0	0.0	0.0
8	11	6	0.0	0.0	0.0	0.0
9	0	0	0.0	0.0	0.0	0.0
10 or more	0	0	0.0	0.0	0.0	0.0
Total deprivation	91 096	94 168	68.9	62.1	100.0	100.0
Total population	132 200	151 657	100.0	100.0	-	-

Source: prepared by the authors on the basis of Brazilian Geographical and Statistical Institute (IBGE), 2003 and 2008 national household surveys.

to 94 million. This translates into a reduction, in relative terms, from 68.9% to 62.1% of the urban population. This means that, in the space of just five years, the percentage of the population that is not living in poverty jumped from 31.8% to 37.9%, thanks to the country's recent progress in socioeconomic terms.

As shown in the last two columns of table 3, in the households whose members were experiencing some degree of deprivation in 2003, 50.9% of them were deprived of the asset or service represented by a single indicator, while in 2008 the corresponding figure was 54.2%. The percentage of households experiencing deprivation as measured by six or more indicators was so small as to be statistically insignificant, and the results for deprivation as measured by 10 or more indicators were nil.

There was a relative increase in the proportion of people residing in households which were experiencing deprivation as measured by a single indicator and a decrease in all the other categories. This means that multidimensional poverty declined in Brazil between 2003 and 2008. This shift is attributable to two different trends: the relative number of people in deprived households dropped; and the proportion of deprived households that were experiencing deprivation in respect of a single indicator rose.

Table 4 shows the MDI results as described in the section on methodology (section II), with members of households that are experiencing deprivation as measured by at least one of the 13 indicators being classified as poor. The proportion of the urban population of Brazil experiencing deprivation (H) as measured by at least one indicator amounted to 68.9% in 2003 and 61.7% in 2008. If the cut-off is deprivation as measured by at least two indicators, the figures drop to 33.8% and 28.0%, respectively.

The mean intensity of deprivation (A), calculated as the weighted average of multidimensional deprivation among the poor population for each category of deprivation indicators, is shown in the third and fourth columns. The reader will see that the value increases every time another indicator is added. This is because poor (deprived) people who are experiencing multidimensional deprivation are the ones who experience this condition most intensely. The last two columns show the MDI (the product of H and A) for 2003 and 2008. This measurement indicates that 0.718% and 0.584% of the people residing in households experiencing deprivation as measured by at least one indicator are subject to multidimensional poverty.

TABLE 4

Brazil: multidimensional deprivation index (MDI), 2003 and 2008

Number of indicators registering deprivation (as a minimum)	H (*percentages*)		A		MDI	
	2003	2008	2003	2008	2003	2008
1	68.9	61.7	0.010419	0.009453	0.718	0.584
2	33.8	28.0	0.014732	0.014405	0.499	0.404
3	13.2	10.2	0.019342	0.019978	0.255	0.203
4	4.2	3.1	0.024177	0.025584	0.101	0.079
5	1.1	0.8	0.029085	0.030654	0.032	0.023
6	0.2	0.1	0.034284	0.036870	0.007	0.005
7	0.0	0.0	0.039192	0.045191	0.001	0.001
8	0.0	0.0	0.043282	0.050437	0.000	0.000
9	0.0	0.0	0.052198		0.000	
10 or more	0.0	0.0				

Source: prepared by the authors on the basis of Brazilian Geographical and Statistical Institute (IBGE), 2003 and 2008 national household surveys.

IV

Analysis of the multidimensional index, by indicator

This section will take a more detailed look at the deprivation indicators used to construct the MDI. Since the results for 2003 and 2008 are so similar, only those for 2008 will be reported here.

Table 5 shows the distribution of relative deprivation for each of the 13 indicators, including both persons who experience deprivation as measured by a single indicator (one-dimensional poverty) and those who experience it as measured by more than one indicator (multidimensional poverty). The upper panel of table 5 shows the totals for each indicator (i.e., the number of people for which a value of 1 was recorded for the specified indicator, either as a one-dimensional or as a multidimensional measurement).

TABLE 5

Distribution of the population, by type of deprivation

Type of deprivation	Number of persons experiencing deprivation (*thousands*)	Proportion of urban population in Brazil (*percentages*)
Total population, by type of deprivation		
Sewerage system	47 884	31.6
Deaths of live-born children	24 814	16.4
Disposal of household waste	14 683	9.7
School attendance	12 605	8.3
Child labour	11 484	7.6
Overcrowding	10 200	6.7
Assets	8 389	5.5
Water	8 246	5.4
Functional illiteracy	7 742	5.1
Self-evaluation of health status	5 373	3.5
Unemployed adults	5 256	3.5
Fuel used for cooking	2 096	1.4
Material used to build house walls	944	0.6
Most common combinations of indicators		
Sewerage system	19 249	12.1
Deaths of live-born children	9 008	5.6
Disposal of household waste	5 066	3.2
Sewerage system / Deaths of live-born children	4 286	2.8
School attendance	3 592	2.3
Overcrowding	3 295	2.1
Child labour	3 192	2.0
Assets	2 651	1.7
Sewerage system /Water	2 589	1.7
Sewerage system / Disposal of household waste	2 317	1.5
Sewerage system / School attendance	1 733	1.1
Sewerage system / Child labour	1 662	1.1
Sewerage system / Overcrowding	1 578	1.0
Other single indicators		
Self-evaluation of health status	1 478	0.9
Water	1 171	0.7
Functional illiteracy	1 107	0.7
Unemployed adults	883	0.6
Fuel used for cooking	235	0.1
Material used to build house walls	94	0.1

Source: prepared by the authors on the basis of Brazilian Geographical and Statistical Institute (IBGE), 2008 national household survey.

The most numerically significant indicator of deprivation was the indicator for sanitation services or sewerage systems, with more than 47 million Brazilians (31.6% of the urban population) registering the absence of this amenity. The second-most significant indicator was "deaths of live-born children", with over 24 million Brazilians living in households where such a death had taken place. The third-most significant indicator in terms of the number of instances of deprivation was that of "disposal of household waste" (14 million people), followed by "school attendance", "child labour" and "overcrowding" (over 10 million people each). The totals for the other indicators varied from slightly more than 8 million people (household assets) to less than 1 million people (material used to construct the walls of the house).

The figures refer to the total for each indicator of deprivation. The rest of table 5 gives a more detailed picture. For example, many of the more than 47 million people who do not have a sewerage connection in their home do not experience deprivation as measured by any of the other indicators, whereas some also register other indicators of deprivation. In other words, some households register only one indicator of deprivation while others register two or more (Ferreira and Lugo, 2012). Table 5 shows the most numerically significant combinations of indicators, which were registered by over 1% of Brazilian households. The potential number of combinations is enormous, since people registering a single indicator of deprivation can have any one of 13 profiles (the total number of indicators), while those registering two indicators could have one of 72 profiles (the number of possible combinations of any two of the 13 indicators) those registering three indicators could exhibit any one of 286 profiles, and so on.

The most commonly registered indicator was "sewerage system", with over 19 million Brazilians experiencing deprivation only with respect to this indicator. The next-most common (also one-dimensional) profiles were those corresponding to "deaths of live-born children" and "disposal of household waste", with over 5 million people registering those types of deprivation in each case. The fourth-most common profile was a combination of two indicators: "sewerage system" and "deaths of live-born children", with over 4 million people exhibiting that profile. This is followed by four different one-dimensional profiles: "school attendance", "overcrowding", "child labour" and "household assets", with over 1.5% of the urban population in Brazil exhibiting each of these profiles. They are followed by another five two-dimensional instances of deprivation that do not include the lack of a sewerage system. None of the two-dimensional profiles that does not include the lack of a sewerage system were very common, and the same is true of all of the profiles corresponding to three or more indicators of deprivation.

As shown in the lower portion of table 5, the other six one-dimensional profiles are less significant in numerical terms, with the percentage of the urban population of Brazil displaying these profiles ranging between 0.1% and 0.9%.

As discussed by Ferreira and Lugo (2012), it is best, whenever possible, to analyse multidimensional poverty from the standpoint of the distribution of the different combinations of indicators. Table 6 shows the five most common profiles for each of the 13 indicators. For example, in the case of people who lack sanitation services or a sewerage system in the home, the most common profile was one-dimensional for that indicator. The next-most common one was the two-dimensional profile denoted by the indicators "sewerage system" and "deaths of live-born children", followed by three other two-dimensional profiles: "sewerage system" in combination with "water", with "disposal of household waste" and with "school attendance". These results suggest that improving people's housing conditions by providing hook-ups to a sewerage system may have direct and indirect implications in terms of the levels of deprivation existing in the urban areas of Brazil. In other words, increased access to a sewerage system would have a direct effect in reducing the level of deprivation associated with this indicator, and may also have an indirect effect that would be reflected in a reduction in the levels of deprivation associated with the indicators of deaths of live-born children, water, the collection of household waste and/or school attendance, among others.

Similar analyses can be undertaken for the other indicators. For example, households registering the indicator "deaths of live-born children" were, in most cases, households with one-dimensional profiles. The next-most common were four two-dimensional profiles in which that indicator was combined with the indicators for "sewerage system", "disposal of household waste", "school attendance" and "overcrowding", in that order.

In a majority of cases, the most common profile corresponded to the single indicator in question. The indicators for the type of water supply, the fuel used for cooking and the material used to build house walls are exceptions in that the most common profiles for these indicators are two-dimensional profiles that are combined with the "sewerage system" indicator. There are also some fairly common three-dimensional profiles, such

TABLE 6

Distribution of types of deprivation as measured by at least one indicator

Indicator	Most numerous (in combination with)				
	First	Second	Third	Fourth	Fifth
Sewerage system	-	Deaths of live-born children	Water	Disposal of household waste	School attendance
Deaths of live-born children	-	Sewerage system	Disposal of household waste	School attendance	Overcrowding
Disposal of household waste	-	Sewerage system	Deaths of live-born children	Deaths of live-born children / Overcrowding	Sewerage system / Water
School attendance	-	Sewerage system	Child labour	Deaths of live-born children	Deaths of live-born children / Sewerage system
Overcrowding	-	Sewerage system	Deaths of live-born children	School attendance	Sewerage system / Deaths of live-born children
Child labour	-	Sewerage system	School attendance	School attendance / Sewerage system	Deaths of live-born children
Assets	-	Functional illiteracy	Sewerage system	Functional illiteracy / Unemployed adults	Sewerage system / Functional illiteracy
Self-evaluation of health status	-	Sewerage system	Deaths of live-born children	Sewerage system / Deaths of live-born children	Disposal of household waste
Water	Sewerage system	None	Sewerage system / Deaths of live-born children	Sewerage system / Disposal of household waste	Sewerage system / Child labour
Functional illiteracy	-	Assets	Sewerage system	Deaths of live-born children	Sewerage system / Assets
Unemployed adults	-	Assets/ Functional illiteracy	Assets	Functional illiteracy	Deaths of live-born children
Fuel used for cooking	Sewerage system	-	Sewerage system / Deaths of live-born children	Deaths of live-born children	Sewerage system / Disposal of household waste
Material that walls are made of	Sewerage system	-	Sewerage system / Deaths of live-born children	Sewerage system / Disposal of household waste	Overcrowding

Source: prepared by the authors on the basis of Brazilian Geographical and Statistical Institute (IBGE), 2008 national household survey.

as those that combine "disposal of household waste", "deaths of live-born children" and "overcrowding", or those that combine "school attendance", "deaths of live-born children" and "sewerage system" or "overcrowding", "sewerage system" and "deaths of live-born children", as well as others. This points to the existence of negative inter-indicator synergies associated with multidimensional forms of deprivation.

The absolute levels of deprivation for each indicator, as detailed in the upper portion of table 5, have an influence on these results, however. For many households, the relative lack of a sewerage system coincides with an instance

of deprivation measured by some other indicator, since the former is the most numerically significant result of all. The results that do not display a level of frequency in absolute terms (i.e., indicators that are more likely to appear in combination with others than alone) are shown in table 6. For example, although the number of households that lack running water is not numerically significant, the two-dimensional "sewerage system-running water" indicator is significant. Another case in point is the combination of child labour and school attendance, for which the absolute values are also more significant than the values for either one of those indicators alone. In yet another case, while the absence of assets and the presence of functional illiterates and unemployed adults in the household are not significant as stand-alone indicators, the combination of those three indicators is.

The results shown in table 6 indicate that some indicators of deprivation tend to be more significant when considered in combination with two or three other dimensions than when they are considered individually. In order to gain a better understanding of these relationships, a factor analysis was undertaken (see table 7) in order to check whether a positive correlation actually does exist among these indicators (e.g., to determine if households lacking a sewerage system also tended to lack a hook-up to a water distribution system).

The factor analysis of the profiles highlighted in table 6 confirmed some of the results presented earlier, since it yielded different groups of indicators. For ease of interpretation, the indicators "sewerage system" and "water" were grouped into a single dimension under the heading "urban features" and the indicators "child labour" and "school attendance" were grouped into a dimension under the heading of "children". Three other indicators ("unemployed adults", "functional illiteracy" and "assets") were grouped under the heading of "unskilled, low-income adults". The factor analysis also turned up another grouping of indicators of low socioeconomic status which was not apparent in table 6 because of the small number of observations ("main material used in the construction of the external walls of the dwelling" and "fuel used for cooking").

The indicators "number of deaths of live-born children", "disposal of household waste", "self-evaluation of health status" and "overcrowding" are relatively independent of the others and are not grouped with other indicators. This suggests that policies aimed at reducing multidimensional poverty should be focused on existing inter-indicator synergies. For example, skills training for adults with low levels of schooling would probably have a positive impact on the indicators for "functional illiteracy" and "assets".

TABLE 7

Dimensions grouped on the basis of the factor analysis

1.	Urban features Sanitation services or sewerage systems and running water in the home
2.	Children Child labour and school attendance
3.	Unskilled low-income adults Unemployed adults, functional illiterates and assets in the home
4.	Very low socioeconomic status – similar to rural environment Main material used in the construction of the dwelling's external walls and fuel used for cooking
5.	Number of deaths of live-born children
6	Disposal of household waste
7	Self-evaluation of health status
8	Overcrowding

Source: prepared by the authors.

V

Comparison of monetary and multidimensional indices at the regional level

This section will compare measurements of multidimensional poverty and measurements of poverty based on a monetary metric in the states of Brazil. To this end, definitions will be needed of what constitutes monetary and non-monetary deprivation.

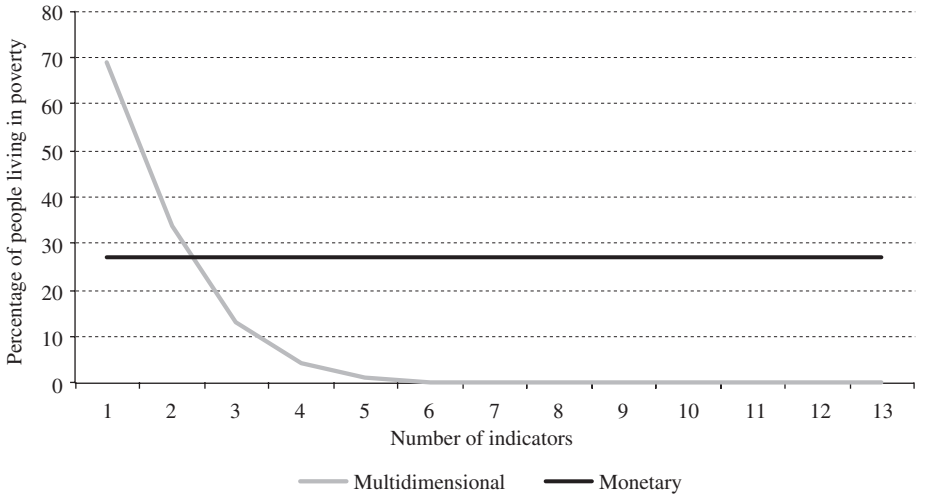
We first define poverty from a monetary standpoint. Household incomes in 2003 —i.e., the sum of the incomes of all members of the household— were divided by the number of people in the household in order to arrive at the per capita household income. This value was then divided by the minimum wage (240 reais) as of September 2003 (the reference date for that year). This yielded a figure for per capita household income expressed in units of the minimum wage for September 2003 for all Brazilian households. Members of households in which that income figure was below 50% of the minimum wage were defined as poor. This threshold figure has been used by the government in the design of its social programmes and policies and is commonly used in studies on poverty in Brazil (see, for example, World Bank, 2006, and, for a detailed analysis of the setting of the poverty line in Brazil, see Rocha, 2003). This same procedure was followed to process the data for 2008, with these values being adjusted by the consumer price index (CPI) of the Brazilian Geographical and Statistical Institute for purposes of comparison with the values for September 2003.

According to the definition used here, 27% and 16.1% of urban dwellers in Brazil were poor in 2003 and 2008, respectively, which represents a considerable reduction in monetary poverty over this time span. For the measurement of multidimensional poverty, a distinction was drawn between households that were not experiencing deprivation and those that were doing so in respect of at least one of the 13 indicators.

Figures 1 and 2 show how monetary poverty compares with the results presented in table 4 for persons experiencing deprivation as measured by at least one indicator in 2003 and 2008. Because the percentage of people defined as poor using the income-based measurement and using the MDI are similar when at least two deprivation indicators are registered, this arbitrary

FIGURE 1

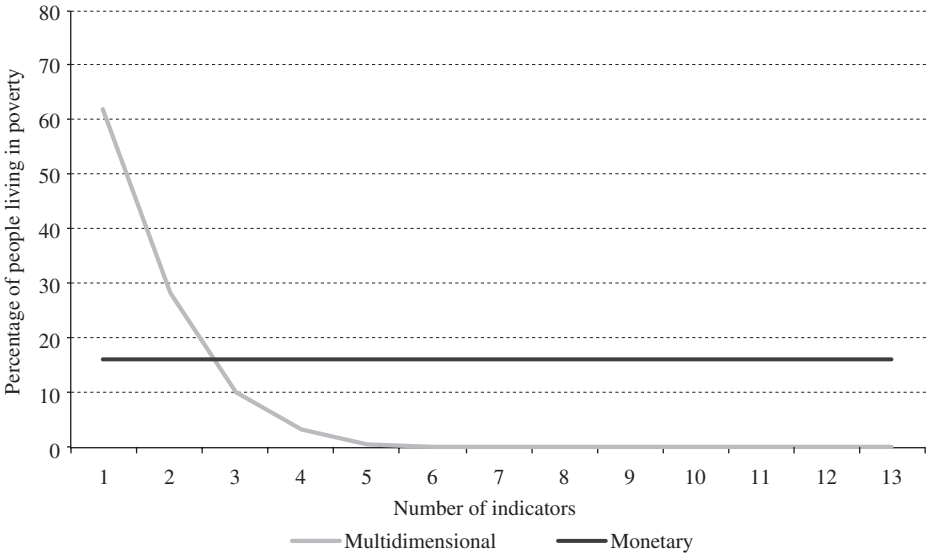
Brazil (urban areas): percentage of people living in poverty as measured by monetary and multidimensional indices, 2003
(Percentages)



Source: prepared by the authors on the basis of Brazilian Geographical and Statistical Institute (IBGE), 2003 national household survey.

FIGURE 2

Brazil (urban areas): percentage of people living in poverty as measured by monetary and multidimensional indices, 2008
(Percentages)



Source: prepared by the authors on the basis of Brazilian Geographical and Statistical Institute (IBGE), 2008 national household survey.

number was used to classify the households. Thus, those that experience deprivation as measured by two or more indicators will be classified as poor using the multidimensional measurement.

The following graphs map the distribution of monetary and non-monetary poverty in the states of Brazil. Maps 1 and 2 show the distribution of income poverty for 2003 and 2008, respectively, while the distribution of multidimensional poverty for those same years is shown in maps 3 and 4.

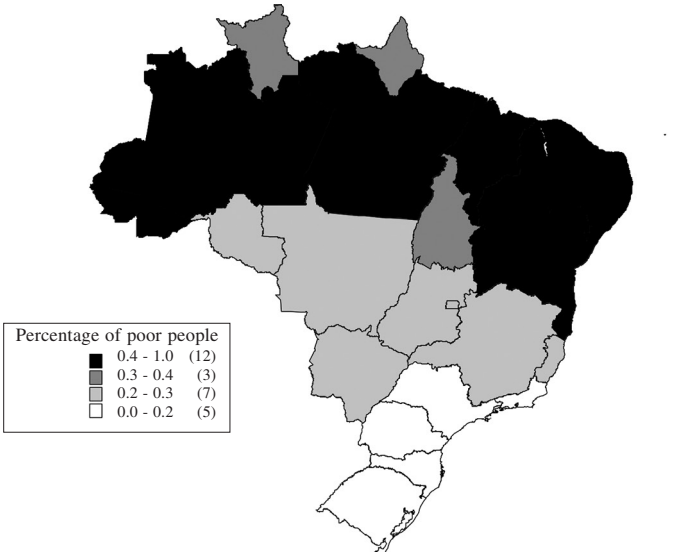
Maps 1 and 2 indicate that the states in which the largest percentages of people were experiencing deprivation in both of the years under study, according to the monetary measurement of poverty, were Alagoas, Ceará, Maranhão, Paraíba, Pernambuco and Piauí, in the north-east, while those in which the smallest percentages of people were experiencing deprivation were in the southern and south-eastern states of Paraná, Rio de Janeiro, Rio Grande do Sul, Santa Catarina and São Paulo. The differing and increasing levels of poverty as one moves from southern Brazil to its northern and north-eastern regions is evident in both years. The maps also point to a reduction in poverty in all the states of the federation over time.

Maps 3 and 4 show the proportion of people who are living in households experiencing deprivation in terms of at least two of the variables measured by the indicators. The highest relative values for non-monetary measures of deprivation (over 70% in 2003 and 50% in 2008) correspond to four states in the north and north-east of the country: Amapá, Pará, Piauí and Rondônia. The values for the Federal District, Minas Gerais and São Paulo, on the other hand, are below 25% and 20% in 2003 and 2008, respectively. The highest figures correspond to the northern, north-eastern and central-western regions of the country. The settlement of these areas, especially the zones along the southern and eastern borders of the Amazon jungle, is quite recent, and the production of agricultural commodities for export in these areas is steadily increasing, but the cities in these zones are still not fully developed. The variables associated with the greatest deprivation have to do with urban services (running water, sewerage systems and systems for the disposal of household waste, etc.). The sharp reduction in multidimensional poverty seen in the majority of the states during the period under study is nonetheless remarkable.

The maps reflect the socioeconomic inequalities existing in Brazil, as well as the sizeable reduction in both monetary poverty and multidimensional deprivation in many states, and the marked changes in the monetary and non-monetary indicators during this period.

MAP 1

Brazil (urban areas): percentage of income poverty, 2003
(Percentages)

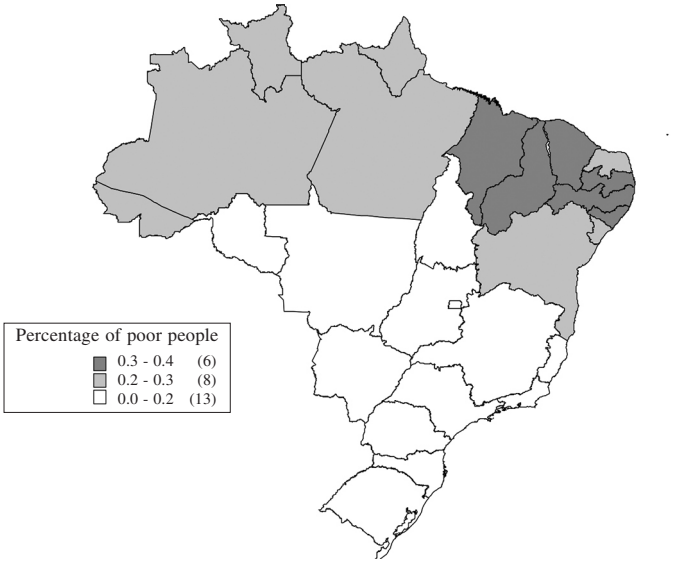


Source: prepared by the authors on the basis of Brazilian Geographical and Statistical Institute (IBGE), 2003 national household survey.

Note: the numbers shown in brackets indicate the number of states exhibiting a given poverty rate.

MAP 2

Brazil (urban areas): percentage of income poverty, 2008
(Percentages)

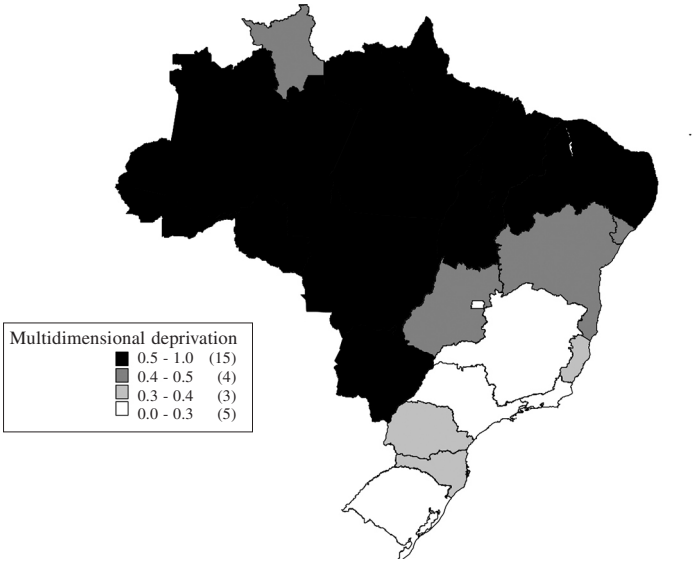


Source: prepared by the authors on the basis of Brazilian Geographical and Statistical Institute (IBGE), 2008 national household survey.

Note: the numbers shown in brackets indicate the number of states exhibiting a given poverty rate.

MAP 3

Brazil (urban areas): percentage of households registering at least two indicators of deprivation, 2003
(Percentages)

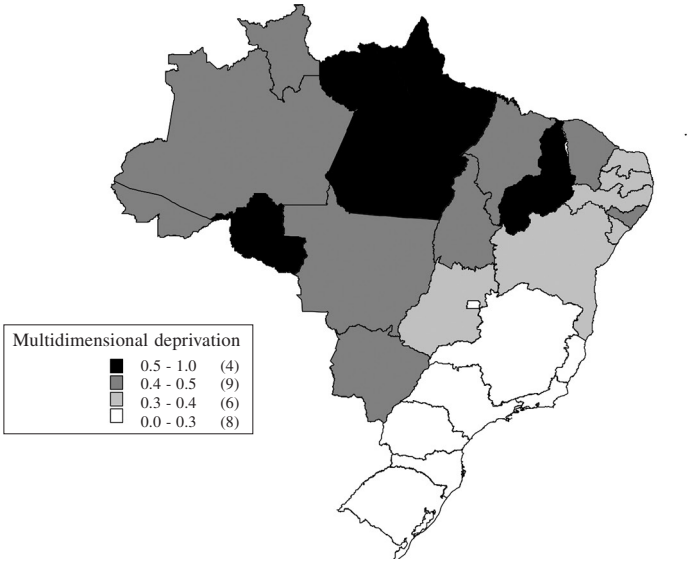


Source: prepared by the authors on the basis of Brazilian Geographical and Statistical Institute (IBGE), 2003 national household survey.

Note: the numbers shown in brackets indicate the number of states falling within a specified range of poverty rates.

MAP 4

Brazil (urban areas): percentage of households registering at least two indicators of deprivation, 2008
(Percentages)



Source: prepared by the authors on the basis of Brazilian Geographical and Statistical Institute (IBGE), 2008 national household survey.

Note: the numbers shown in brackets indicate the number of states falling within a specified range of poverty rates.

Table 8 shows the correlation between these indicators, which, as the reader will see, are all positive and significant at 5%. When the same indicator is compared for two different years, there is a strong correlation (both over 95%), whereas the correlation of the values for the monetary and multidimensional indicators is much lower (around 60%). What is more, the weaker correlation between the multidimensional indicator and the income-based indicator for 2008 points to an increase in the differences between the two types of metrics.

The last sections provide an overall picture of the MDI and present an analysis of some of the specific features of each dimension of deprivation and their common aspects and interrelationships, along with comparisons of these dimensions with monetary poverty. Generally speaking, the results indicate that multidimensional deprivation in Brazil declined between 2003 and 2008, for two reasons: a decrease in the relative number of people living in poor households and, among those living in households that were experiencing deprivation, an increase in the number for which that deprivation corresponded to only one indicator. Monetary poverty also declined during the period under study.

The results of these indicators reflect a shifting pattern. Section VI draws on synthetic cohorts and econometric models in order to paint a more detailed picture of the pattern of deprivation.

TABLE 8

Correlation between income-based poverty and multidimensional deprivation

Indicators	Monetary poverty in 2003	Monetary poverty in 2008	Multidimensional poverty in 2003
Monetary poverty in 2008	0.98	-	-
Multidimensional deprivation in 2003	0.69	0.62	-
Multidimensional deprivation in 2008	0.59	0.52	0.96

Source: prepared by the authors on the basis of Brazilian Geographical and Statistical Institute (IBGE), 2003 and 2008 national household surveys.

VI

Analysis of patterns of deprivation based on synthetic cohorts

This section draws on synthetic cohorts and econometric models inspired by age-period-cohort models (Ben-Schlomo and Kuh, 2002; Reither, Hauser and Yang, 2009; Yang, 2007, 2008a and 2008b; Yang and Lee, 2009) to look at patterns of deprivation. More specifically, an effort is made to answer the following questions: are monetary poverty and multidimensional deprivation distributed differently among the various population groups? Are the same trends seen over time in these groups as measured by these indicators?

Given the absence of longitudinal data, synthetic cohorts defined on the basis of certain characteristics of heads of household were used instead. While the cohorts do not include all the same people, the database is representative of the national population, so the synthetic cohorts are representative of the same population groups in the two periods and can be used to undertake a point analysis of the time trend. In other words, the individual longitudinal data can be equated with the representative homogeneous cohort data.

The synthetic cohorts were classified on the basis of homogeneous groups using four variables: race or colour (white or black), sex (male or female), age group (20-29, 30-39, 40-49, 50-59 and 60-69 years in 2003 and five years older than that in 2008) and years of formal schooling (0, 1-3, 4-7, 8-10, 11 and 12 years or more). These categories (2 x 2 x 5 x 6) yielded 120 synthetic cohorts. In order to ensure that these groups would be as homogeneous and as representative as possible, a minimum threshold of 50 observations was set for each

group in each year. Thus, the parameters were set to take into account the trade-off between homogeneity and representativeness.

The features used to define the synthetic cohorts are such that very similar groups can be selected for the two years in question. A change in the sex of the people concerned is extremely rare, but changes in race or colour are more common, since this variable is defined by the respondents, who may change their mind as to their race or colour. Most of the heads of household were over 20 years of age and their level of formal schooling did not change in terms of the categories defined for this purpose. While international migration may have some effect on the composition of the urban population, the size of this change relative to the population of Brazil is minimal.

We determined whether the heads of household in all of the homogeneous groups belonged to a household classified as poor on the basis of the monetary metric and then classified them according to the number of deprivation indicators that they registered. Table 9 shows which population groups displayed the greatest propensity to monetary or multidimensional poverty. A number of trends stand out clearly: poverty or deprivation as defined by the two metrics tends to be greater among households headed by persons of African descent than among households headed by other persons and to be greater among female-headed households than male headed households. The values for the three indicators for white male heads of household are below average for both years, whereas the values for all other categories were above the average (signalling a greater propensity to monetary and multidimensional poverty). The values of both types of poverty indicators were lower in 2008 than in 2003.

The monetary metric indicates that there were relatively fewer poor households in the older age cohorts for both years. The trend in terms of deprivation as measured by at least one indicator is unclear, since all the cohorts register similar values (around 70%). As far as the levels of deprivation that are measured by at least two indicators, similar values are obtained for the four youngest cohorts in 2003 and for the first three in 2008. The highest values corresponded to the members of the older cohorts, and the differences increased over the time span in question.

Higher levels of schooling are associated with lower levels of poverty or deprivation in both years and in relation to all the variables, but this is especially true in the case of monetary poverty. The values for 2008 are also lower than the values for 2003, which points to a

TABLE 9

Descriptive statistics on the proportion of households subject to monetary poverty and deprivation levels of different age cohorts
(Percentages)

Categories	Monetary poverty		Deprivation as measured by at least one indicator		Deprivation as measured by at least two indicators	
	2003	2008	2003	2008	2003	2008
Total	28.0	16.3	71.0	66.8	36.9	34.4
White	17.8	9.4	67.4	63.3	33.2	31.2
Black	39.2	22.8	74.6	70.3	40.7	37.6
Male	27.0	15.0	69.1	64.0	34.1	31.7
Female	31.2	18.9	72.8	69.6	39.7	37.1
Cohorts (age in 2003)						
20-29	38.4	23.8	71.1	67.5	36.4	32.3
30-39	33.7	19.4	71.1	66.6	35.9	31.7
40-49	26.2	13.6	71.4	64.9	36.2	32.3
50-59	21.4	10.9	69.7	65.9	35.6	34.6
60-69	18.4	6.5	71.7	69.1	40.5	41.1
Level of schooling (years)						
0	54.1	33.4	80.3	76.9	51.5	46.2
1 to 3	42.9	27.9	79.7	79.8	51.6	47.1
4 to 7	31.7	19.3	74.0	70.5	40.2	35.4
8 to 10	22.1	15.0	65.8	64.7	29.4	28.7
11	10.6	7.1	63.0	58.4	24.7	20.9
12 an over	3.2	2.4	63.7	55.0	21.1	15.6

Source: prepared by the authors on the basis of Brazilian Geographical and Statistical Institute (IBGE), 2003 and 2008 national household surveys.

positive trend in the three indicators. The improvement in the indicators for monetary poverty was stronger than it was for the other indicators.

Table 9 provides an overall view of the results, but in order to take a closer look at the effect that the various variables have on levels of deprivation, we turned to econometric models and used three dependent variables: monetary poverty, deprivation as measured by at least one indicator and deprivation as measured by at least two indicators. The independent variables are: a dummy variable for sex (1 for male, 0 for female), a dummy variable for race/colour (1 for white, 0 for black), dummy variables for cohorts (the youngest cohort was used as a point of reference), five dummy variables for levels of schooling (the least-educated group was used as a point of reference) and a dummy variable for the year (1 for 2008, 0 for 2003).

The analysis of the synthetic cohorts was based on four models which were estimated using the ordinary least squares (OLS) method. The first corresponded to the data for 2003 and the second to data for 2008. The third referred to aggregate data (an analysis similar to an analysis of panel data with random effects) and the fourth to the variations between the values for 2003 and 2008.

Table 10 shows the results, which confirm some of the general trends noted in the first three models and the three dependent variables. Monetary poverty and deprivation as measured by the other indicators are more prevalent in households headed by persons of African descent and by women, even when other variables are controlled for.

People of African descent have historically been overrepresented in the low-income and most deprived sectors of the Brazilian population. One —and perhaps the most important— explanatory variable for this is the education gap them and the rest of the population. The policies that have been applied in recent years in Brazil have made primary education almost universal, have opened up access to secondary education and have boosted the number of people attending private schools, while affirmative action policies have had the same kind of effect in the country's universities. Nonetheless, the children of lower-income people still often attend poorer-quality primary schools, and their lower level of education hinders them from achieving meaningful social advancement.

An analysis of these results yielded coefficients that were either not significant or very weakly so. The coefficients for race were positive and statistically significant for both monetary poverty and deprivation as measured by at least two indicators, but were not significant for the model for deprivation as measured by a at least one indicator. This suggests that households headed by persons of African descent exhibit a pattern of monetary poverty that is similar to the pattern displayed by other households but that the level of deprivation was slightly higher for the former, especially in terms of multidimensional forms of deprivation.

In the case of female-headed households, the statistically significant negative coefficients recorded for the first three models come as no surprise. The absence of a spouse in the majority of these households is one of the reasons for their low incomes. Households in which there is a couple, many of which have at least two sources of income, tend to be headed by males. When households headed by single males or females are compared, the differences are much smaller. The last model, which is the framework for an analysis of differences in indicators over time, yielded statistically significant negative coefficients for deprivation as measured by at least one indicator; the results in all other cases were not statistically significant. Even though the results suggest that female-headed households are worse off in respect of this indicator, in this case a slight trend towards the levelling of non-monetary deprivation is observed. The social policies recently implemented in Brazil (e.g., policies that have increased six-year-olds' access to schooling), which have been particularly effective for these types of households, may have exerted a positive effect in this respect.

Regardless of the dependent variable concerned, the same trend in terms of level of education becomes apparent. The lower the level of schooling, the higher the percentage of households experiencing deprivation. While these results were to be expected, the temporal trends differ. As can be seen from the last model, even though a higher level of schooling is associated with a lower rate of monetary poverty, households with higher levels of education had a greater propensity to experience deprivation. This result can be attributed, in part, to the overall increase in levels of education in Brazil, the reduction in income inequality brought about by conditional cash transfer policies (such as those underlying the Brazilian Family Benefit (*Bolsa Familia*) Programme and the Continuing Benefit (*Benefício de Prestação Continuada*) Programme) and changes in the labour market. On the other hand, the widening in these differences in respect of the relative level of deprivation as measured by at least indicator, especially in households headed by persons who have some higher education, suggests that people with more schooling have greater success in avoiding non-monetary forms of deprivation.

TABLE 10

Analysis of values and variations of econometric models estimated using synthetic cohorts

Variables		Value			Difference
		2003	2008	Aggregate data	
		Monetary poverty			
Constant		0.80	0.56	0.74	-0.24
Race		-0.11	-0.07	-0.09	0.04
Sex		-0.05	-0.04	-0.04	**0.01**
Level of schooling	1-3	-0.11	-0.07	-0.09	0.04
(years of formal education)	4-7	-0.24	-0.18	-0.21	0.06
	8-10	-0.34	-0.22	-0.28	0.12
	11	-0.45	-0.29	-0.37	0.16
	12 or more	-0.52	-0.33	-0.43	0.19
Cohort (age en 2003)	30-39	-0.05	-0.09	-0.07	-0.04
	40-49	-0.16	-0.17	-0.16	**-0.02**
	50-59	-0.24	-0.23	-0.23	**0.01**
	60-69	-0.30	-0.28	-0.29	**0.02**
Year (2003)		-	-	-0.12	-
		Deprivation in terms of at least one indicator			
Constant		90.9	89.4	88.1	**-1.5**
Race		-7.4	-6.9	-7.2	**0.5**
Sex		-3.1	-4.8	-3.9	-1.8
Level of schooling	1-3	-4.0	-2.7	-3.4	**1.4**
(years of formal education))	4-7	-11.3	-10.3	-10.8	**1.0**
	8-10	-16.9	-16.8	-16.8	**-0.1**
	11	-18.3	-21.3	-19.8	-3.0
	12 or more	-18.9	-26.0	-22.4	-7.1
Cohort (age in 2003)	30-39	**-0.2**	**-0.8**	**-0.5**	**-0.6**
	40-49	**0.1**	-3.1	-1.5	-3.1
	50-59	-2.1	-2.2	-2.2	**-0.1**
	60-69	-0.1	**0.8**	**0.3**	**0.9**
Year (2003)		-	-	-4.0	-
		Deprivation in terms of at least two indicators			
Constant		65.6	59.5	61.2	-6.1
Race		-7.7	-6.0	-6.9	1.7
Sex		-5.1	-5.1	-5.1	**0.0**
Level of schooling	1-3	-6.1	-6.2	-6.1	**-0.1**
(years of formal education)	4-7	-17.0	-16.2	-16.6	**0.7**
	8-10	-27.0	-26.4	-26.7	**0.6**
	11	-30.8	-30.5	-30.7	**0.3**
	12 or more	-35.9	-35.7	-35.8	**0.2**
Cohort (age en 2003)	30-39	**-0.9**	**-0.1**	**-0.5**	**0.8**
	40-49	**-1.3**	**-0.3**	**-0.8**	**1.0**
	50-59	**-1.8**	2.2	**0.2**	4.0
	60-69	2.5	8.4	5.4	5.9
Year (2003)		-	-	-2.6	-

Source: prepared by the authors on the basis of Brazilian Geographical and Statistical Institute (IBGE), 2003 and 2008 national household surveys.

Note: the coefficients shown in bold are not significant.

The relative results for the various cohorts differ depending on which dependent variable is used. The trends for income poverty are clear-cut: the older the age cohort, the lower the propensity to this type of poverty. This result is reflected in the fact that younger people have less success in entering the labour market, which may be linked to recent trends in school drop-out rates and in drug abuse associated with the crack epidemic.

Many of the coefficients for deprivation as measured by at least one indicator were not significant, and the corresponding profile is therefore slightly different from the profile for income poverty in terms of both values and differences. Although age is a factor in the type of deprivation being experienced, the differences are not very large for people experiencing non-monetary deprivation. When deprivation as measured by at least two indicators was analysed, on the other hand, the values were higher for older cohorts, which suggests that multidimensional deprivation is more common among older adults, and the differences increased over the period under study.

VII

Final remarks and conclusions

Using the capability approach as a theoretical frame of reference, a multidimensional deprivation index (MDI) was developed for Brazil and the individual Brazilian states for 2003 and 2008. The construction of this index, which was inspired by the methodology developed by Alkire and Santos (2010), was based on four dimensions (living conditions, health, level of education and participation in the labour market) and 13 indicators. The MDI was then used to analyse deprivation from various standpoints in an effort to obtain a more complete, multidimensional picture of deprivation in urban areas of Brazil.

The results indicate that a majority of the population segment in question lives in households that are not experiencing non-monetary deprivation or are experiencing deprivation only in terms of one of the indicators. Households registering deprivation as measured by many different indicators made up no more than a small proportion of the sample. The relative number of people living in households experiencing deprivation also declined over the study period and, among those that were already deprived, the proportion that were registering deprivation in terms of a single indicator increased.

The common features and relationships among the indicators were examined by means of a factor analysis. Some aspects of deprivation may show up in two or more indicators, such as: water and sewerage systems, child labour and school non-attendance, and the presence of assets, unemployed adults and functional illiterates in the home. The results thus suggest that policies aimed at reducing multidimensional situations of deprivation should also target the synergies that may exist among the different dimensions.

A comparison of income poverty and multidimensional deprivation in the states of Brazil showed up regional inequalities as reflected in these two metrics. It is noteworthy that both monetary poverty and multidimensional deprivation decreased considerably in the great majority of states. There was very little correlation, however, between the indicators for monetary and non-monetary deprivation.

Finally, patterns of deprivation were examined using synthetic cohorts and OLS models. This approach made it possible to analyse the relationship between attributes such as sex, race, year of birth and level of education of the head of household, on the one hand, and, on the other, a household's propensity to become or remain in a state of deprivation.

Both monetary and non-monetary forms of deprivation are found more often in households headed by persons of African descent, women, persons lacking in vocational skills and young people, even after controlling for the other variables. Trends over time for the various indicators also differed.

The results show that an increase in the level of schooling reduces both monetary and non-monetary deprivation. However, education became a less important factor in terms of the first of these indicators over the study period. This may be attributable, in part, to the overall increase in levels of education and the decrease seen in income inequality in Brazil.

The results regarding cohorts are not neutral for the dependent variable. In the case of monetary poverty, the

trend is clear-cut: the propensity towards deprivation is lower in older cohorts. This may be reflecting a lower rate of successful entry into the labour market for younger generations.

In the case of deprivation as measured by at least one indicator, even though age has an effect on the type of deprivation concerned, no major differences are apparent with respect to people experiencing non-monetary forms of deprivation. Our understanding of this aspect of the situation may benefit from further research in the future. On the other hand, the analysis of deprivation as measured by at least two indicators demonstrates that the values are higher for older cohorts, suggesting that multidimensional deprivation is more prevalent among older adults. These cohorts also tend to be faced with specific types of problems relating to multidimensional deprivation which could also be researched in greater depth.

The evidence compiled in this study indicates that the non-monetary multidimensional metric can capture deprivation-related and welfare-related aspects that are not captured with a monetary-based metric. For example, a household that is classified as poor in monetary terms may not be considered to be poor when viewed from the standpoint of other measurements, such as that of multidimensional deprivation. Deprivation, defined as insufficient well-being, should be assessed on the basis of both monetary and non-monetary variables (Bourguignon and Chakravarty, 2003; Thorbecke, 2005). This study has been conducted in an effort to help to arrive at a fuller, multidimensional picture of deprivation in urban areas of Brazil and to suggest some promising areas for future research.

APPENDIX

As shown in map A.1, Brazil is one of the largest countries in the world, with a territory stretching over more than 8 million square kilometres. Its five macro-regions (the northern, north-eastern, south-eastern, southern and central-western regions) are divided into 26 states plus the Federal District.

MAP A.1

Political map of Brazil, 2008

Source: http://www.Brazil-turismo.com/geografia.htm

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The impacts on family consumption of the *Bolsa Família* subsidy programme

Marcela Nogueira Ferrario

ABSTRACT

The aim of this paper is to evaluate the effects of the *Bolsa Família* family conditional cash transfer programme (PBF) on beneficiary families' spending on food, fruit, meat and fish, poultry and eggs, green vegetables, cereals and oilseed products, flours and pastas, tuber and root vegetables, sugar, bakery products, alcoholic beverages, education, hygiene, health and school utensils. The estimation was based on microdata obtained from the 2008-2009 Brazilian Household Budget Survey; and the propensity-score matching methodology was used to calculate the average effect of the treatment on the families treated. The results were statistically significant in respect of expenditure on: (i) food products; (ii) poultry and eggs; (iii) legumes and green vegetables; (iv) cereals, leguminous and oilseed products; (v) flours, starches and pastas; (vi) tuber and root vegetables; (vii) sugars and sugar-based products; and (viii) school articles. The fact that beneficiary families increased their purchases of priority goods and school utensils suggests an investment in education.

KEYWORDS Poverty mitigation, programmes of action, family, family incomes, family expenditures, food, education, health, statistical data, statistical methodology, Brazil

JEL CLASSIFICATION I30, I31, I38

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I
Introduction

The income-transfer programmes implemented in developing countries have helped to reduce inequality and poverty and to raise the education and health status of beneficiary families. According to Attanasio and others (2005, p. 1), "conditional cash-transfer (CCT) programmes are becoming an extremely popular tool for improving the education and health outcomes of poor children in developing countries."

Rocha (2005) shows that the recent reduction in inequality is largely the result of the income-transfer policies implemented since the mid-1990s. During the presidency of Fernando Henrique Cardoso, the federal government implemented a set of poverty-reduction policies involving direct income transfers, and these were maintained and expanded in 2003 by the government of President Luiz Inácio Lula da Silva. Barros and others (2010) found that income-transfer programmes, such as *Bolsa Família* (PBF), are much more effective in reducing inequality than policies to raise the minimum wage, for example. Hoffmann (2010) demonstrated the effectiveness of the *Bolsa Família* programme and the continuous cash-benefit (BPC) programme in reducing inequality and poverty, and found that the former is even more effective than the latter.

Although Brazil had the ninth largest gross domestic product (GDP) in the world in 2008, it suffers from profound social inequalities and high poverty levels as a result of its bad income distribution. The analysis performed by Barros and others (2010), based on data from the National Household Survey (PNAD), shows that 51 million people were living below the poverty line in 2007; and Hoffmann and Ney (2008) report that while the wealthiest 10% of the population received 44.4% of total income in 2005, the poorest 50% received just 14.7%.

Nonetheless, income inequality and the proportion of the population living in poverty are declining. According to Ipeadata, the Gini coefficient,[1] which measures the degree of inequality in the personal distribution of per-capita household income, declined systematically from 2001 onwards, to reach a level of 0.54 in 2009. In addition, the proportion of the population classified as poor, with a per-capita household income below the poverty line,[2] fell from 0.36 in 2003 to 0.21 in 2009. Barros and others (2010) report that the degree of income inequality decreased by an average of 1.2% per year between 2001 and 2007.

Despite the lower income-inequality and poverty rates recorded in recent years, social inequality in Brazil remains very high. Barros and others (2007, p. 113) state that between 2001 and 2005, the income share received by the poorest 20% of the population grew by 0.5 percentage points (p.p.) per year. At that rate, 25 years would be needed for Brazil's international ranking in term of the average income of the poorest 20% of the population to match its per-capita income position. Accordingly, economic measures are still needed to reduce income inequality and poverty levels, such as public policies for direct income transfer and education policies that improve the quality of teaching at all levels. Direct income-transfer policies, conditional or otherwise, are important tools for enhancing poor families' access to the consumer market and helping them to break free from social exclusion and extreme poverty.

This article is organized as follows: section II outlines the social-protection system in Brazil and the most important income-transfer programmes. Section III describes the methodology used and the databases consulted. Section IV evaluates the effects of the *Bolsa Família* programme on consumer spending; and section V sets out the main conclusions of this study.

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[1] The Gini coefficient, which takes values between 0 and 1, is used to measure income inequality in the country. The closer the index is to 1, the greater the concentration of income.

[2] The poverty line used in data published by the Institute of Applied Economic Research (IPEA) is twice the level of the extreme poverty line, which is an estimation of the cost of a basket of food products containing the minimum calories needed for a person's subsistence, based on recommendations made by the Food and Agriculture Organization of the United Nations (FAO) and the World Health Organization (WHO).

II

Brief review of the Brazilian social protection system and the main income-transfer programmes

The first income-transfer programme initiatives in Brazil date back to 1995 (Soares and Sátyro, 2010); and, in1996, the Child Labour Eradication Programme (PETI) was created, as the first federal government conditional income-transfer programme aimed at removing children and adolescents up to 16 years of age from work.

The second programme of this type was the school subsidy programme *Bolsa Escola* (PBE), introduced by the federal government in 2001. The conditionality in the PBE requires the beneficiary family to keep their 6-15 year-old children in school, maintaining a minimum annual attendance of 85% (Soares and Sátyro, 2010). Also in 2001, the *Vale-Gás* gas voucher programme was created, which involved a transfer of 15 reais to enable poor families to purchase cooking gas. Immediately afterwards, the food subsidy programme *Bolsa Alimentación* (PBA) was introduced, and this was followed by the *Cartão Alimentação* food card programme in 2003.

As a result, the federal government had implemented at least five conditional income-transfer programmes by 2003: PETI, PBE, *Vale-Gás*, PBA and the food card programme, each of them under the responsibility of a ministry or an undersecretariat. The PETI programme was coordinated by the Office of the Under-Secretary for Social Assistance; the PBE by the Ministry of Education; the *Vale-Gás* by the Ministry of Mines and Energy; and the PBA and food card programmes by the Ministry of Health.

The *Bolsa Família* (PBF) programme was created in 2003, with the aim of combating poverty by making direct income transfers to families with per-capita monthly incomes of up to 70 reais. The PBF was formed by merging the following programmes: *Bolsa Escola, Bolsa Alimentação, Cartão Alimentação* and *Auxílio-Gás*. Through income transfers, the PBF increased poor families' access to health, education and social assistance services, while also enhancing their food security.

The fact that the PBF is a conditional income-transfer programme means that the beneficiary families have to make and fulfil commitments in the area of health, education and social assistance.

The amount of money transferred will depend on the size of the family and its per-capita monthly income. Pursuant to Decree No. 6.917, of 30 July 2009, families without children with per-capita monthly incomes of up to 70 reais are entitled to the basic benefit of 68 reais. The variable benefit, of 22 reais, is paid to families that have children and adolescents of up to 15 years of age and per-capita monthly incomes of up to 140 reais. The variable benefit of 33 reais tied to the adolescent, known as the variable youth benefit (BVJ), is given to families with adolescents of 16 or 17 years of age.

As shown in table 1, families with per-capita monthly incomes of up to 70 reais can receive a maximum benefit of 200 reais if, for example, they have three children and adolescents of up to 15 years of age and two 16 or 17 year-old.

Families with per-capita monthly incomes of between 70 and 140 reais do not receive the basic benefit, and the maximum transfer they can receive is 132 reais.

The 2009 Budgetary Guidelines Law provides for an 11,953 million reais appropriation to the PBF, equivalent to 0.38% of GDP. According to data contained in the Unified Cadastre (CadÚnico) available online at the website of the Ministry of Social Development and Hunger Alleviation, the PBF had over 12 million beneficiary families in 2010.

Decree No. 5.209 of 2004, defines the basic objectives of the PBF in relation to its beneficiaries as:

> "I - Promote access to the public services network, particularly health, education and social assistance; II - Combat hunger and promote food and nutritional security; III - Stimulate the sustained emancipation of families living in poverty and extreme poverty; IV - Combat poverty; and V - Promote the intersectorality, complementarity and synergy of the social actions undertaken by public authority.

Through the PBF, the Ministry of Social Development and Hunger Alleviation also seeks to uphold the human right to adequate food, by promoting food and nutritional security, and by contributing to the eradication of extreme poverty and the conquest of citizenship by the most

TABLE 1

Bolsa Família programme: calculation of the benefit transferred to families under Decree No. 6.917, of 30 July 2009

(Reais)

Number of children and adolescents of up to 15 years of age	Number of young people of 16 or 17 years of age	Type of benefit: families with per-capita monthly incomes of up to 70 reais	Transfer amount (*reais*)	Type of benefit: families with per-capita monthly incomes of 70-140 reais	Transfer amount (*reais*)
0	0	Basic	68	Does not receive benefit	0
1	0	Basic + 1 variable	90	1 variable	22
2	0	Basic + 2 variables	112	2 variables	44
3	0	Basic + 3 variables	134	3 variables	66
0	1	Basic + 1 BVJ	101	1 BVJ	33
1	1	Basic + 1 variable + 1 BVJ	123	1 variable + 1 BVJ	55
2	1	Basic + 2 variables + 1 BVJ	145	2 variables + 1 BVJ	77
3	1	Basic + 3 variables + 1 BVJ	167	3 variables + 1 BVJ	99
0	2	Basic + 2 BVJ	134	2 BVJ	66
1	2	Basic + 1 variable + 2 BVJ	156	1 variable + 2 BVJ	88
2	2	Basic + 2 variables + 2 BVJ	178	2 variables + 2 BVJ	110
3	2	Basic + 3 variables + 2 BVJ	200	3 variables + 2 BVJ	132

Source: Ministry of Social Development and Hunger Alleviation.

BVJ: variable youth benefit.

hunger-vulnerable segment of the population" (Ministry of Social Development and Hunger Alleviation, 2010).

According to research undertaken in 2008 by the Brazilian Institute of Social and Economic Analyses (IBASE) on a sample of 5,000 holders of the *Bolsa Família* card living in 229 municipalities in all regions of the country, 87% of PBF money is used to buy food. The beneficiary families spend an average of 200 reais per month in that category, or 56% of total family income.

A brief analysis of the 2008-2009 Brazilian Household Budget Survey shows that poor families still have problems in satisfying their food needs. The data generated by that survey show that the percentage of families declaring insufficient food consumption was 12.3% in rural areas and 8.6% in urban zones; whereas the percentage of families that habitually or potentially had some difficulty in satisfying their food needs was 45.6% and 33.6% in rural and urban areas, respectively.

The data of the 2002-2003 Brazilian Household Budget Survey shows that 27.2% of families had major difficulties in making their income last to the end of the month, but this figure had fallen to 17.9% in 2008-2009.

"A review of the perceptions expressed by different income groups in the 2008-2009 Brazilian Household Budget Survey, showed that 31.1% of families with monthly incomes of up to 830 reais claimed to have major difficulties, whereas just 2.6% of families with monthly household incomes of over 10,375 reais mentioned that level of difficulty. The largest proportion of families who said it was easy to get to the end of the month (72%) was recorded in the income group of over 10,375 reais per month, whereas 88% of families with incomes of up to 830 reais claimed some degree of difficulty" (IBGE, 2010, p. 82).

Against that backdrop, this study will use an evaluation method to determine the effects of income-transfer policies on the beneficiary families' consumption expenditure. The database used comes from the Brazilian Household Budget Survey (POF) conducted by the Brazilian and Geographical and Statistical Institute (IBGE) from 19 May 2008 to 18 May 2009.

The idea of evaluating the effects of income transfers on the consumption of beneficiary families is based on studies such as those of Hoddinott, Skoufias and Washburn (2000); Martínez (2005); Attanasio and

Mensard (2006); Resende and Oliveira (2008), and Duarte, Sampaio and Sampaio (2009).

Hoddinott, Skoufias and Washburn (2000) studied the effects of the Mexican *Progresa* programme on food purchased by poor families, and noted that the beneficiary families increased their food consumption (particularly fruit, green vegetables and products of animal origin), compared to the non-beneficiaries.

Martínez (2005) studied the effects of the Solidarity Bond (*Bonosol*) programme implemented by the Plurinational State of Bolivia on families' consumption, and showed that beneficiary families in rural zones increased their food consumption in proportion to the amount of the transfer.

Attanasio and Mensard (2006) analysed the effects of the Colombian "Families in Action" programme, and demonstrated its effectiveness in increasing food consumption by poor families in both urban and rural areas, and in improving the quality of the consumption of protein- and cereal-rich foodstuffs.

Resende and Oliveira (2008) investigated the effects of the *Bolsa Escola* school subsidy programme on the consumption expenditure of beneficiary families, using the database of the 2002-2003 Brazilian Household Budget Survey. The authors found positive results, which indicate an efficient use of the programme's resources by the families (consumption of food, hygiene products, education and clothing).

Duarte, Sampaio and Sampaio (2009) estimated the effects of the PBF on food expenditure by rural families in the Brazilian states of Paraíba (Cariri), Ceará (Sertão Central), Rio Grande do Norte (Apodi) and Sergipe (Sertão) in 2005. The results show an increase in food consumption among PBF-beneficiary families. Although this is a national income-transfer programme, the authors' analysis was confined to the consumption expenditure of rural families in 32 municipalities in the north-east region. For this reason a nationwide level analysis is needed, covering families from both rural and urban areas.

A study conducted by Brandão, Dalt and Gouvêa (2007) to evaluate the food and nutritional security of PBF beneficiaries found that the beneficiary families spend the resources received from the programme essentially on food and school utensils. The article does not specify the food products purchased by the families, and the control group consists of families that received the benefit for a maximum of three months.

In a masters degree dissertation, Baptistella (2012) analysed the effects of the PBF on expenditure on food consumption using data from the 2008-2009 Brazilian Household Budget Survey, and applying the propensity-score matching methodology. The author noted that the beneficiary families increased their spending on food products such as grains and cereals, poultry and eggs, meat and alcoholic beverages; but the research did not consider expenditure on tobacco, health, education, hygiene and school utensils. Moreover, the study evaluated the effects on per-family expenditure in total rather than in per-capita terms.

The hypothesis that beneficiary families are investing in their children's education has been analysed in studies by Glewwe and Kassouf (2012) and Helfand and Souza (2010).

Glewwe and Kassouf (2012) studied the effects of the PBF on the school performance of students at public schools that had students whose families were recipients of this programme, compared to public schools that did not have beneficiary students. They found that the PBF caused an increase in enrolment rates, a reduction in school dropout rates, an increase in student pass rates from first to fourth grade and from fifth to eighth grade.

Helfand and Souza (2010) analysed the effects of the *Bolsa Escola* programme on school attendance and progression, and also on child labour in rural zones, comparing the situation of beneficiary and non-beneficiary siblings in the same family. Although they found that the programme increased school attendance and progression rates, they did not detect any effects on child labour.

The studies cited above examine the effects of the PBF on school performance and attendance. To make a more detailed evaluation of the programme's effect on education, this analysis used expenses on education and school utensils as proxy variables for family investment in that category.

The present article makes several contributions to the evaluation of the effects of the PBF on family consumption expenditure. Firstly, it considers gross and net per-capita income to control for the income effect caused by the transfer of resources to the families; and, secondly, it evaluates investments in education, health and hygiene, in addition to consumer spending.

III

Methodology and description of the database

1. Empirical strategy

The process of evaluating a public policy involves identifying its effects and verifying whether there is a causal relation with the variable of interest.

To estimate the effects of the PBF on beneficiary families' consumption, two groups were defined: the control group, consisting of non-beneficiary families, and the treatment group representing beneficiary families. In equation (1), Y_i is the variable of interest (consumption of family i); and D_i is a binary variable that indicates whether or not the family participates in the programme, such that $D_i = 1$ in the case of participating families and $D_i = 0$ in the case of non-participants. The variable of interest, Y_{1i}, measures the consumption expenditure of families belonging to the treatment group, and variable Y_{0i} measures the consumption expenditure of families in the control group.

$$Y_i = Y_{0i} + \left(Y_{1i} - Y_{0i}\right)D_i \tag{1}$$

The analysis uses the propensity-score matching method, proposed by Rosenbaum and Rubin (1985). Thus, the selection of the control group was based on the probability $p(X_i)$ of the family being a beneficiary, based on observable characteristics. The propensity score can be defined as the conditional probability that a person receives the treatment, given his or her observable characteristics, according to equation (2):

$$p\left(\boldsymbol{X}\right) \equiv \Pr\left(D = 1 \,|\, \boldsymbol{X}\right) = E\left(D \,|\, \boldsymbol{X}\right) \tag{2}$$

where D indicates exposure to the treatment, X is the co-variables vector, and $p(X)$ is the conditional probability that the person receives the treatment. Rosenbaum and Rubin (1985) show that if exposure to the treatment is random in X, then the estimated values of $p(X)$ will also be random. Nonetheless, considering a sample of units defined by i, if the propensity score $p(X_i)$ is known, then the average effect of the treatment on the treated (ATT)[3] can be described as follows, as in Becker and Ichino (2002):

$$\begin{aligned} \tau &\equiv E\left\{Y_{1i} - Y_{0i} \,|\, D_i = 1\right\} \\ \tau &= E\left[E\left\{Y_{1i} - Y_{0i} \,|\, D_i = 1, p\left(X_i\right)\right\}\right] \\ \tau &= E\left[E\left\{Y_{1i} \,|\, D_i = 1, p\left(\boldsymbol{X}_i\right)\right\} - E\left\{Y_{0i} \,|\, D_i = 0, p\left(X_i\right)\right\} \,\middle|\, D_i = 1\right] \end{aligned} \tag{3}$$

where Y_{1i} and Y_{0i} are the potential results of the treatment and control group, respectively.

The treatment group will thus consist of families that are beneficiaries of one of the income-transfer programmes; and the control group will comprise families with observable characteristics that are similar to those of the treatment group, but which are not beneficiaries. Nonetheless, this methodology has been criticized for its failure to control for unobservable characteristics.

To illustrate the problem of the unobservable conditioning variables, one can allow for the possibility that the woman head of family may or may not be a responsible person,[4] by letting T=1 if she is responsible and T=0 otherwise. It is reasonable to assume that a poor family is more likely to participate in the *Bolsa Família* programme if the woman is responsible. Moreover, a responsible woman will manage the domestic budget more effectively and will use its scarce resources to meet the family's basic needs. The likelihood that the woman will remain with a husband who spends most of the budget on alcoholic beverages should also be lower in the case of a responsible woman. Thus, the fact that the woman is or is not a good "housekeeper" could generate a positive relation between the fact that the family receives the PBF and higher spending on food, and a negative relation with respect to alcoholic beverages and tobacco. As the variable T is unobservable, both the multiple regression and the propensity-score matching methodology will be able to detect those relations, without the changes in the expenditure patterns actually being caused by the fact that the family receives PBF benefits.

After estimating the propensity score using a logit or probit model, the units of the treatment group

[3] The acronym ATT stands for average effect of treatment on the treated.

[4] A behaviourally autonomous or highly responsible woman could be an active, secure, developed person with leadership qualities and self-governance capacity. The expression "responsible woman" represents a set of characteristics pertaining to the woman and other circumstances that are hard to describe clearly and precisely.

need to be matched with those of the control group. According to Becker and Ichino (2002), the following matching methods can be used: nearest-neighbour matching, radius matching, kernel matching, local linear matching and stratification matching. This article uses two methodologies: three nearest neighbours, and kernel matching. As there are no substantial differences with the other matching methodologies, it was decided to present results for these two only.

To check that the matching has been done satisfactorily requires comparing the averages of the control variables of the treatment and control groups, both before and after the procedure. A reduction in the absolute value of the standard deviation after matching is the first sign that the procedure was done well. The standard deviation is the standardized difference between the average values of a given control variable (covariate) in the treatment and control groups.

Nonetheless, Caliendo and Kopeinig (2005) argue that the value of the standard deviation alone does not clearly indicate whether the matching was done adequately. For that reason, the *t* -test must be used to verify whether a statistically significant deviation with respect to each covariable still persists after the matching. The null hypothesis for the *t*-test is that the difference between the averages of the covariables is zero. Accordingly, after performing the matching, one expects the null hypothesis not to be rejected.

2. Description of the database

The aim of the Brazilian Household Budget Survey, conducted by the IBGE, is to investigate family budgets and combine them with data on the families' social conditions. The survey used in the present study was performed from 19 May 2008 to 18 May 2009, in urban and rural areas throughout Brazil. Data were collected on 55,970 households, which, when expansion factors are applied, represent a population of 57,816,604 households. The main variables analysed are: characteristics of the households and persons, monetary and non-monetary expenses and purchases, monetary and non-monetary income, and evaluation of living standards.

Table 2 clarifies the statistics of the data obtained from the 2008-2009 Brazilian Household Budget Survey. The average family size was 3.30 individuals, which is less than the average recorded in 2002-2003; and average per-capita income was 838.60 reais, compared to 696.60 reais in 2002-2003. It can also be seen that all indices of income inequality decreased during the period 2002-2003 to 2008-2009.

Figure 1 shows the income concentration curves for Brazil based on data from the 2008-2009 Household Budget Survey. The dotted line shows the concentration of income obtained from PBF transfers. The per-capita income of the poorest 40% of families is less than 358.08 reais. Based on this information, a sample group was created for the PBF including only families with per-capita income is below 358 reais. That cut-off point can be useful for the matching process, because it removes outliers from the sample, such as families with per-capita incomes in excess of 6,000 reais that receive the PBF benefit. Resende and Oliveira (2008) and Tavares (2010) also use the income cut-off point to obtain more homogeneous control and treatment groups.

Table 3 sets out the descriptive statistics of the variables used in the propensity- score matching procedure. Of the total of 56,091 consumption units in the 2008-2009 Household Budget Survey, 198 observations were excluded for replying "Don't know" with respect to colour; 343 were excluded because they did not specify the level of schooling (Code 88 "Not determined"); 205 cases were eliminated because the families in question were receiving *Bolsa Família* and the BPC simultaneously; and 34,407 families were eliminated with per-capita incomes of 358 reais or more. This reduced the sample to 20,938 observations.

Table 3 shows that 33.6% of families receive PBF transfers. The analysis of data on families that do not participate in the programme shows that 69.6% of their heads of household are male, 35.7% claim to be white or yellow, and 30.8% have four to seven years of schooling. In terms of household infrastructure, 37.5% of homes are connected to the general sewerage network, 84.7% have brick walls, 74.5% obtain water from the general network (see table 3), and 35.9% have a rudimentary septic tank. In terms of geographic location, 48% of the families are in the north-east region.

Table 3 also shows that the gross per-capita income of non-PBF-beneficiary families was 220.99 reais. In terms of family composition, 26.8% of the families have four members; 26% of the families have a child in the 0-4 year age range and 7.7% have two or more; 25.2% of the families with children in the 5-9 year age range have one child in that age bracket, and 7.9% have two or more.

The net per-capita family income of PBF-beneficiary families was 152.58 reais. Of these families, 24.8% of heads of family claimed to be white or yellow, and 69.2% are male; 28.1% of the families have one child in the 0-4-year-old bracket and 9.5% have two or more; while 35.6% of the families with children in the 5-9 year age

TABLE 2

Brazil (urban and rural areas): main characteristics of the distribution of per-capita family income,[a] according to the 2002-2003 and 2008-2009 Household Budget Surveys

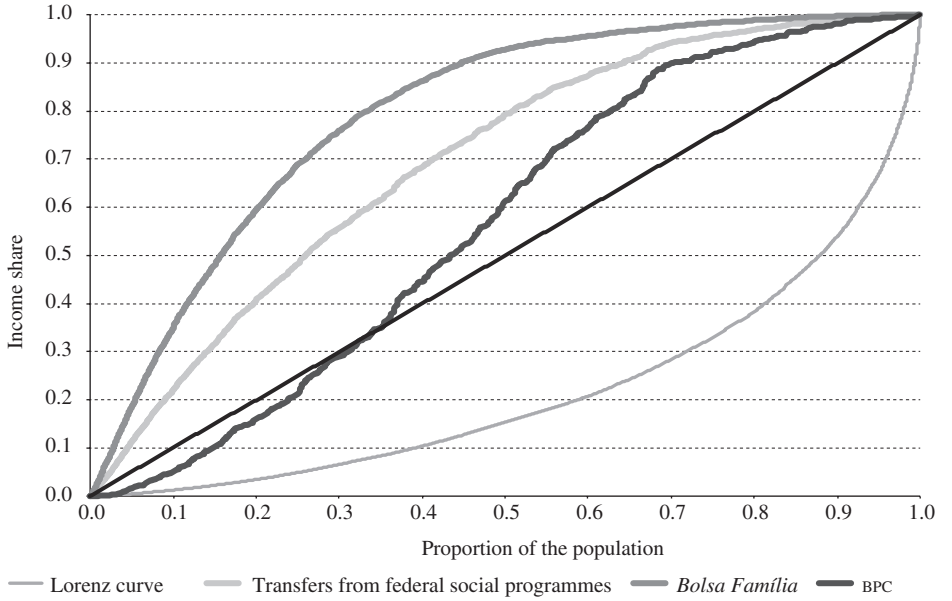
Statistic	2002-2003 Household Budget Survey			2008-2009 Household Budget Survey		
	Brazil	Urban areas	Rural areas	Brazil	Urban areas	Rural areas
Number of families (*thousand*)	48 535	41 133	7 401	57 817	48 809	9 008
Number of persons (*thousand*)	175 846	145 846	30 000	190 519	158 080	32 440
Number of persons per family	3.62	3.55	4.05	3.30	3.24	3.60
Average income (*reais*)	696.6	777.7	302.2	838.6	926.3	411.5
Percentile 25	174.1	204.6	95.2	237.0	273.9	134.4
50	348.9	397.4	177.6	457.3	518.2	247.5
75	724.2	820.4	332.5	903.0	1 007.3	470.0
80	874.9	986.3	388.9	1 072.2	1 184.2	543.6
90	1 513.9	1 679.4	586.4	1 746.6	1 921.0	807.3
95	2 392.9	2 619.3	851.2	2 765.0	3 018.0	1 157.9
99	5 687.5	6 123.1	2 282.7	6 329.1	6 707.3	2 844.6
Income share of the:						
50% poorest	12.9	13.5	16.1	14.5	15.1	16.4
10% wealthiest	47.1	46.0	42.3	44.4	43.5	40.7
5% wealthiest	33.7	32.6	30.7	31.5	30.6	29.0
1% wealthiest	14.0	13.5	14.0	12.8	12.4	12.9
Gini coefficient	0.591	0.579	0.534	0.561	0.550	0.522
Theil-T[b]	0.715	0.680	0.606	0.635	0.608	0.561
Theil-L[c]	0.655	0.624	0.510	0.578	0.549	0.491

Source: R. Hoffmann, "Desigualdade da renda e das despesas per-capita no Brasil, em 2002-2003 e 2008-2009, e avaliação do grau de progressividade ou regressividade de parcelas da renda familiar", *Economia e sociedade*, vol. 19, No. 3, Campinas, Institute of Economics, State University at Campinas, 2010.

[a] Per-capita value of total income and variation in capital, in reais at 2009 prices.
[b] Theil T and L: indices that measure income inequality.
[c] Considering positive income only.

FIGURE 1

Brazil: income concentration based on data from the 2008-2009 household budget survey



Source: prepared by the author on the basis of data from the 2008-2009 Brazilian Household Budget Survey.

Note: Lorenz curve of per-capita family income and concentration curves for several of its components: Continuous Benefit Programme (BPC); *Bolsa Família* programme (PBF) and concentration of income obtained from federal income-transfer programmes. All of the curves are identified as per the legend below the figure.

TABLE 3

Bolsa Família programme (PBF): average and coefficient of variation of the variables used in the propensity-score matching procedure
(Families with per-capita incomes below 358 reais)

Variable	Not a PBF beneficiary		PBF beneficiary		Total	
	Mean	CV[a]	Mean	CV[a]	Mean	CV[a]
Sample size	13 601		7 337		20 938	
PBF = 1 if receives PBF	0		1		0.336	
Income						
Per-capita gross income[b]	220.99	0.366	170.82	0.471	201.67	0.411
Per-capita net income[c]	220.99	0.366	152.58	0.535	194.66	0.441
Location of household						
Zone = 1 if urban	0.775	0.539	0.637	0.755	0.728	0.610
Region						
North	0.097	3.049	0.112	2.819	0.102	2.967
North-east	0.359	1.338	0.609	0.801	0.443	1.122
South	0.124	2.663	0.053	4.241	0.100	3.004
Centre-west	0.084	3.295	0.039	4.983	0.069	3.673
South-east	0.336	1.404	0.188	2.080	0.286	1.578
Household characteristics						
Sex = 1 if male	0.696	0.661	0.692	0.667	0.695	0.663
Colour = 1 if white[d]	0.357	1.342	0.248	1.742	0.320	1.456
Age	44	0.350	42	0.282	43	0.331
Age^2	2 156	0.694	1867	0.588	2 059	0.671
Presence of young children and adolescents						
0-4 years						
None	0.663	0.713	0.623	0.777	0.650	0.734
Has 1	0.260	1.686	0.281	1.600	0.267	1.656
Has 2 or more	0.077	3.473	0.095	3.078	0.083	3.325
5-9 years						
None	0.669	0.703	0.466	1.070	0.601	0.815
Has 1	0.252	1.724	0.356	1.346	0.287	1.577
Has 2 or more	0.079	3.409	0.178	2.149	0.112	2.810
10-15 years						
None	0.645	0.742	0.404	1.214	0.564	0.879
Has 1	0.243	1.766	0.321	1.454	0.269	1.648
Has 2 or more	0.112	2.811	0.275	1.625	0.167	2.234
16-17 years						
None	0.852	0.416	0.780	0.531	0.828	0.455
Has 1	0.138	2.498	0.199	2.004	0.159	2.302
Has 2 or more	0.009	10.254	0.020	6.937	0.013	8.681
Presence of adults and older adults						
18-30 years						
None	0.396	1.234	0.428	1.157	0.407	1.207
Has 1	0.327	1.436	0.335	1.408	0.330	1.426
Has 2 or more	0.277	1.616	0.237	1.795	0.263	1.672
31-64 years						
None	0.222	1.870	0.142	2.455	0.196	2.028
Has 1	0.337	1.403	0.336	1.404	0.337	1.403
Has 2 or more	0.441	1.127	0.521	0.959	0.468	1.067
65 years or more						
None	0.854	0.413	0.939	0.255	0.883	0.364
Has 1	0.112	2.812	0.055	4.132	0.093	3.120
Has 2 or more	0.033	5.381	0.006	13.111	0.024	6.363
Education						

Table 3 (*conclusion*)

Variable	Not a PBF beneficiary		PBF beneficiary		Total	
	Mean	CV[a]	Mean	CV[a]	Mean	CV[a]
Less than 1 year	0.165	2.254	0.216	1.908	0.182	2.122
1-3 years	0.197	2.017	0.276	1.622	0.224	1.863
4-7 years	0.308	1.497	0.332	1.420	0.316	1.471
8-10 years	0.144	2.441	0.094	3.108	0.127	2.622
11-14 years	0.175	2.168	0.082	3.342	0.144	2.437
15 years or more	0.010	9.719	0.001	27.040	0.007	11.571
Family size						
Single person	0.037	5.116	0.006	12.605	0.027	6.056
2 members	0.149	2.392	0.049	4.391	0.115	2.769
3 members	0.257	1.699	0.171	2.200	0.228	1.838
4 members	0.268	1.653	0.275	1.623	0.270	1.643
5 members	0.152	2.366	0.223	1.869	0.175	2.168
6 members	0.078	3.433	0.127	2.621	0.095	3.093
7 members	0.030	5.649	0.069	3.670	0.043	4.695
8 members or more	0.029	5.783	0.079	3.411	0.046	4.560
Bathroom or toilet						
Bathroom or toilet = 1 if it has bathroom or toilet	0.936	0.262	0.867	0.392	0.913	0.310
Infrastructure-walls of the home						
Brick	0.847	0.425	0.824	0.462	0.839	0.438
Building wood	0.105	2.912	0.089	3.205	0.100	3.003
Bare adobe	0.029	5.835	0.060	3.959	0.039	4.957
Recycled wood	0.014	8.327	0.017	7.605	0.015	8.062
Straw	0.001	32.280	0.002	23.398	0.001	28.273
Other	0.004	15.742	0.009	10.708	0.006	13.356
Infrastructure-sewerage						
Sewerage	0.375	1.292	0.226	1.850	0.325	1.442
Septic tank	0.185	2.101	0.161	2.286	0.177	2.160
Rudimentary pit	0.305	1.510	0.386	1.262	0.332	1.418
Sewerage pipe directly into a ditch	0.029	5.807	0.046	4.575	0.034	5.294
Sewerage pipe direct to the river	0.037	5.122	0.037	5.115	0.037	5.120
Other type of sewerage pipe	0.006	12.590	0.012	9.201	0.008	11.07
No sewerage pipe	0.064	3.820	0.133	2.549	0.087	3.231
Infrastructure-water supply						
Water from the general network	0.745	0.585	0.655	0.725	0.715	0.632
Water from a well or spring	0.209	1.944	0.260	1.685	0.226	1.848
Other type	0.046	4.563	0.084	3.298	0.059	4.004

Source: prepared by the author on the basis of data from the 2008-2009 Brazilian Household Budget Survey.

[a] Coefficient of variation.
[b] Gross per-capita income includes all income including transfers from the PBF.
[c] Net per-capita income includes all income other than transfers from the PBF.
[d] Colour: white (white and yellow); non-white (negro, mulatto and indigenous races).

group have one child in that age range and 17.8% have two or more. In terms of the average schooling of the heads of beneficiary households, 21.6% have completed less than one year of studies, 27.6% have completed between one and three years, and 33.2% have completed between four and seven years of schooling.

IV

Evaluation of effects of the *Bolsa Família* programme on consumption expenditure

1. Selected statistics from the *Bolsa Família* programme

The number of PBF-beneficiary families has grown over time. According to data from the Ministry of Social Development and Poverty Alleviation, the number of families assisted rose from over 6 million in 2004 to over 13 million in 2011. The same ministry also reports the largest number of beneficiary families in the north-east region (50.51% in 2010) and the second largest number in the south-east region (24.93% in 2010).

Table 4 shows that the heads of PBF-beneficiary families have an average of 3.93 years of schooling, compared to 5.31 years among the heads of non-beneficiary families. The heads of beneficiary families in the north-east region have completed an average of 3.49 years of study (see table 4), the lowest of all regions.

The average per-capita income of PBF-beneficiary families is 22.70% less than that of families that are not affiliated to the programme. In the case of beneficiary families from the north-east region, the difference widens to 24.62%. The average size of families assisted by the PBF is 4.84 members, with the highest average (5.49 persons per family) being recorded in the north region. In summary, according to the data shown in table 4, PBF-beneficiary families are poorer, larger, and have lower levels of schooling.

Table 5 shows that PBF-beneficiary families spend 13.71% less per-capita on food than non-beneficiary families. Similarly, per-capita expenditure on education by families assisted by the programme is 36.67% less than that of families that do not participate. Nonetheless, per-capita family expenditure on alcohol and tobacco consumption among beneficiary families is 38.35% less than that of non-beneficiary families.

The results presented in table 5 show that, even the in the sample restricted to families with per-capita incomes below 358 reais, there are very significant differences between PBF beneficiaries and non-beneficiaries. Consequently, a much better control procedure needs to be applied, or else a suitable matching technique for the differences in consumption to be considered as effects of the PBF.

2. Results

Table 6 sets out the results of the logit model. The first column reports a model that controls for gross per-capita income and the second column reports the results controlling for net per-capita income. In relation to the per-capita income of the family without the PBF transfer, the greater the income, the less the likelihood of participation in the PBF. That probability also decreases when the household is headed by a white man. In terms

TABLE 4

Brazil and regions: average head-of-household characteristics, per-capita family income (in reais) and family size
(Families with per-capita income below 358 reais)

	Years of schooling		Per-capita income		Age		Family size	
	Does not receive	Receives	Does not receive	Receives	Does not receive	Receives	Does not receive	Receives
North	5.20	4.39	198.87	170.96	42.18	41.28	4.27	5.49
North east	4.58	3.49	207.95	156.76	45.47	42.27	3.75	4.70
Centre-west	5.82	4.47	223.75	191.58	41.95	39.65	3.84	4.72
South-east	5.78	4.87	235.52	202.44	43.25	39.82	3.86	4.67
South	5.86	4.32	234.59	200.73	43.18	41.94	3.75	4.77
Brazil	5.31	3.93	221.00	170.82	43.82	41.58	3.87	4.84

Source: prepared by the author on the basis of data from the 2008-2009 Brazilian Household Budget Survey.

TABLE 5

Average monthly consumption expenditure of *Bolsa Família* (PBF) beneficiary and non-beneficiary families

(Families with per-capita income of less than 358 reais)

Expenditure category	Total family expenditure			Per-capita family expenditure		
	Does not receive	Receives	Total	Does not receive	Receives	Total
Food[a]	266.00	289.32	273.83	68.58	60.31	65.39
Fruit	7.64	7.29	7.52	1.97	1.52	1.80
Meat, offal and fish	49.88	54.57	51.46	12.86	11.38	12.29
Poultry and eggs	18.69	24.29	20.57	4.82	5.06	4.91
Milk and other dairy products	22.66	20.55	21.95	5.84	4.28	5.24
Legumes and green vegetables	6.73	7.16	6.87	1.74	1.49	1.64
Cereals, leguminous and oilseed products	24.65	34.27	27.88	6.36	7.14	6.66
Flours, starches and pastas	12.44	18.00	14.31	3.21	3.75	3.42
Tubers and root vegetables	3.29	3.25	3.27	0.85	0.68	0.78
Sugars and derivative products	9.12	10.82	9.70	2.35	2.26	2.32
Bakery products	24.59	25.33	24.84	6.34	5.28	5.93
Alcohol and tobacco[b]	18.80	14.34	17.30	4.85	2.99	4.13
Education[c]	14.72	11.52	13.64	3.79	2.40	3.26
Health	56.45	45.16	52.65	14.55	9.41	12.57
Hygiene	31.12	29.86	30.69	8.02	6.22	7.33
Schoolbooks and utensils	5.54	7.50	6.20	1.43	1.56	1.48

Source: prepared by the author on the basis of data from the 2008-2009 Brazilian Household Budget Survey.

[a] The "food" category consists of the sum of expenditures on: cereals, leguminous and oilseed products, flowers, starches and pastas; tubers and root vegetables, sugars and derivative; legumes and green vegetables; fruit; meat, offal and fish; poultry and eggs; milk and other dairy products; bakery products; oils and fats; beverages and infusions (except alcoholic beverages); canned and conserved products; prepared foods; food consumed outside the home (except near, barrel beer, and other alcoholic beverages).

[b] The "alcohol and tobacco" category consists of the sum of expenditures on: beer, barrel beer and other alcoholic beverages (consumed in the home); beer, barrel beer and other alcoholic beverages (consumed outside the home) and tobacco.

[c] The "education" category consists of regular courses, higher-education courses, other courses and activities, didactic books and technical magazines, school utensils and others.

of family size, all coefficients were positive: four-member families are most likely to be participants in the programme. In terms of region, the likelihood of participation in the PBF increases if the family lives in the north-east, and it decreases if the family lives in the south region. In terms of infrastructure, if the home is connected to the general sewerage network and it obtains its water from the general grid, it will be less likely to participate in the PBF. All coefficients relating to the presence of children and adolescents were positive: families with children between 10 and 15 years of age were most likely to participate in the PBF. Lastly, as the level of schooling rises, the probability of participation in the programme falls.

Table 7 reports the average effect on the treatment on the treated. The calculation is performed using two different algorithms: nearest neighbour (with replacement) and kernel normal. The average effect of the treatment on the treated was significant under both methodologies, and positive for per-capita family expenditure on food; milk and dairy products; legumes and green vegetables; cereals, leguminous and oilseed products; flours, starches and pasta; tubers and root vegetables; sugars and derivative; didactic books, technical magazines and school utensils.

The results of the matching of the treatment and control groups shows that the beneficiary families increased their expenditure on the specified categories. Table 7 shows that the average per-capita expenditure on food consumption by participating families was 3.11 reais more than the average consumption expenditure of families in the control group defined by kernel matching.

Decree No. 5.209 of 2004 defines two of the basic objectives of the PBF as combating hunger and stimulating the sustained emancipation of families living in situations of poverty and extreme poverty. The results obtained suggest that the programme has been successful in achieving these aims. Greater consumption of poultry, eggs, legumes, green vegetables, cereals, leguminous and oilseed products, confirms that the programme has made foodstuffs containing proteins and essential vitamins easier for the families to obtain.

TABLE 6

Bolsa Família programme (PBF): results of the logit model for propensity-score matching

(Families with a per-capita income of less than 358 reais)

Variable	Gross per-capita income			Net per-capita income		
	Coefficient	Standard deviation	p value[a]	Coefficient	Standard deviation	p value[a]
Per-capita income without PBF (*thousand*)	–5.904	0	0			
Gross per-capita income (*thousand*)				–2.637	0.214	0
Characteristics of head of household						
Age (*tens of years*)	0.941	0.008	0	0.948	0.078	0
Age^2 (*hundred years*)	–0.110	0	0	–0.115	0.008	0
Colour or race[b] = 1 if white	–0.127	0.040	0	–0.143	0.039	0
Sex = 1 if male	–0.121	0.039	0	–0.170	0.038	0
Family structure						
Presence of young children and adolescents:						
0-4 years						
Has 1	0.096	0.046	0.03	0.161	0.045	0
Has 2 or more	0.102	0.075	0.18	0.250	0.074	0.001
5-9 years						
Has 1	0.602	0.042	0	0.653	0.041	0
Has 2 or more	0.928	0.065	0	1.057	0.064	0
10-15 years						
Has 1	0.641	0.043	0	0.682	0.042	0
Has 2 or more	1.064	0.059	0	1.173	0.058	0
16-17 years						
Has 1	0.386	0.049	0	0.417	0.048	0
Has 2 or more	0.685	0.150	0	0.722	0.146	0
Family size						
2 members	0.847	0.182	0	0.848	0.181	0
3 members	1.229	0.177	0	1.251	0.176	0
4 members	1.367	0.179	0	1.385	0.178	0
5 members	1.344	0.183	0	1.371	0.182	0
6 members	1.224	0.191	0	1.257	0.190	0
7 members	1.284	0.202	0	1.321	0.200	0
8 members or more	1.016	0.21	0	1.048	0.208	0
Education						
1-3 years	0	0.052	1	–0.024	0.051	0.643
4-7 years	–0.100	0.053	0.06	–0.167	0.052	0.001
8-10 years	–0.422	0.068	0	–0.520	0.067	0
11-14 years	–0.656	0.069	0	–0.800	0.068	0
15 years or more	–1.727	0.333	0	–1.971	0.332	0
Infrastructure						
Bathroom or toilet						
Bathroom or toilet = 1 if it has a barter or toilet	–0.120	0.064	0.06	–0.181	0.063	0.004
Walls of the home						
Building wood	–0.090	0.066	0.17	–0.068	0.065	0.296
Bare adobe	–0.159	0.085	0.06	–0.063	0.083	0.452
Recycled wood	–0.052	0.135	0.7	0.036	0.133	0.784
Straw	–0.505	0.368	0.17	–0.384	0.364	0.292
Other	0.382	0.223	0.09	0.440	0.220	0.046
Sewerage						
General sewerage network	–0.293	0.052	0	–0.325	0.051	0
Septic tank	–0.131	0.046	0.01	–0.153	0.046	0.001
Ditch	0.067	0.087	0.44	0.086	0.085	0.314
Direct to the river	–0.073	0.098	0.46	–0.052	0.096	0.589
Other form	0.129	0.166	0.44	0.186	0.164	0.256
Water supply						
Well or spring	–0.095	0.048	0.05	–0.097	0.047	0.041
Other form	–0.037	0.076	0.63	0.013	0.075	0.861
Location of the home						
Zone						
Zone = 1 if urban	–0.253	0.046	0	–0.274	0.046	0
Region						
South-east	–0.387	0.071	0	–0.954	0.054	0
North-east	0.464	0.057	0	–0.538	0.057	0
South	–0.670	0.088	0	–1.250	0.086	0
Centre-west	–0.795	0.073	0	–1.355	0.063	0
Constant	–2.667	0.269	0	–2.640	0.260	0

Source: prepared by the author on the basis of data from the 2008-2009 Brazilian Household Budget Survey.

[a] Causal probability of the test.

[b] To identify the category taken as the base, see table 3.

The negative impact on education expenditure, as reported in the gross-income column in table 7, reflects lower expenditure on regular or higher-education courses among the beneficiary families. Nonetheless, those families may have prioritized expenditure on school books and utensils, given the positive effects of the transfer on those expenditure categories, as also shown in table 7. This is due to the fact that the beneficiary families have children and adolescents who attend public primary or secondary schools and have to spend more on school books and utensils.

It is also important to remember that the mother is responsible for receiving the benefit in the home, because she knows the family's needs and those of her children. For that reason she is better able to organize the domestic budget, allocating it to food for example. In that case, on the hypothesis that the mother plays the role of good housekeeper, it is natural to expect the family to spend more on food. It also needs to be remembered that propensity-score matching cannot control for unobservable factors, so the results found may not be exclusively attributable to the PBF.

Table 8 reports the results of the effects of the PBF, according to the gender of the head of household. The gross-income column shows that expenditure on poultry and eggs, cereals, leguminous and oilseed products, and also on flours, starches and pastas, were greater among families headed by men. As the presence of an adult man in the family may increase food expenses, the effects of the PBF on families headed by men are greater than on those headed by women. Bearing this in mind, 68.39% of PBF-beneficiary families are headed by married men, whereas 20.87% are headed by single women. Nonetheless, expenditure on school books and articles was nearly eight times greater among families headed by women than on those headed by men.

TABLE 7

***Bolsa Família* programme (PBF): average effect of treatment on the treated in terms of monthly per-capita consumption expenditures**

Expenditure category	Controlling for net income		Controlling for gross income	
	Kernel (normal)	3 nearest neighbours	Kernel (normal)	3 nearest neighbours
Food	3.115	4.094	0.453	0.911
	(2.61)*	(3.32)*	(0.4)	(0.76)
Fruit	0.014	0.032	–0.114	–0.099
	(0.17)	(0.38)	(–1.45)	(–1.19)
Meat, offal and fish	0.129	0.308	–0.392	–0.524
	(0.35)	(0.79)	(–1.13)	(–1.38)
Poultry and eggs	0.51	0.579	0.336	0.399
	(3.16)*	(3.4)*	(2.17)**	(2.35)*
Milk and dairy products	–0.128	–0.169	–0.343	–0.225
	(–0.79)	(–0.93)	(–2.22)**	(–1.34)
Legumes and green vegetables	0.217	0.234	0.127	0.182
	(3.35)*	(3.44)*	(2.04)**	(2.83)*
Cereals, leguminous and oilseed products	0.958	1.092	0.796	0.973
	(3.25)*	(3.54)*	(2.81)*	(3.21)*
Flours, starches and pastas	0.315	0.37	0.243	0.268
	(2.25)**	(2.39)*	(1.80)***	1.78***
Tubers and root vegetables	0.132	0.149	0.092	0.108
	(2.63)*	(2.8)*	(1.88)***	(2.20)**
Sugars and derivatives	0.218	0.229	0.15	0.155
	(2.32)*	(2.27)**	(1.66)***	(1.56)
Bakery products	0.005	0.071	–0.202	–0.086
	(0.04)	(0.51)	(–1.66)***	(–0.64)
Alcohol and tobacco	–0.194	–0.161	–0.368	–0.299
	(–0.78)	(–0.69)	(–1.56)	(–1.30)
Education	–0.205	–0.046	–0.442	–0.386
	(–0.96)	(–0.23)	(–2.20)**	(–2.03)**
Health	–0.037	0.341	–0.673	–0.220
	(–0.07)	(0.72)	(–1.37)	(–0.46)
Hygiene	–0.238	–0.170	–0.642	–0.638
	(–1.08)	(–0.7)	(–3.03)*	(–2.72)*
School books and utensils	0.239	0.292	0.177	0.167
	(4.19)*	(4.53)*	(3.23)*	(2.73)*

Source: prepared by the author on the basis of data from the 2008-2009 Brazilian Household Budget Survey.

Note: t-statistics in parentheses.
* Significant at 1%. ** Significant at 5%. *** Significant at 10%.

TABLE 8

Bolsa Família programme (PBF): average effect of the treatment on monthly per-capita consumption expenditures

(Controlling for the effect of gross and net per-capita family income, by gender of head of household)

Variables	Net income				Gross income			
	3 nearest neighbours		Kernel		3 nearest neighbours		Kernel	
	Man	Woman	Man	Woman	Man	Woman	Man	Woman
Food	4.52	3.83	3.48	2.29	2.07	0.98	0.67	–0.03
	(3.03)*	(1.70)***	(2.39)*	(1.07)	(1.4)	(0.45)	(0.48)	(–0.02)
Fruit	0.09	–0.098	0.06	–0.09	0.02	–0.19	–0.08	–0.18
	(0.88)	(–0.64)	(0.58)	(–0.63)	(0.21)	(–1.3)	(–0.84)	(–1.37)
Meat, offal and fish	0.31	0.43	0.20	–0.04	–0.17	–0.49	–0.41	–0.37
	(0.64)	(0.68)	(0.43)	(–0.07)	(–0.36)	(–0.77)	(–0.94)	(–0.63)
Poultry and eggs	0.71	0.37	0.62	0.26	0.56	0.32	0.43	0.12
	(3.39)*	(1.25)	(3.19)*	(0.88)	(2.77)*	(1.06)	(2.31)*	(0.44)
Milk and dairy products	–0.05	0.10	–0.15	–0.10	–0.32	–0.14	–0.40	–0.26
	(–0.22)	(0.3)	(–0.77)	(–0.33)	(–1.61)	(–0.45)	(–2.11)***	(–0.92)
Legumes and green vegetables	0.26	0.15	0.23	0.14	0.14	0.13	0.11	0.10
	(3.05)*	(1.14)	(2.96)*	(1.15)	(1.78)***	(0.99)	(1.55)	(0.88)
Cereals, leguminous and oilseed products	1.11	1.08	1.17	0.72	1.20	0.71	1.00	0.59
	(2.95)*	(2.15)**	(3.23)*	(1.4)	(3.07)*	(1.31)	(2.85)*	(1.19)
Flours, starches and pastas	0.38	0.16	0.42	0.11	0.44	0.06	0.37	0.03
	(2.02)*	(0.6)	(2.4)*	(0.48)	(2.35)*	(0.26)	(2.18)*	(0.14)
Tubers and root vegetables	0.17	0.09	0.16	0.06	0.08	0.08	0.11	0.04
	(2.51)*	(0.94)	(2.62)*	(0.63)	(1.13)	(0.77)	(1.91)	(0.37)
Sugars and derivatives	0.24	0.38	0.20	0.26	0.25	0.21	0.14	0.18
	(1.93)***	(2.18)**	(1.76)***	(1.55)	(2.1)*	(1.24)	(1.25)	(1.14)
Bakery products	0.18	0.20	0.00	0.00	–0.14	–0.11	–0.22	–0.19
	(1.05)	(0.78)	(0.01)	(–0.01)	(–0.87)	(–0.42)	(–1.48)	(–0.85)
Alcohol and tobacco	–0.08	0.27	–0.26	0.06	–0.20	0.29	–0.46	–0.04
	(–0.30)	(0.67)	(–0.78)	(0.17)	(–0.72)	(0.82)	(–1.47)	(–0.12)
Education	–0.33	0.27	–0.43	0.24	–0.68	–0.02	–0.64	–0.08
	(–1.31)	(0.74)	(–1.57)	(0.71)	(–2.77)*	(–0.07)	(–2.46)*	(–0.25)
Health	0.01	–0.24	–0.32	–0.15	–0.63	–0.72	–0.73	–0.56
	(0.03)	(–0.47)	(–1.23)	(–0.36)	(–2.29)*	(–1.53)	(–2.92)*	(–1.38)
Hygiene	0.23	0.61	–0.12	0.24	–0.83	0.27	–0.68	–0.56
	(0.40)	(0.80)	(–0.17)	(0.30)	(–1.26)	(0.34)	(–1.06)	(–0.74)
School books and utensils	0.20	0.43	0.16	0.39	0.04	0.32	0.11	0.30
	(2.60)*	(3.28)*	(2.43)*	(3.45)*	(0.56)	(2.46)*	(1.7)	(2.73)*

Source: prepared by the author on the basis of data from the 2008-2009 Brazilian Household Budget Survey.

Note: *t*-statistics in parentheses.
* Significant at 1% (t=2.32). ** Significant at 5% (t=1.96). *** Significant at 10% (t=1.64).

V
Conclusions

Income-transfer programmes play a major role in Latin American economies, because they translate into public policies that directly and indirectly help reduce inequality and poverty. Most of these programmes target poor families and combine actions in the education, health and nutrition areas. They can also be effective in breaking the intergenerational cycle of poverty, because they enable families to encourage their children to stay in school, improve their nutritional level, and have good health consequences.

One of the main contributions of this article has been the use of gross per-capita income to measure the income effect of the PBF. As food expenditure is relatively higher among the poorest segments of the population, the beneficiary families can be expected to spend the additional income obtained from the cash transfer from the government on food. Using gross rather than net income as the control variable makes it possible to verify whether the effect of receiving the benefit includes budgetary redistribution, in addition to the direct effect

of the increase in per-capita disposable income. The use of net per-capita income as the explanatory variable showed the effects of the benefit and of the budgetary redistribution on family consumption expenditure. Using net income as the control variable enables the average effect of the treatment on the treated to capture both the effect of the increase in income and the potential effect of being a beneficiary on the redistribution of the family's budget.

As noted above, income-transfer programmes make a major contribution to improving family education and health. An evaluation of the effects of the PBF showed that the beneficiary families, particularly those headed by women, increased their on expenditure on school books and utensils. It also reported higher expenditure on poultry and eggs; legumes and green vegetables; cereals, leguminous and oilseed products; flours, starches and pastas; tuber and root vegetables.

The research also showed that the beneficiary families use their income to purchase priority goods, which alleviate their extreme poverty, and also school utensils which represent an investment in their children's education. As this is a wide-ranging topic, some aspects remain to be studied in greater detail, including the nutritional value of the food consumed by the beneficiary families. Lastly, the results obtained were satisfactory in terms of achieving the basic objectives of the PBF, namely to combat hunger and enhance the food and nutritional security of families living in poverty and indigence.

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The international asparagus business in Peru

Jaime de Pablo, Miguel Ángel Giacinti, Valentín Tassile and Luisa Fernanda Saavedra

ABSTRACT

A variety of methodologies, such as the Foreign Trade Competitiveness Index, the Foreign Trade Policy Index and the TradeCAN competitiveness matrix, reveal a process of adaptation to changes in world trade in the period from 2002 to 2012, within the context of the so-called "complex adaptive system" as a transition from the fourth to the fifth technological revolution in fresh asparagus exports from Peru. The country's competitiveness map shows that it is not competing globally at the international level but rather partially or regionally. Mexico is its main competitor, with comparative advantages over Peru because of its currency's real exchange rate against the United States dollar, but there are challenges that need to be dealt with in the medium term in this process of adaptation to change.

KEYWORDS

Peru, exports, asparagus, competitiveness, foreign trade, trade policy, United States, Europe, trade statistics

JEL CLASSIFICATION

F14, Q13, Q17

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I
Introduction

Industrial revolutions are associated with the periodizations of Kondratieff long waves, as a number of research studies have pointed out, among them those of Martínez Sánchez (2001) and Jijena (2003). From this theory were subsequently derived the short waves of Kitchin (3 years), Kuznets (5 years) and Juglar (15 years). All these waves concern innovation processes and the introduction of new production areas that drive growth. Kondratieff argues that every technological revolution gives rise to a long economic cycle lasting about 50 years, of which 25 are "boom" years and another 25 "crisis" years. Schumpeter (1935) uses time series to study cyclical crises. In all cases, these are phases of incremental adjustment, improvement or progress in the technologies that drive economic growth.

In particular, the fourth technological revolution in the post-Second World War period saw the greatest wave of construction of organizations for managing world trade. However, the current situation of global economic crisis and the economic recession since 2008 mark the beginning of the fifth technological revolution. This new situation entails a paradigm shift from the fourth revolution, specifically in the following areas: (i) basic resources: from cheap, plentiful energy to adaptable, strategic information and knowledge; (ii) production: from automated to flexible; (iii) product mix: from stable and homogeneous to varied and changing; (iv) skills: from specialization to multiskilling; (v) organizational structure: from hierarchical and departmentalized to horizontal and networked; (vi) labour relations: from conflict resolution to negotiation and cooperation; (vii) markets: from massive and homogeneous to segmented and changing; (viii) competitiveness: from static to dynamic; (ix) management: from costs to management.

It should also be stressed that this fifth revolution is the first to include agriculture in what is considered to be the era of recovering international food prices. Real trade prices have improved steadily since 2000 (by comparison with data from 1961 onward) for soya, wheat, maize, soya oil, roasted coffee, wine, grape must, non-alcoholic beverages, lamb and beef, chicken and pork, fresh fruit and concentrated juices. In the case of vegetables, if garlic, onion, tomato and asparagus are taken for the purposes of analysis, there was a decline in real prices that bottomed out in 2000, and the current situation is one of stability with no price recovery for the time being.

This phenomenon means that agriculture will once again be strategically crucial to the countries' economic and social development over the coming decades. People migrated from the countryside to large cities because of cheap food, as did young people in consequence of the generational changeover problem. But now the process is almost certain to go into reverse, with people moving to cities close to where production takes place, and even the availability of wage income for non-food consumption will change, with repercussions for other sectors.

In this context, the key questions are these. Are there going to be shifts in agricultural markets in the coming years, aside from real price recovery in some sectors? And will this be the case in particular with the trade in asparagus, as a non-traditional product in Latin America?

Answering the second question is the purpose of this article, which particularly analyses the model adopted in Peru and its process of adaptation to change, since it is the world's leading exporter of asparagus.

Section II deals with the global trade in asparagus, looking at exports and imports. Section III presents a competitiveness map based on the Foreign Trade Competitiveness Index (FTCI). Section IV discusses the sector's evolution in terms of production, exchange rates, the structure of trade and company policies. Lastly, section V provides the main conclusions.

II
The global asparagus trade

1. Exports

Fresh asparagus exports generate revenues of US$ 1.027 billion a year, with a volume of 343,000 tons. Average annual sales growth in 2003-2012 was 7.7% in dollar terms, while volume increased by 5% a year on average, which explains why the free on board (FOB) export price increased by only 2.3% a year in the period analysed. Peru is the world's largest exporter, registering 6.7% annual growth in foreign sales by volume and 11% by value.

In 2000, worldwide export shares were as follows: Peru: 33.1%; Mexico: 22.3%; United States: 15%; Netherlands: 8.4%; Spain: 4.5%; Germany: 2.1%; Italy: 2.1%; Greece: 2%; France: 2%; Australia: 1.7%; Thailand: 1.2%; Poland: 0.9%; Hungary: 0.9% (see table 1).

Some 60% of world asparagus exports in 2012 took place from January to June, with the remaining 40% taking place from July to December. When a country exports outside of its own production calendar, it usually sells asparagus previously imported from other countries.

At the country level, the following distinctions can be made regarding the seasonality of production, and they explain why the exportable global supply is what it is: (i) Peru and Thailand are the only countries that produce all year round; (ii) the United States produces from January to September; (iii) Spain produces from January to July and France and Portugal from March to July; (iv) Germany and the Netherlands produce from August to November; (v) China produces in two periods, from February to July and from September to December; (vi) Canada produces in May and June; (vii) Mexico produces in two periods, from January to April and from June to October; (viii) Ecuador produces from June to February; (ix) Chile produces from July to December; (x) New Zealand produces from September to December; (xi) Australia produces from September to November.

2. Imports

Fresh asparagus imports cost the importing countries a total of US$ 1.2 billion a year, with a volume of 343,000 tons.

Taking the annual rate as given by the table 2 data and using the linear adjustment trend slope calculation

TABLE 1

Fresh asparagus exports worldwide, by value, 2003-2012
(Thousands of dollars)

Country	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Total	497 848	550 831	602 971	663 382	709 361	738 116	761 765	902 963	955 879	1 026 809
Peru	108 343	141 545	160 015	187 364	235 701	230 427	250 823	290 684	291 828	339 987
Mexico	77 357	78 508	114 044	129 094	116 553	101 582	146 209	217 413	229 822	228 767
United States	69 137	70 527	81 075	79 611	81 719	95 178	101 241	128 861	140 148	153 955
Netherlands	28 186	35 627	32 148	38 325	53 338	65 113	59 867	56 014	70 807	86 343
Spain	77 869	70 908	59 130	64 391	51 677	51 731	47 109	40 771	47 146	46 508
Greece	29 861	33 029	31 273	38 932	43 665	50 289	32 793	39 051	22 835	20 260
Thailand	15 625	24 532	28 093	26 266	23 601	23 406	17 540	12 974	15 618	12 042
Germany	4 590	5 126	7 274	8 825	9 482	11 958	10 934	16 698	21 409	21 954
Italy	2 315	2 829	4 072	4 569	7 788	12 778	9 902	13 949	16 192	21 787
France	27 517	22 829	20 037	22 843	19 012	17 548	19 630	16 477	20 639	20 470
Australia	14 579	19 661	16 969	13 562	13 802	20 538	11 887	15 822	16 842	17 029
Poland	3 076	4 087	3 396	3 521	2 906	3 716	5 567	7 027	9 145	9 389
Hungary	5 392	6 355	5 366	5 854	7 390	11 797	10 391	9 971	7 847	9 678
Other countries	34 001	35 268	40 079	40 225	42 727	42 055	37 872	37 251	45 601	38 640

Source: prepared by the authors on the basis of data from the International Trade Centre (ITC) and the United Nations Commodity Trade Statistics Database (COMTRADE).

TABLE 2

Fresh asparagus imports worldwide, by value, 2003-2012
(Thousands of dollars)

Country	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	Annual growth (*percentages*)[a]	Share (*percentages*)
Total	633 904	701 374	782 610	886 017	927 282	999 182	947 869	1 115 948	1 180 346	1 209 314	4.8	
United States	205 988	245 361	286 959	336 968	360 440	374 507	385 135	500 923	516 437	511 424	8.1	43.00
Germany	91 832	83 193	98 359	117 762	96 559	124 633	85 748	95 030	93 153	88 008	-2.0	7.27
Canada	36 187	42 387	50 869	57 988	60 947	62 299	61 017	73 870	81 079	84 543	7.7	7.07
Netherlands	25 669	31 004	27 702	25 102	36 946	48 675	51 094	52 548	55 063	66 777	10.4	5.52
France	42 361	49 685	42 283	43 917	50 726	50 074	49 034	44 564	44 245	47 269	-0.3	3.90
Japan	75 413	81 563	79 067	71 765	64 768	61 121	64 145	74 951	82 499	95 751	-3.6	7.91
Spain	20 800	22 521	33 205	37 290	40 318	43 282	37 887	40 354	46 801	42 308	4.3	3.49
United Kingdom	19 705	23 374	30 072	45 074	50 792	56 060	45 210	48 923	53 461	61 039	5.5	5.04
Switzerland	42 303	42 118	40 951	41 582	45 083	48 610	44 687	49 789	53 699	51 468	-0.3	4.25
Italy	16 835	12 312	14 570	16 867	16 228	16 995	15 701	16 254	17 968	16 272	-0.8	1.34
Belgium	9 730	13 205	15 308	19 095	20 581	22 227	22 306	21 509	22 921	25 338	4.5	2.09
Taiwan Province of China	13 575	11 495	13 553	13 853	11 372	11 529	10 896	8 869	8 211	7 053	-6.8	0.58
Australia	2 380	3 248	3 328	4 406	6 187	7 804	7 209	8 386	11 455	14 708	18.4	1.21
Other countries	31 126	39 908	46 384	54 348	66 335	71 366	67 800	79 978	93 354	97 356	7.9	8.05
Sweden	683	844	884	979	1 144	1 339	1 391	1 518	2 036	2 129	13.6	0.17
Norway	736	797	925	992	1 133	1 319	1 257	1 384	1 733	1 937	10.8	0.16
Ireland	183	226	213	333	400	426	684	677	931	931	27.9	0.07
Brazil	138	178	222	220	272	377	502	668	887	887	43.5	0.07
Malaysia	74	78	124	464	575	556	618	740	874	874	35.9	0.07
Finland	246	238	305	349	387	420	408	483	588	588	10.5	0.05
Russian Federation	115	142	130	224	315	365	319	410	538	538	21.7	0.04

Source: prepared by the authors on the basis of data from the International Trade Centre (ITC) and the United Nations Commodity Trade Statistics Database (COMTRADE).

[a] Annual rate based on the linear adjustment trend slope calculation methodology.

methodology, worldwide trade grew by 4.8% a year from 2003 to 2012, while the importing countries with above-average growth rates were Brazil (43.5%), Malaysia (35.9%), Ireland (27.9%), the Russian Federation (21.7%), Australia (18.4%), Sweden (13.6%), Norway (10.8%), Finland (10.5%), the Netherlands (10.4%), Canada (7.7%) and the United Kingdom (5.5%). Major importers whose purchases tended to tail off were Italy, Germany and Japan. The largest buyers were the United States (42.3% of the total), Japan (7.9%), Germany (7.3%), Canada (7%), Netherlands (5.5%), the United Kingdom (5%), Switzerland (4.3%), France (3.9%), Spain (3.5%), Belgium (2.1%), Italy (1.3%), Australia (1.2%) and Taiwan Province of China (0.6%).

III

Competitiveness map

1. Foreign Trade Competitiveness Index (FTCI)

At present, the only universally accepted concept of competitiveness is the economicist one developed by the World Economic Forum and used to develop the country-level Global Competitiveness Index. This index measures a set of institutions, policies and factors that determine what levels of economic prosperity are sustainable at the present time and in the medium run. There is in fact a wide range of definitions of sectoral or corporate competitiveness, but the most appropriate one for international trade from the vantage point of this study is the ability to keep or expand market share while simultaneously raising the living standards of the population associated with the production area. On the basis of this definition, a useful tool is the Foreign Trade Competitiveness Index (FTCI), which takes as its numerator "market share" in the countries that are major importers of a particular product and as its denominator the exporting country's global "export share" for that product.

Formula: $$\text{FTCI} = \left(M_{kij} / M_{kj}\right) / \left(X_{ki} / X_{kw}\right)$$

where:

M_{kij} Imports of product k from country i by country j
M_{kj} Total imports of product k by country j
X_{ki} Exports of k by country i
X_{kw} Worldwide (w) exports of product k

The data are for monetary turnover rather than volume, on the basis that this is more relevant as an indicator of competitiveness because it incorporates the value added to the product analysed into the study. A higher share in a particular international market than in worldwide exports can be taken to denote greater competitiveness because the market share is greater than the worldwide share, and vice versa if it is lower.

Carrying out an analysis that combines the FTCI and the trend of market share (because this is an effect rather than a cause variable) is an effective way of obtaining a "global competitiveness map" for a product in a country while also making it easier to visualize the trend in major markets under the trade complexity and adaptability paradigm. This implies a larger number of importing countries, with the peculiarity of continuous changes in competition between international suppliers owing to shifts in market share arising from alterations in trade policy (price, volume or both) in one or another of them.

In the construction of the "competitiveness map", the horizontal axis is the originating country's market share in each of the main importing countries relative to its mean worldwide market share for the product analysed, while the vertical axis compares the trend of market share over a given period, with the size of the circle, which represents annual dollar turnover, showing how great this is (see figure 1).

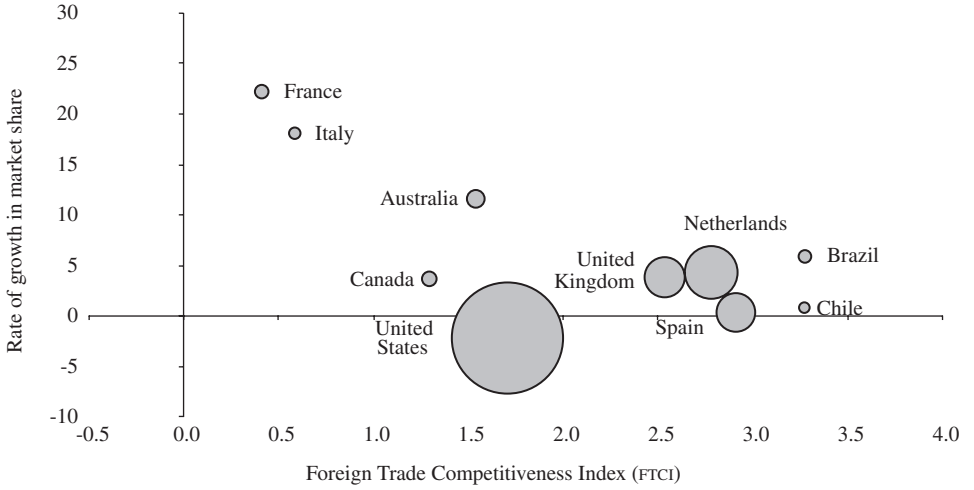
This methodology is efficient, because access to international trade data is not expensive, and effective, because it fulfils the purpose it was created for. It has been used to analyse fruits such as kiwi (De Pablo and Giacinti, 2012a), pears (De Pablo and Giacinti, 2012b; De Pablo, Giacinti and Uribe, 2012), apples (De Pablo and Giacinti, 2012c) and lemons (De Pablo and Giacinti, 2013).

2. Findings

Peru is tending to diversify its international asparagus trade (see figure 1), but its main customer is still the United States market, which its asparagus enters at a 0% tariff rate and which accounts for 60.58% of sales.

FIGURE 1

Peru: asparagus export competitiveness map, 2003-2011



Source: prepared by the authors on the basis of table 3 data.

Note: circle size indicates value of exports in 2011.

Sales in the Netherlands (13.62%), the United Kingdom (7.89%) and Spain (7.32%) are also substantial.

Table 3 shows that the highest values of the Foreign Trade Competitiveness Index (FTCI) are now found in Brazil (3.28), Spain (2.91), the Netherlands (2.78) and the United Kingdom (2.54), while the value for the United States is 1.70. It can also be seen that only the United States presents negative values for the average annual rate of change in market share (2.2%), while the highest values are in Japan (34.5%), France (22.3%), Italy (18.1%) and Australia (11.6%). Indeed, there are countries where market share is higher than in the United States (with strong competition from Mexico), such as the United Kingdom, the Netherlands, Spain, Chile and Brazil.

The changes observed in the countries importing Peruvian asparagus bear out the new paradigm of dynamic competitiveness, as this is not global but presents peculiarities in its rate of growth in each market.

It is striking that Germany (see table 2), the country with the highest per capita consumption and the world's second-largest importer, is not directly a customer of Peru. The explanation is that the Netherlands, as with other fruits and vegetables, acts as a broker, carrying out trade triangulation with European markets whose commercialization costs are higher. Although Japan and the United States are the other great global consumers of asparagus, the latter is Peru's main customer while Japan is currently marginal; in the years covered by this study, however, its purchases increased very substantially. These observations also reveal that the management paradigm has not been developed to its fullest extent in the Peruvian asparagus trade to adapt it to the whole of the market potential that exists.

TABLE 3

Peru: asparagus trade indicators, 2011

Importer	FTCI	Annual change in market share (*percentages*)	Exports *(thousands of dollars)*
United States	1.70	-2.2	176 790
Netherlands	2.78	4.4	39 749
United Kingdom	2.54	3.9	23 037
Spain	2.91	0.4	21 348
Japan	0.49	34.5	4 651
Australia	1.54	11.6	4 471
Canada	1.29	3.6	3 046
France	0.41	22.3	2 621
Brazil	3.28	6.0	2 276
Italy	0.58	18.1	1 878
Chile	3.27	0.8	1 602

Source: Fruit and Vegetable Information Centre, "Business Intelligence" [online] 410http://www.cif-businessintelligence.com/eng/index.html, and United Nations Commodity Trade Statistics Database (COMTRADE).

FTCI: Foreign Trade Competitiveness Index.

IV
The evolution of the sector

1. Production

The main production areas in Peru lie on the coast, in the departments of La Libertad, Ica and Lima.

White asparagus is planted along the northern coast, especially in the vicinity of Trujillo, and green asparagus is grown between Lima and the southern city of Arequipa. According to official data, average annual growth in the land area planted with asparagus in Peru was 8.9% in 2004-2011, with a total of somewhat over 30,000 hectares in the latter year. The increase in the exportable supply from 2004 to 2011 was due to the increase in growing area (from 18,900 to 30,000 hectares) and technological improvements, with an initial stage of good international prices (Illescas and Jaramillo, 2011). At the fifth International Asparagus Congress, held in Peru in 2010, it was stated that the business accounted directly and indirectly for 120,000 rural jobs.[1]

In 2004-2012 (see table 4), total Peruvian asparagus exports grew at an average annual rate of 5.6% by volume, with exports of tinned asparagus increasing by 3.2% a year and those of fresh or refrigerated asparagus by 6.9%. There was also a drop in asparagus production that resulted in lower sales abroad in 2012, owing to climatic factors and agricultural conditions in old plantations, which have switched to other crops owing to difficulties in earning a return in the asparagus sector because of rising domestic costs in dollar terms.

[1] See [online] http://www.exportando-peru.com/tips-detalle.php?idnoticia=603&idcategoria=9.

TABLE 4

Peru: total asparagus exports, 2004-2012
(Tons)

Detail	2004	2005	2006	2007	2008	2009	2010	2011	2012	Annual growth (*percentages*) [a]
Total exported	112 247	121 007	137 857	154 222	167 422	163 928	173 945	197 074	173 497	5.6
Tinned	40 184	41 353	45 448	58 598	63 563	49 837	47 070	60 757	53 816	3.2
Fresh	72 063	79 654	92 409	95 624	103 859	114 091	126 875	136 317	119 681	6.9

Source: prepared by the authors on the basis of data from the Office of the National Superintendent of Customs and Tax Administration (SUNAT) of Peru.

[a] Annual rate based on the linear adjustment trend slope calculation methodology.

Peru is the world's largest exporter of fresh or refrigerated asparagus, but the second-largest for tinned asparagus, although in 2012 it pulled just ahead of China in volume and was the global leader. Exports of tinned asparagus have expanded since the late 1980s, although they tended to level off in the mid-1990s. Fresh and tinned asparagus is Peru's second-largest agricultural export after coffee.

If the trade is measured by annual dollar turnover, Peru has consistently been the world's largest seller of tinned asparagus since 2004. The main destinations for this are European countries (see table 5), while the main market for fresh asparagus is the United States (see table 6).

Although supplies are available in every month of the year, the main production and trade window is from July to December (Benson, 2012). These months have accounted for 68% of the total in recent years, with 85% of fresh or refrigerated asparagus exports being sent by air; this compares with a figure of 80% in the 2004-2012 period, when there was a low of 70% and a high of 91%.

This growth process was heavily influenced by policy changes, as manifested in legislation that set no limits on the size of agricultural holdings; established the same rights and obligations for local and foreign owners; promoted development by reducing the 15% company profits tax; and provided regional incentives in the form of a 15-year tax exemption for those investing in special

TABLE 5

Peru: exports of tinned asparagus, 2004-2012
(Tons)

Market	2004	2005	2006	2007	2008	2009	2010	2011	2012
Africa	0	0	0	0	0	308	50	0	113
Asia	1 636	1 491	1 133	1 019	1 339	1 306	1 433	1 458	1 688
Europe	32 989	29 962	31 126	44 405	43 117	35 116	35 166	45 269	37 114
Latin America	421	440	822	912	921	849	966	1 223	1 446
MERCOSUR	0	9	0	11	11	2	0	2	11
North America	5 137	9 451	12 366	12 252	18 176	12 255	9 456	12 805	13 445
Russian Federation	0	0	0	0	0	0	0	0	0
Grand total	40 184	41 353	45 448	58 598	63 563	49 837	47 070	60 757	53 816

Source: prepared by the authors on the basis of data from the Office of the National Superintendent of Customs and Tax Administration (SUNAT) of Peru.

TABLE 6

Peru: exports of fresh or refrigerated asparagus, 2004-2012
(Tons)

Market	2004	2005	2006	2007	2008	2009	2010	2011	2012
Africa	0	45	96	106	81	66	105	146	133
Asia	624	1 017	1 662	1 558	1 400	2 174	3 167	3 294	3 553
Europe	15 277	18 692	21 485	22 342	25 745	28 499	32 098	33 738	33 310
Latin America	191	265	465	458	341	528	723	1 083	855
Middle East	11	3	7	8	2	7	13	44	57
MERCOSUR	164	244	400	571	741	902	1 216	1 528	1 915
North America	55 796	59 373	68 283	70 582	75 544	81 915	89 549	96 485	79 855
Russian Federation	0	15	11	0	6	0	3	0	2
Grand total	72 063	79 654	92 409	95 624	103 859	114 091	126 875	136 317	119 681

Source: prepared by the authors on the basis of data from the Office of the National Superintendent of Customs and Tax Administration (SUNAT) of Peru.

export zones and in basic crop irrigation infrastructure, one example being the Chavimochic project in the department of La Libertad. The creation of the Ministry of Foreign Trade and Tourism was also a public policy milestone, not only because it pursues trade agreements with other countries, but also because it operates the Commission for the Promotion of Peruvian Exports and Tourism (PromPeru), the National Strategic Exports Plan (PENX) and the Foreign Trade Single Window (VUCE).

2. The exchange rate

A macroeconomic factor affecting the profitability of asparagus growing and exporting in Peru is the exchange rate of its currency against the United States dollar. The Economic Research Service of the United States Department of Agriculture prepares statistics on the evolution of both real and nominal exchange rates for many countries. Figure 2 shows that the Nuevo Sol has been strengthened so that dollar costs have been rising, while the Mexican currency tended to weaken up to 2012, reducing local costs in dollars. This means that more technology needs to be incorporated into the whole Peruvian asparagus chain, including logistics and commercialization as well as production and packing, and management needs to be optimized to improve the economic performance of the sector.

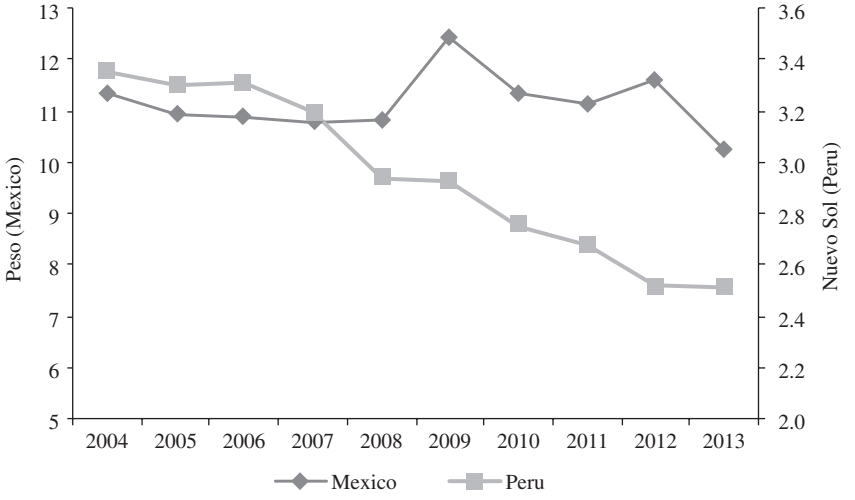
3. The trade structure

(a) *The Herfindahl-Hirschman Index (HHI)*

The HHI is used to analyse changes in the structure of world trade over and above real price movements, and is the only legally regulated tool for those in the

FIGURE 2

Real exchange rates of the Mexican and Peruvian currencies against the dollar, 2004-2013



Source: Mathew Shane, United States Department of Agriculture [online] http://www.ers.usda.gov/ers-staff-directory/mathew-shane.aspx#.UsLYY9JDuSo.

European Union, the United States[2] and elsewhere, as some studies have noted (Sawaya Jank, Paes Leme and Meloni Nassar, 2001; Mariscal and Rivera, 2007; Durán Lima and Álvarez, 2008; Baumann, 2009; Alarco and del Hierro, 2010; Petit, 2012; Caputi Lélis, Moreira Cunha and Gomes de Lima, 2012; Fadzlan and Muzafar, 2013). Some authors have also analysed the issue of whether the HHI is effective or requires adjustments (Hirschman, 1964; Djolov, 2011).

This index measures the market concentration, taking account of both the number of competitors and their market shares, and is calculated as the square of the sum of the percentage share of the *i*-th firm in the industry. The calculation is expressed in the following formula:

$$\text{HHI} = \sum_{i=1}^{n} \left(\frac{X_i}{X} 100 \right)^2$$

where:

$\frac{X_i}{X}$ share of the *i*-th firm in the market

(n) number of firms in the industry

The scale used in the United States is as follows: (i) HHI < 1,000 represents a low level of concentration, (ii) 1,000 < HHI < 1,800 represents a moderate level of concentration and (iii) HHI > 1,800 represents a high level of concentration.

European Union rules are the same except that a score has to be over 2,000 points for economic concentration to be considered high.

To compare data across countries or analyse some explanation for the evolution of the HHI in a time series, it is valid for the data to be normalized to remove the effects of aggregating the number of firms (Baumann, 2009). This entails a new index in percentage terms, solely for the purposes of comparison or analysis, with the following formula in the present case:

$$\frac{\sqrt{HHI} - \left(100 * \sqrt{\frac{1}{n}}\right)}{100 * \left(1 - \sqrt{\frac{1}{n}}\right)}$$

(b) *Market concentration*

The structure of the Peruvian export model for fresh asparagus is one of low concentration (below 1,000 points on the HHI scale), with an increasing trend towards lower levels, given that there was an annual decrease of 4.3% in 2002-2012 (see table 7).

[2] See [online] http://www.justice.gov/atr/public/testimony/hhi.htm.

TABLE 7

Peru: Herfindahl-Hirschman Index for exports of fresh asparagus, 2002-2012

Market	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	Annual growth (*percentages*)
Export HHI												
Average	687	563	488	476	463	427	380	384	380	419	420	-4.3
North America	751	599	391	315	293	300	297	332	369	410	347	-5.5
Europe	1 209	1 350	1 139	1 247	1 133	1 032	753	742	714	731	860	-5.5
Latin America	4 266	3 207	4 087	4 786	5 489	3 542	3 869	2 779	2 326	2 635	1 715	-5.8
MERCOSUR	4 374	3 025	1 677	2 676	5 231	4 768	1 513	1 450	1 172	1 557	1 364	-8.7
Asia	10 000	7 279	9 019	6 712	4 707	5 047	2 386	1 465	1 437	1 556	1 707	-19.7
Africa				8 238	9 319	9 711	9 399	4 087	5 680	9 057	8 361	-2.3
Middle East				5 159	10 000	9 949	10 000	6 172	3 987	4 546	3 101	-10.0

Source: prepared by the authors on the basis of data from the Office of the National Superintendent of Customs and Tax Administration (SUNAT) of Peru.

The market accounting for the largest volume of trade, such as North America and Europe, present low concentration, while smaller markets currently present moderate concentration (Latin America, MERCOSUR and Asia) and high concentration (Africa and the Middle East).

The records of those importing by sea, analysed using the HHI, project a structure of lower trade concentration (see table 8); it should be noted that maritime exports fell in 2012 because of a smaller harvest, which explains the rise in the index relative to 2011. The bulk of asparagus exports goes by air, but records for this form of transport, unlike sea transport, were not available. In this case, the data indicate low concentration in the North American market (the main destination for Peruvian asparagus), unlike the Latin American market, where concentration is moderate, and the European and Asian markets, where it is high.

TABLE 8

Peru: Herfindahl-Hirschman Index for seaborne imports of fresh asparagus, 2011-2012

Market	2011	2012
Import HHI		
Average	489	840
North America	816	962
Europe	1 510	2 304
Latin America	1 606	1 449
Asia	7 091	7 883

Source: prepared by the authors on the basis of data from Fresh Cargo [online] http://www.qcfreshfruit.com/.

The rise in the number of exporting firms from 60 in 2002 to 99 in 2012 (see table 9) is one of the factors accounting for the decline in the economic concentration of the sector in general, as well as the market shares of the main exporters. Some firms have begun a process of sales diversification and are growing and exporting less asparagus, but increasing their supply of other products, such as avocado, table grapes or blueberries for the European, Latin American, Asian and North American markets. The change in their market share within the larger firms category and the increase in the number of exporters account for the decline in economic concentration. In MERCOSUR and the Middle East, there has been no sales diversification or decline in the export volumes of the largest firms, which include the Beta Agroindustrial Complex, Damper Trujillo, Agrícola la Venta and Agro Paracas, and only the growth in new exporters explains the drop in economic concentration. As a result, the normalized HHI is positive (see table 10) whereas in the markets the normalized HHI is negative because, alongside growth in the number of exporters, large firms have reduced the intensity of their asparagus sales to offer other produce in their trade portfolios.

The effects of the continued strengthening of the local currency in real terms since 2010 (see figure 2) have been a drop in the number of firms from 123 in 2009 to 99 in 2012 (see table 9) and, consequently, a slight upward trend in the HHI in the last few years (see table 7), although it remains within the lower economic concentration level of the scale.

The atomization of the trade structure of Peruvian asparagus because of reduced economic concentration (more firms and declining market shares for the biggest traders) would appear to be a new paradigm of the fifth technological revolution. The same phenomenon as regards the level of economic concentration in the structure of exporters and importers can also be seen in Chile's foreign trade in fruit, on which a case study will shortly

TABLE 9

Peru: number of firms exporting fresh asparagus, by trade region, 2002-2012

Market	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	Annual growth *(percentages)*
Total	60	72	95	121	125	119	111	123	113	106	99	3.1
North America	59	61	86	103	110	101	98	102	86	82	83	1.8
Europe	29	42	53	69	64	74	65	68	69	67	54	3.9
Latin America	7	8	9	7	14	18	17	26	20	22	28	16.5
MERCOSUR	3	9	13	13	6	13	13	20	23	26	26	18.3
Asia	1	3	9	16	13	21	27	32	27	30	27	24.9
Africa				5	6	3	2	5	4	4	3	-4.6
Middle East				2	1	2	1	5	3	6	8	41.2

Source: prepared by the authors on the basis of data from the Office of the National Superintendent of Customs and Tax Administration (SUNAT) of Peru.

TABLE 10

Peru: normalized Herfindahl-Hirschman Index for exports of fresh asparagus, 2002-2012
(Percentages)

Market	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	Annual growth
Normalized HHI												
Average	13.8	12.5	12.4	13.3	13.2	12.1	10.5	11.2	10.6	11.3	11.0	-2.1
North America	14.9	12.2	9.5	8.4	8.1	7.8	7.6	8.8	8.9	9.7	8.1	-3.8
Europa	16.7	21.9	20.6	24.0	21.8	21.2	15.6	15.7	15.3	15.4	16.3	-2.9
Latin America	27.9	21.9	20.6	24.0	21.8	21.2	15.6	15.7	15.3	15.4	16.3	-5.0
MERCOSUR	8.5	22.1	13.5	24.5	31.9	41.9	11.5	16.1	13.8	20.4	17.8	0.1
Asia	0.0	27.9	62.3	57.6	41.5	49.9	30.2	21.2	19.2	21.7	22.6	-3.1
Africa				46.6	56.3	41.2	26.5	19.5	25.7	45.7	34.1	-5.4
Middle East				1.1	0.0	29.3	0.0	34.3	5.5	27.0	20.7	22.1

Source: prepared by the authors on the basis of data from the Office of the National Superintendent of Customs and Tax Administration (SUNAT) of Peru.

be published by the Association of Chilean Exporters (ASOEX) as "Expediente 11". In particular, economic concentration is tending to decline most markedly for table grapes, apples, stone fruits, blueberries, avocados and citric fruits. For pears and kiwi, concentration is low but stable or rising slightly.

4. Company policy

(a) *The Foreign Trade Policy Index (FTPI)*

The purpose of this methodology is to analyse companies' sales policy, and accordingly the index takes a firm's "market share in a trade country or region" as the numerator and the firm's "share of sales" from the country for that product as the denominator:

$$\text{FTPI} = \left(FS_{kej} / FS_{ke}\right) / \left(X_{ke} / X_{ki}\right)$$

where:

FS_{kej} foreign sales of product k by firm e in country j
FS_{ke} foreign sales of product k by firm e
X_{ke} exports of k by firm e
X_{ki} exports of k from country i

If a particular firm's share of a market is higher than its mean share of the country's exports of the product analysed, this will indicate that the firm specializes in that region. The opposite situation would indicate that its sales in that region were marginal for the time being. The trend will show whether or not the firm is showing an increasing interest in selling in a particular trade country or region.

This tool was developed to gauge how adaptable exporters were to manage changes in international trade under the complexity paradigm (Spilzinger, 2004). It is related to "complex adaptive system" theory (Serlin, 2010), which is based on dynamic systems theory (in mathematics) and complex systems theory (in management). It is this approach that indicates the effectiveness of the methodology (giving a renewed role to trade intelligence as a means of developing creativity in a complex world) via the adaptability of foreign sales management. It is efficacious because it fulfils its purpose (sales policy analysis) and effective when detailed company-level information is available.

Statistical analysis of dissimilarity between firms is carried out on the basis of three items of information for each: its ranking in the Foreign Trade Policy Index (FTPI), the trend of annual changes in the FTPI and annual dollar turnover in each trade region, namely Europe, Asia, Africa, Latin America, the Middle East, MERCOSUR and North America. The combination of these three elements for each exporting firm is what underpins the analysis of dissimilarity between them.

Dissimilarity is measured by Gower's coefficient (Gower, 1967 and 1971), which takes the number of variables with data for pairwise comparisons. A multivariate hierarchical clustering analysis is carried out on the matrix obtained, taking average distances as the linkage criterion.

$$S_{ij} = \frac{1}{p}\sum_{k=1}^{p} S_{ijk}$$

In the most straightforward situation, when individuals *I* and *j* are compared to character *k*, if this is a binary or qualitative variable, then the value one (1) is assigned to Si_{jk} if X_{ik} and X_{jk} are the same, and zero (0) if they are different. If the variable is quantitative, the similarity between individuals will be given by:

$$S_{ijk} = 1 - \frac{\| x_{lk} - x_{jk} \|}{r_{kh}} : S_{ij}$$

$$= \sum_{k=1}^{p_1} \left(1 - \frac{\| x_{ik} - x_{jk} \|}{r_k} + a + d + \alpha\right) \Big/ p_1 + p_2 + p_3$$

where:

p_1 number of quantitative variables
r_k range of the *k*-th continuous variable
p_2 number of binary variables
a number of 1-1 matches for the binary variables
d number of 0-0 matches for the binary variables (p_2-d)
p_3 number of qualitative variables
α number of matches for the qualitative variables

(b) *Sales planning*

The statistical analysis using Gower's coefficient to prepare a dissimilarity matrix, supplemented by a hierarchical clustering analysis of leading firms (see figure 3), confirms the low level of trade policy similarity when these firms are compared. This can then be seen by comparing turnover by market, FTPI rankings and annual rates of change (2004-2012) across the main exporters.

As an example, asymmetries or differences can clearly be seen in the competitiveness maps of the exporters in the Beta Agroindustrial Complex (see figure 4) and Camposol (see figure 5). Besides these two cases, the leading firms generally differ from one another in their sales turnover in each market and the annual rate of change in their trade positioning or share. This evidence bears out the new paradigm of segmented markets as a process of trade adaptation in the face of change, since each firm is seeing the opportunities and threats in each market differently.

5. Market positioning

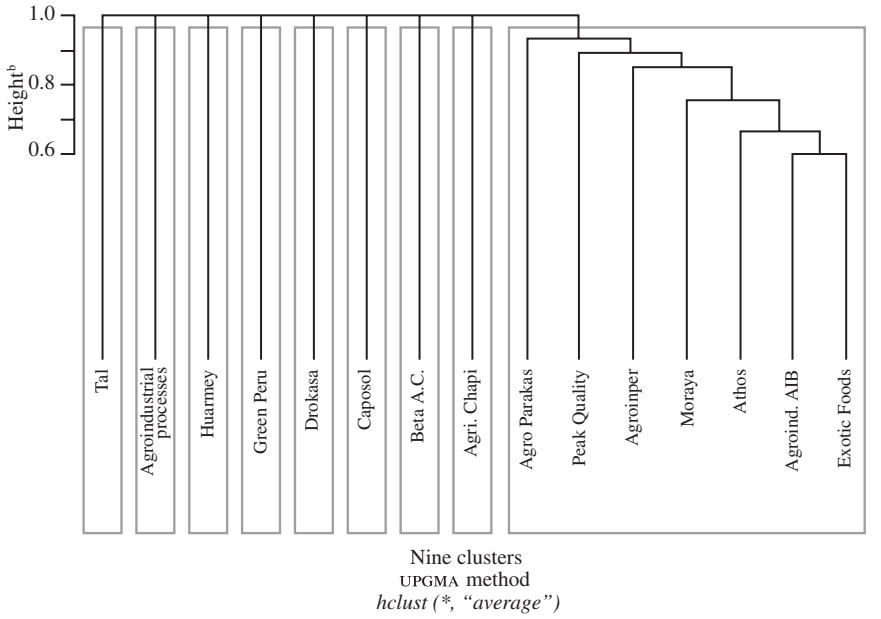
(a) *Import competitiveness matrix (TradeCAN)*

The focus of analysis this time is the import market, with the goal of detecting changes on the side of international suppliers but also of revealing the implications and scope of the new dynamic competitiveness paradigm.

In the present case, the objective is to understand the dynamic of Peru and its competitors in a major importing country (figure 1: United States, Netherlands, Spain and the United Kingdom) and grasp strategic changes in trade prices and volumes, with the construction of a TradeCAN competitiveness matrix as developed by the Economic Commission for Latin America and the Caribbean (ECLAC) and already used in other studies (Dussel, 2001; Clemente, 2001; Toro and Ruiz, 2005; Matesanz and Sánchez Díez, 2005; Romo Murillo, 2007; Ponce, Contreras and Vásquez, 2007; Sánchez Díez and Villalobos Álvarez, 2010). To measure a country's competitiveness for a product, two variables are related,

FIGURE 3

Peru: dissimilarity of trade policies at the leading firms studied[a]



Source: prepared by the authors on the basis of data from the Office of the National Superintendent of Customs and Tax Administration (SUNAT) of Peru.

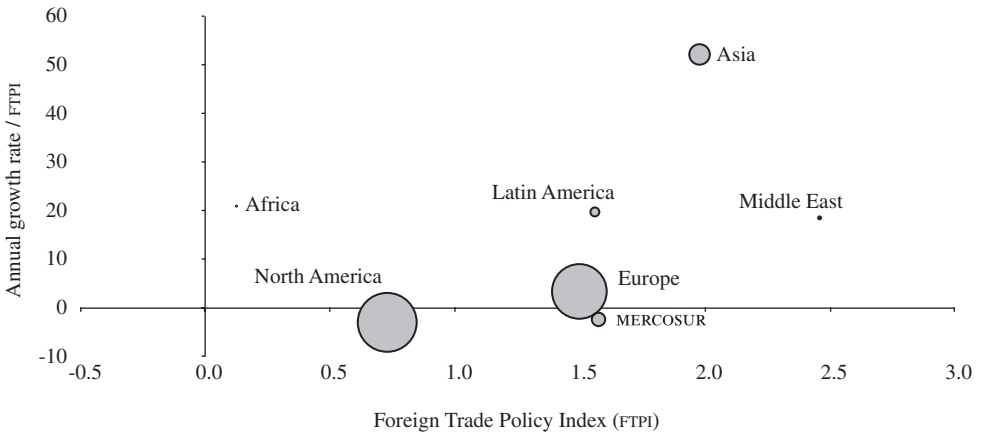
[a] The chart was constructed using the "hclust" function of the R statistics program. The vertical axis shows the height at which the clusters are grouped. The horizontal axis shows the number of clusters using the UPGMA or "average" method.

[b] The "height" variable represents the distance calculated using the UPGMA method at which the different elements and then the different groups formed come together. This is expressed by the values 0.6, 0.8 and 1.0, which are relative references, with 1.0 being the maximum cluster distance and 0.6 being 60% of the maximum distance. These values give a visual idea of the scale of the distances at which clustering takes place.

FIGURE 4

Beta Agroindustrial Complex: trade policy trend, 2004-2012

(Percentages)

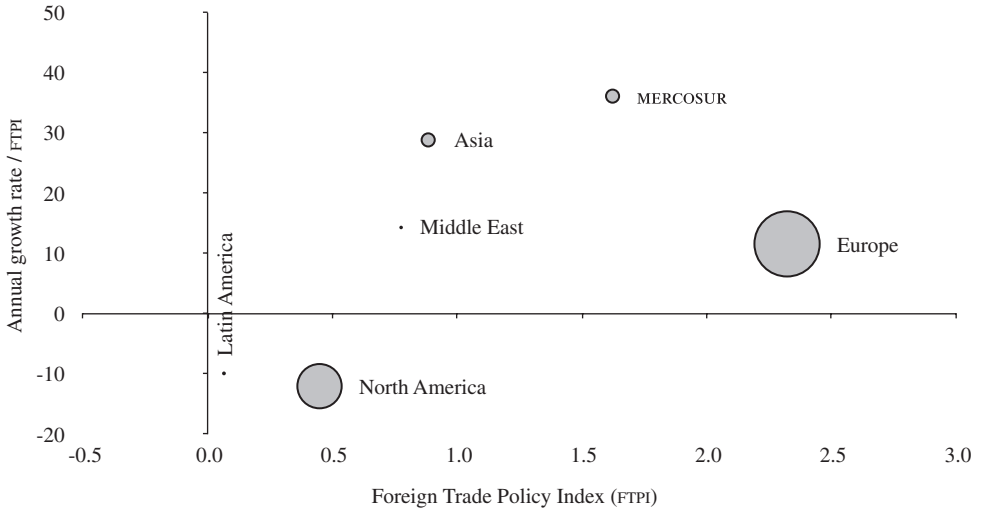


Source: prepared by the authors on the basis of data from the Office of the National Superintendent of Customs and Tax Administration (SUNAT) of Peru.

Note: circle size indicates the value of exports in 2012.

FIGURE 5

Camposol: trade policy trend, 2004-2012
(Percentages)



Source: prepared by the authors on the basis of data from the Office of the National Superintendent of Customs and Tax Administration (SUNAT) of Peru.

Note: circle size indicates the value of exports in 2012.

the exogenous factor and the endogenous one. The first of these (the exogenous factor) concerns changes in the international market, while the second (the endogenous factor) relates to each country's ability to respond to alterations in the first variable, either by increasing or reducing exports, depending on the product dynamic. The matrix on the horizontal (X) axis measures the behaviour of the first factor, while the second factor is measured on the vertical (Y) axis. The ratio between these two variables allows four different situations to be distinguished: rising stars, declining stars, retreats, and missed opportunities.

(b) *The United States*

This is a market dependent on imports because of declining local production and rising consumption. Mexican asparagus, as a "rising star", dominates the supply year-round (see figures 6 and 7). Mexico's trade is 58% of the international supply by volume for the year in the first semester and up to 42% during the second. Mexico sells 20% of its asparagus in the second semester, while asparagus represents 80% of Peruvian shipments in that period.

In Peru, there has to be pressure for higher asparagus export prices on cost, insurance and freight (CIF) terms because dollar costs have been rising as the local currency has strengthened (see figure 2), by contrast with Mexico (see figures 8 and 9). While the price outlook for Mexican asparagus is different, Peru has a growing need to diversify its markets.

Prices are usually higher in the second half than in the first (see table 11), particularly export logistics costs, with commercialization and brokerage costs holding steady. This explains why the retail or consumer price in the United States does not increase in proportion to the rise in export or prices FOB, something that derives from the problem of Peru's exchange rate and its repercussions for dollar costs.

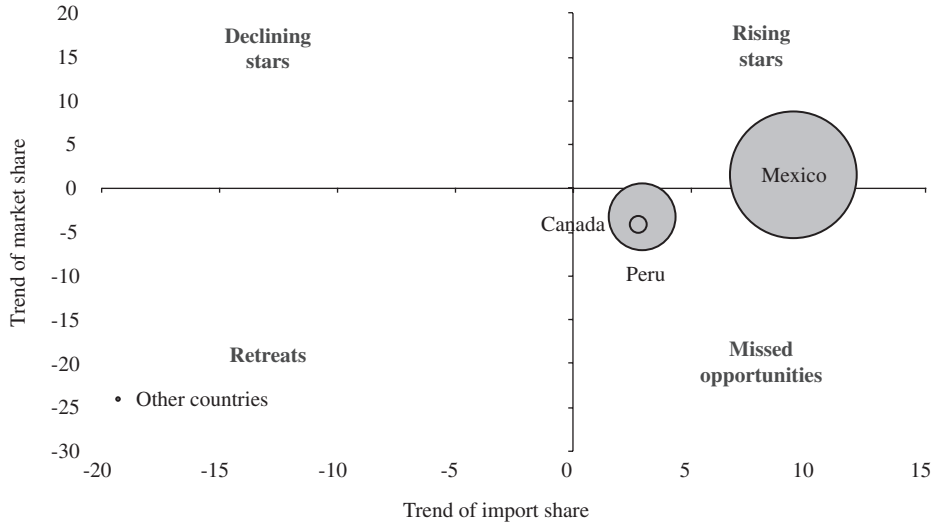
(c) *The Netherlands*

In 2012, 55% of the year's imports were made in the first half and 45% in the second. Purchase volumes trended downward in the first period, falling by 11.2% a year from 2008 to 2012. Local asparagus production takes place between April and July, and the trend is positive, as output rose from 14,000 to 17,000 tons in the period analysed, which accounts for the slowdown of imports in the first half.

The market share of Greek asparagus, once 12%, is now down to 1%, while by 2012 the German share was down from 57% to 3%, with sales being reoriented towards the Swiss market for the early and central part

FIGURE 6

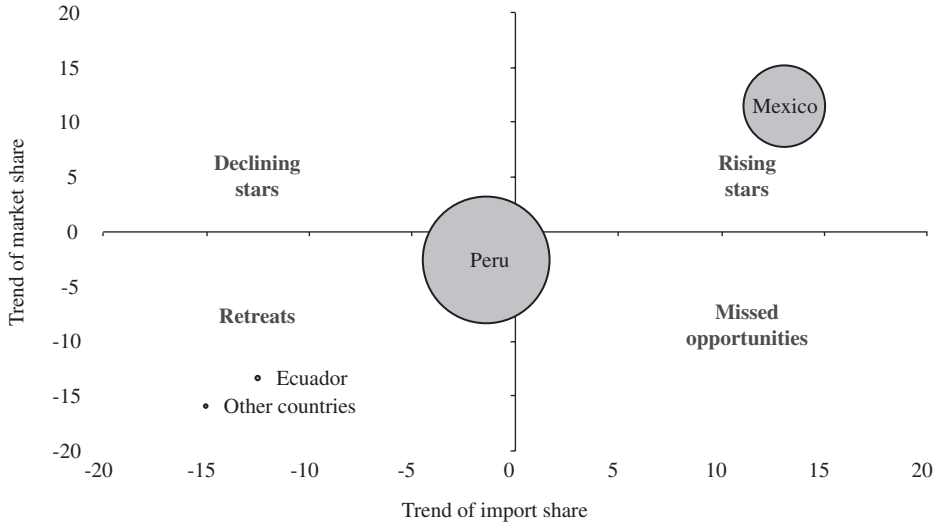
United States: TradeCAN matrix for first-half imports, 2008-2012
(Percentages)



Source: prepared by the authors on the basis of data from the International Trade Centre (ITC) and the United Nations Commodity Trade Statistics Database (COMTRADE).

FIGURE 7

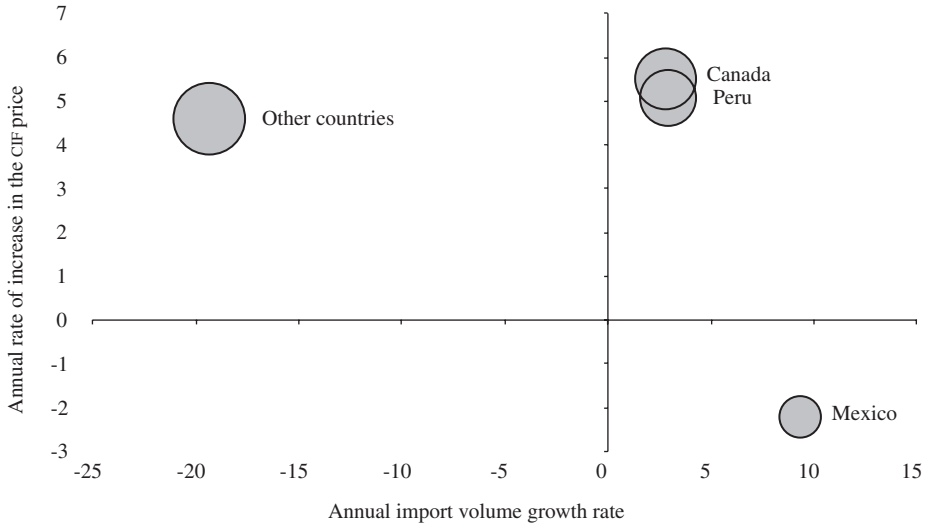
United States: TradeCAN matrix for second-half imports, 2008-2012
(Percentages)



Source: prepared by the authors on the basis of data from the International Trade Centre (ITC) and the United Nations Commodity Trade Statistics Database (COMTRADE).

FIGURE 8

United States: trade analysis for first-half imports, 2008-2012
(Percentages)

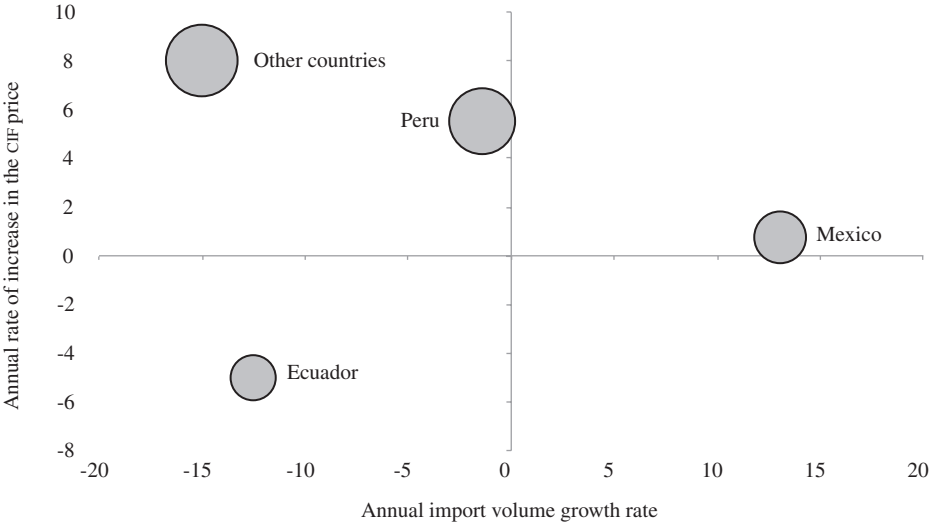


Source: prepared by the authors on the basis of data from the International Trade Centre (ITC) and the United Nations Commodity Trade Statistics Database (COMTRADE).

CIF: cost, insurance and freight.

FIGURE 9

United States: trade analysis for second-half imports, 2008-2012
(Percentages)



Source: prepared by the authors on the basis of data from the International Trade Centre (ITC) and the United Nations Commodity Trade Statistics Database (COMTRADE).

CIF: cost, insurance and freight.

TABLE 11

United States: trade prices for Peruvian asparagus. 2008-2012
(Dollars per kilogram)

July to December	2008	2009	2010	2011	2012	Annual change (*percentages*)
Price FOB in Peru	1.79	1.80	2.48	2.18	2.67	6.5
- Logistics	0.84	0.86	0.94	1.02	1.01	3.5
CIF price in United States	2.62	2.65	3.42	3.20	3.69	5.6
- Commercialization	3.46	2.80	2.36	3.09	3.01	-1.2
Retail price in United States	6.09	5.46	5.77	6.28	6.70	2.1
January to June	2008	2009	2010	2011	2012	Annual change (*percentages*)
Price FOB in Peru	1.94	1.94	1.93	2.07	2.74	5.2
- Logistics	0.71	0.72	0.83	0.90	0.92	4.7
CIF price in United States	2.65	2.66	2.76	2.97	3.66	5.1
- Commercialization	2.88	2.59	2.63	3.17	2.66	0.3
Retail price in United States	5.54	5.25	5.38	6.14	6.32	2.7

Source: prepared by the authors on the basis of data from the Office of the National Superintendent of Customs and Tax Administration (SUNAT) of Peru. the United States Department of Agriculture and the United Nations Commodity Trade Statistics Database (COMTRADE).

CIF: cost. insurance and freight.
FOB: free on board.

of the harvesting period. This gap in the first half has been filled by asparagus from Mexico and Peru, which explains their position as "rising stars", while Germany and Greece are "retreats" (see figure 10).

For the second half, the average annual rate of supply growth in the period from 2008 to 2012 was 5.7%, a contrast to the early months of the year. Peru dominates the second part of the year with a 93% market share. Otherwise, there have been small changes in suppliers, such as the growth of Germany and Spain, which have been positioning themselves as "rising stars" for the later part of their harvest, displacing sales from Thailand and other countries, particularly the United Kingdom and Belgium, which are now "retreats" (see figure 11).

In the first half, sales in Germany and Greece are associated with a more selective supply and higher prices (see figure 12), while the rising sales of Mexico and Peru are not associated with any substantial increase in prices, which rose by 1.6% and 1% a year, respectively.

In the second half, however, Peru, Germany and Spain can all show higher CIF prices (see figure 13).

The increase in the CIF price for Peruvian asparagus imported into the Netherlands is mainly accounted for by rising international logistics costs in both the first and second halves, owing to rising prices FOB origin (see table 12).

(d) *Spain*

Asparagus produced in Spain is harvested in the first half, with volume increasing from 44,000 to 58,000 tons between 2008 and 2011. Imports into this market by volume are divided equally between the first and second halves, although consumption is higher from January to June because of local production. Purchases from Morocco, Mexico and the Netherlands take place in the early part of the year, while Peru ships 41% of its sales from January to June. Mexico and the Netherlands are the "rising stars" in this period, while Morocco is a "retreat" (see figure 14).

All consumption in the second half is about imported asparagus, and Peru sends 59% of its annual shipments in this period, with a market share of 97% by value, while Ecuador's small sales make it a "rising star", filling the gap left by the "retreat" of Morocco and France (see figure 15).

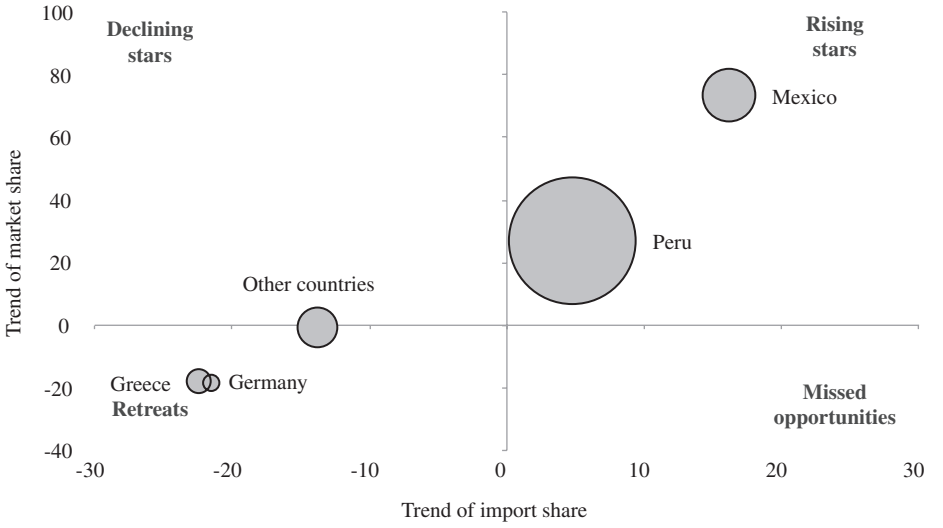
The trading strategy is a policy of price adjustment in the first half (see figure 16), although this is more the case of asparagus sold from the Netherlands than for Mexican asparagus.

The improved position of Peru is explained by the increase in prices and thence in turnover, with only a small increase in volume. This explains why the CIF price rose at an average annual rate of 2.6% (see figure 17), driven by the rise in domestic costs as the real exchange rate of the Peruvian currency against the United States dollar strengthened. The rising price of asparagus imported from Peru is very likely to be acting as a constraint on second-half sales growth, explaining why sales volumes held steady between 2008 and 2012.

In summary, the CIF price of Peruvian asparagus in Spain in the first half has tended to rise owing to the combination of a higher price FOB and rising international

FIGURE 10

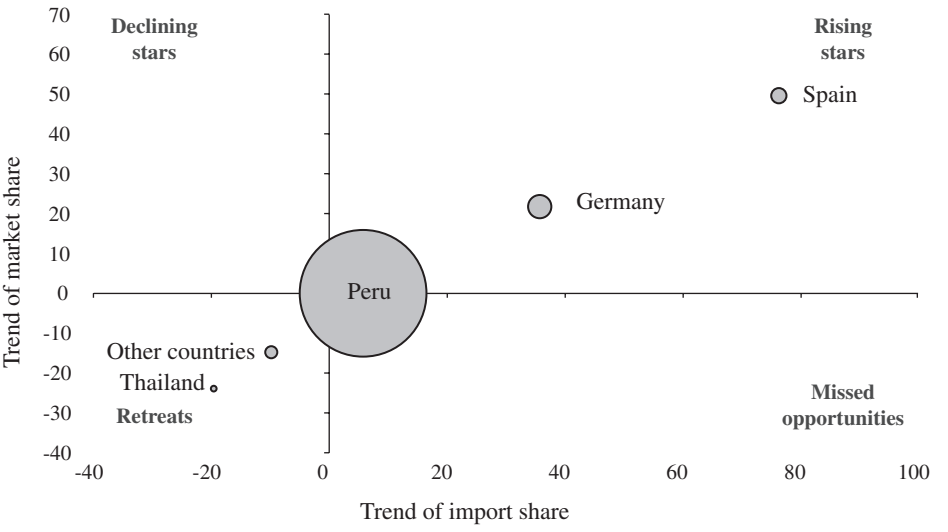
Netherlands: TradeCAN matrix for first-half imports, 2008-2012
(Percentages)



Source: prepared by the authors on the basis of data from the International Trade Centre (ITC) and the United Nations Commodity Trade Statistics Database (COMTRADE).

FIGURE 11

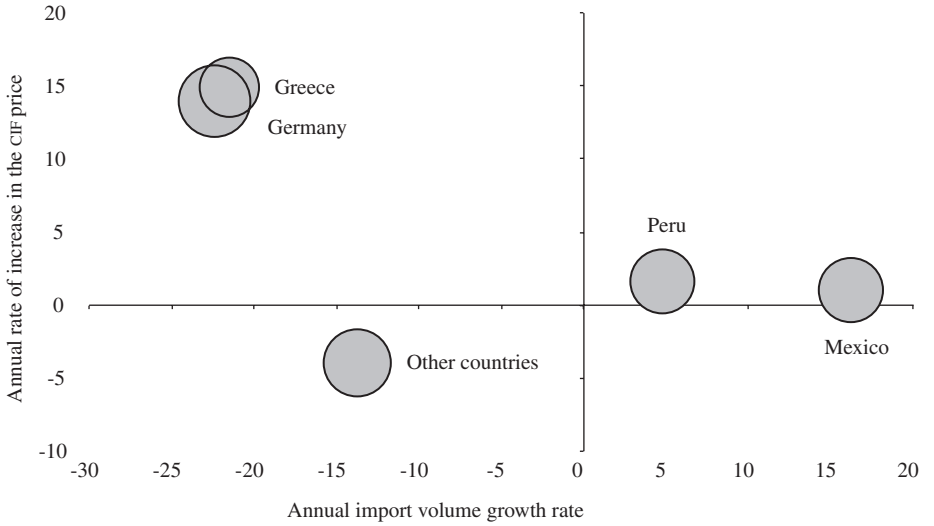
Netherlands: TradeCAN matrix for second-half imports, 2008-2012
(Percentages)



Source: prepared by the authors on the basis of data from the International Trade Centre (ITC) and the United Nations Commodity Trade Statistics Database (COMTRADE).

FIGURE 12

Netherlands: trade analysis for first-half imports, 2008-2012
(Percentages)

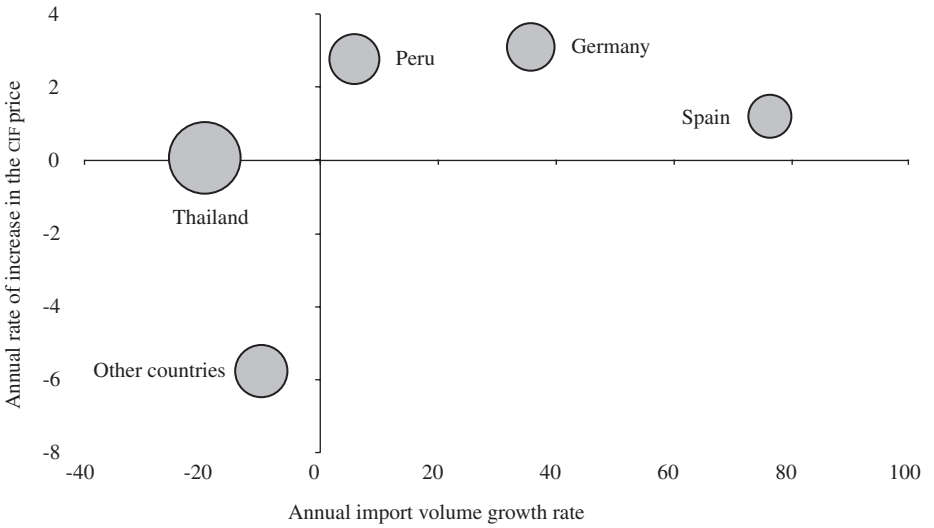


Source: prepared by the authors on the basis of data from the International Trade Centre (ITC) and the United Nations Commodity Trade Statistics Database (COMTRADE).

CIF: cost, insurance and freight.

FIGURE 13

Netherlands: trade analysis for second-half imports, 2008-2012
(Percentages)



Source: prepared by the authors on the basis of data from the International Trade Centre (ITC) and the United Nations Commodity Trade Statistics Database (COMTRADE).

CIF: cost, insurance and freight.

TABLE 12

Netherlands: trade prices for Peruvian asparagus, 2008-2012
(Dollars per kilogram)

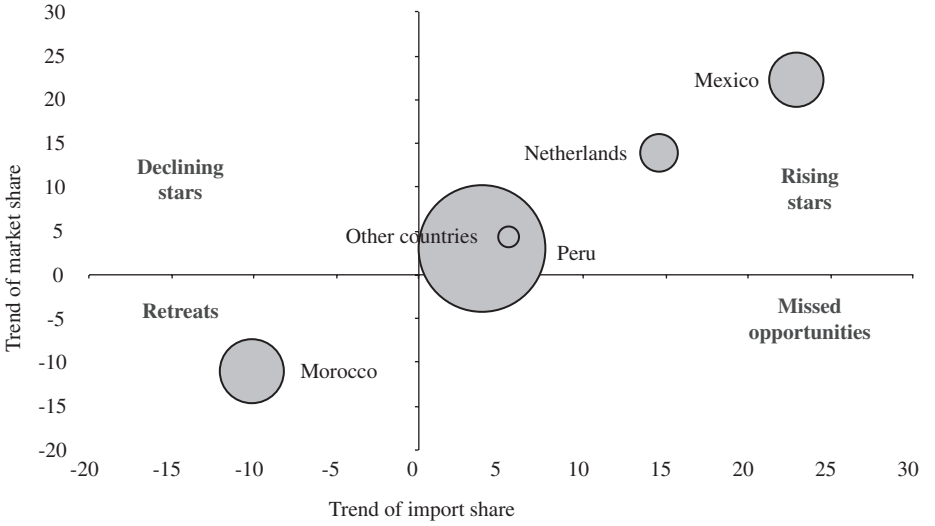
July to December	2008	2009	2010	2011	2012	Annual change (*percentages*)
Price FOB in Peru	3.05	2.99	3.44	3.21	3.25	1.2
- Logistics	1.06	1.01	1.29	1.23	1.64	7.3
CIF price in Netherlands	4.11	4.00	4.73	4.44	4.88	2.8
January to June	2008	2009	2010	2011	2012	Annual change (*percentages*)
Price FOB in Peru	3.35	3.16	3.35	3.42	3.20	-0.1
- Logistics	0.79	0.88	0.82	1.12	1.25	8.0
CIF price in Netherlands	4.14	4.04	4.17	4.54	4.45	1.6

Source: prepared by the authors on the basis of data from the Office of the National Superintendent of Customs and Tax Administration (COMERCIO) of Peru, the United States Department of Agriculture and the United Nations Commodity Trade Statistics Database (COMTRADE).

CIF: cost, insurance and freight.
FOB: free on board.

FIGURE 14

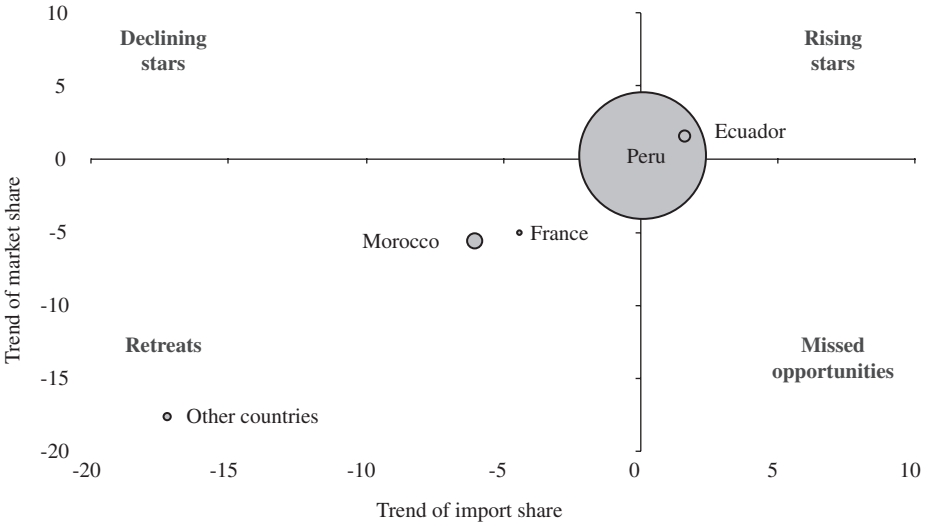
Spain: TradeCAN matrix for first-half imports, 2008-2012
(Percentages)



Source: prepared by the authors on the basis of data from the International Trade Centre (ITC) and the United Nations Commodity Trade Statistics Database (COMTRADE).

FIGURE 15

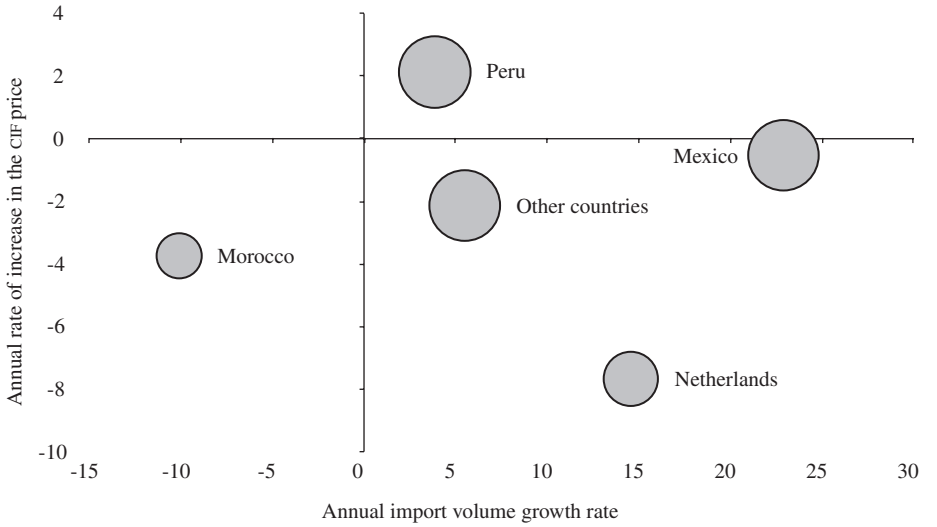
Spain: TradeCAN matrix for second-half imports, 2008-2012
(Percentages)



Source: prepared by the authors on the basis of data from the International Trade Centre (ITC) and the United Nations Commodity Trade Statistics Database (COMTRADE).

FIGURE 16

Spain: trade analysis for first-half imports, 2008-2012
(Percentages)

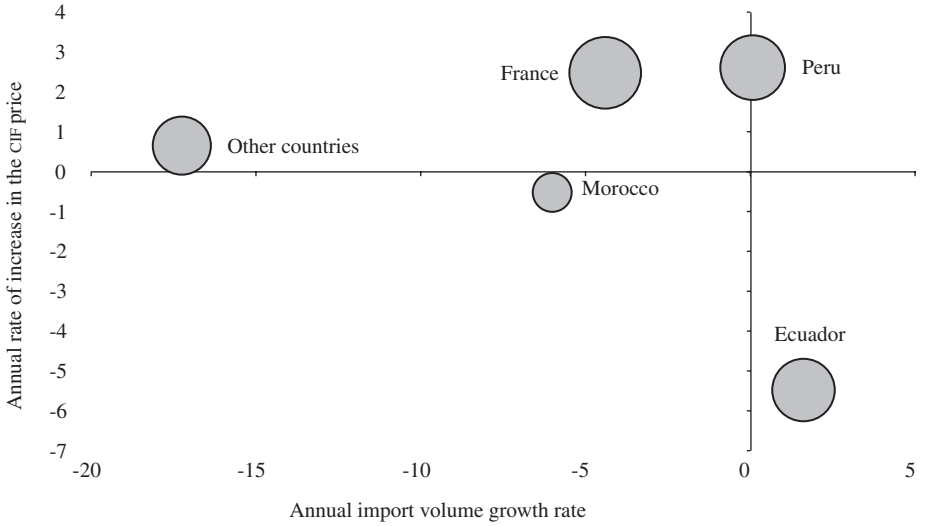


Source: prepared by the authors on the basis of data from the International Trade Centre (ITC) and the United Nations Commodity Trade Statistics Database (COMTRADE).

CIF: cost, insurance and freight.

FIGURE 17

Spain: trade analysis for second-half imports, 2008-2012
(Percentages)



Source: prepared by the authors on the basis of data from the International Trade Centre (ITC) and the United Nations Commodity Trade Statistics Database (COMTRADE).

CIF: cost, insurance and freight.

logistics costs. In the second half, however, the change in the CIF price is accounted for by the higher price FOB alone (see table 13).

(e) *United Kingdom*

The health benefits of consuming vegetables, particularly asparagus for diabetics,[3] have strongly supported consumption in the United Kingdom. Some 46% of annual imports fall in the January to June period (supplemented by the local supply from April to June, with local production increasing from 32,000 to 51,000 tons between 2008 and 2011), with the other 54% falling between July and December.

While 98% of Mexico's annual sales in this market is made in the first half, the figure for Peru is 30%, with the other 70% being made from July to December. Mexico is once again a "rising star", along with Italy, in the first half (see figure 18) because of rising sales, while Spain and Peru are in "retreat".

The second half is dominated by shipments from Peru, while the small supply from the Netherlands (whose origin is unknown) makes it a "rising star" occupying the gap left by the "retreat" of Kenya and Thailand (see figure 19).

In the first half, Peru's "retreat" is explained by its objective of obtaining better selling prices FOB, while Italy has become a "rising star" with its policy of lower prices (see figure 20).

Spain has been in "retreat" from January to June, with both lower volumes and falling prices. Kenya in the second half is in much the same position as Spain in the first, while Thailand has been obtaining better prices FOB for a smaller volume, even as the "rising star" that is the Netherlands has increased both volume and prices (see figure 21).

Peru's second-half CIF prices have also been improved, and this increase is a factor that may well account for the stability of consumption in the United Kingdom.

By contrast with the United States market, one peculiarity of the United Kingdom is that the increase in the CIF price of Peruvian asparagus imports has been mainly due to the rise in international logistics costs in both the first and second halves, owing to the rise in the FOB origin price (see table 14). In general terms, the strengthening of the pound sterling and euro against the dollar has also helped to absorb some of the increase in dollar-denominated domestic costs in the period analysed.

[3] See [online] http://www.dailymail.co.uk/health/article-2236322/Asparagus--trendy-vegetable-fights-diabetes.html.

TABLE 13

Spain: trade prices for Peruvian asparagus, 2008-2012
(Dollars per kilogram)

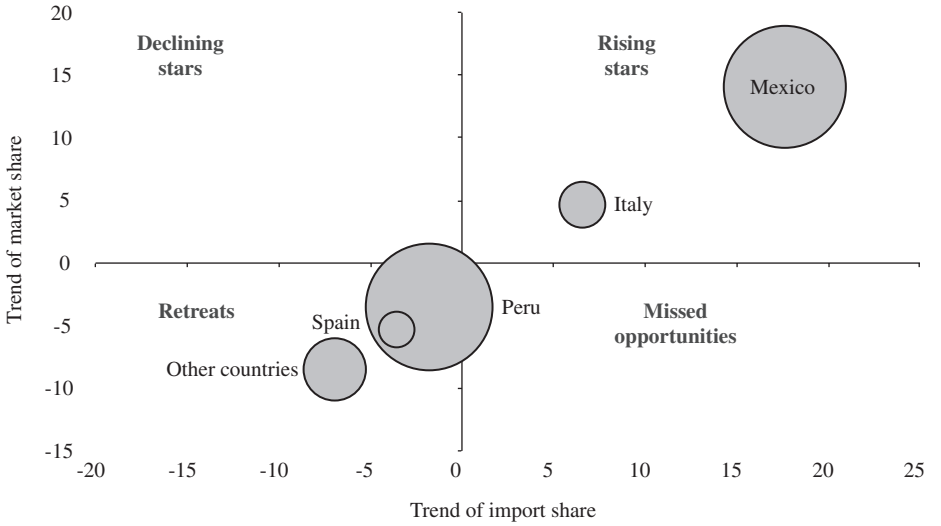
July to December	2008	2009	2010	2011	2012	Annual change (*percentages*)
Price FOB in Peru	1.97	2.09	2.64	2.39	2.89	5.8
- Logistics	2.13	1.97	1.58	2.01	1.95	-1.0
CIF price in Spain	4.10	4.06	4.23	4.40	4.84	2.6
January to June	2008	2009	2010	2011	2012	Annual change (*percentages*)
Price FOB in Peru	2.10	2.12	2.14	2.27	2.63	3.4
- Logistics	1.89	1.71	3.10	3.31	3.36	12.1
CIF price in Spain	3.99	3.83	5.24	5.58	5.99	7.8

Source: prepared by the authors on the basis of data from the Office of the National Superintendent of Customs and Tax Administration (SUNAT) of Peru, the United States Department of Agriculture and the United Nations Commodity Trade Statistics Database (COMTRADE).

CIF: cost, insurance and freight.
FOB: free on board.

FIGURE 18

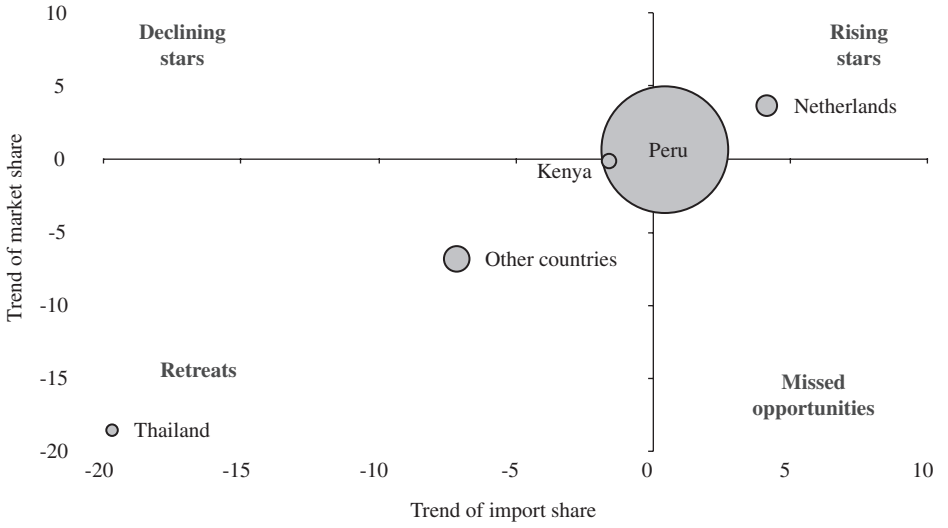
United Kingdom: TradeCAN matrix for first-half imports, 2008-2012
(Percentages)



Source: prepared by the authors on the basis of data from the International Trade Centre (ITC) and the United Nations Commodity Trade Statistics Database (COMTRADE).

FIGURE 19

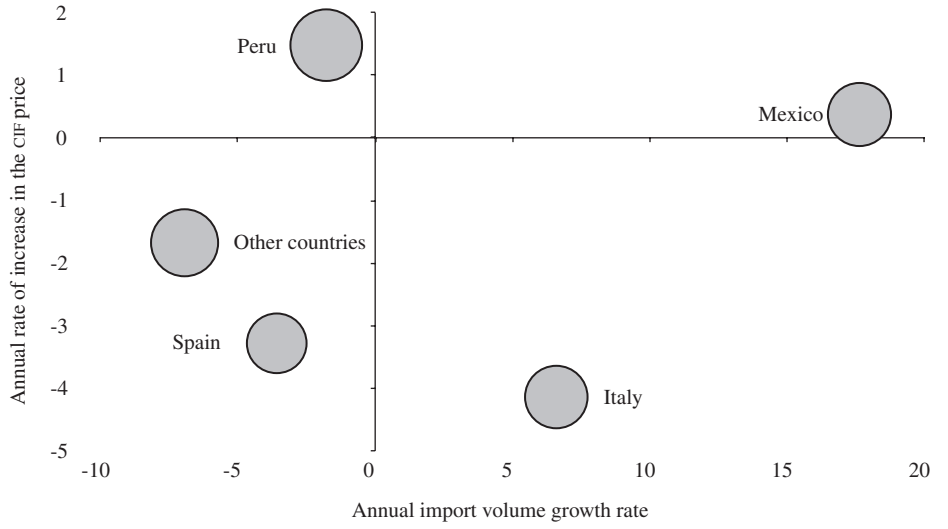
United Kingdom: TradeCAN matrix for second-half imports, 2008-2012
(Percentages)



Source: prepared by the authors on the basis of data from the International Trade Centre (ITC) and the United Nations Commodity Trade Statistics Database (COMTRADE).

FIGURE 20

United Kingdom: trade analysis for first-half imports, 2008-2012
(Percentages)

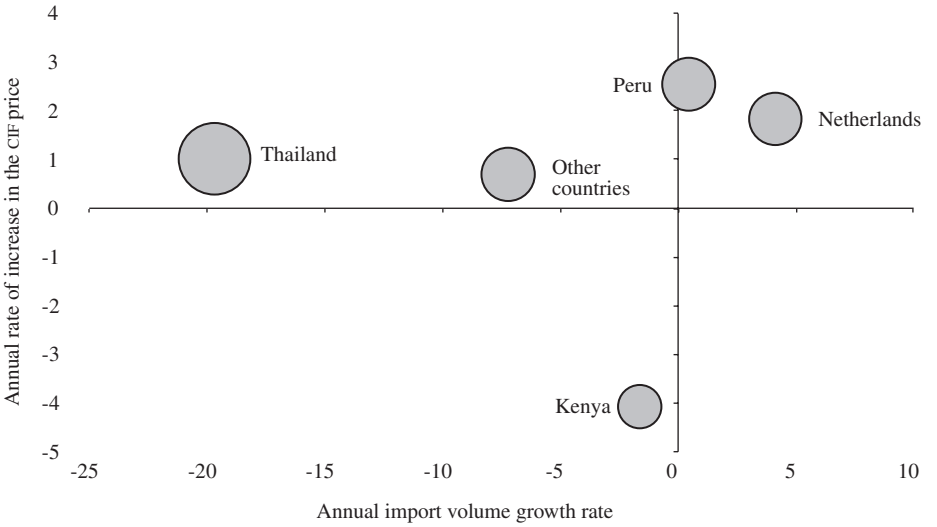


Source: prepared by the authors on the basis of data from the International Trade Centre (ITC) and the United Nations Commodity Trade Statistics Database (COMTRADE).

CIF: cost, insurance and freight.

FIGURE 21

United Kingdom: trade analysis for second-half imports, 2008-2012
(Percentages)



Source: prepared by the authors on the basis of data from the International Trade Centre (ITC) and the United Nations Commodity Trade Statistics Database (COMTRADE).

CIF: cost, insurance and freight.

TABLE 14

United Kingdom: trade prices for Peruvian asparagus, 2008-2012
(Dollars per kilogram)

July to December	2008	2009	2010	2011	2012	Annual change (*percentages*)
Price FOB in Peru	2.93	3.17	3.60	3.19	3.16	0.9
- Logistics	1.77	1.81	1.78	2.33	2.33	5.3
CIF price in United Kingdom	4.70	4.98	5.38	5.52	5.49	2.5
January to June	2008	2009	2010	2011	2012	Annual change (*percentages*)
Price FOB in Peru	3.58	3.19	3.09	3.40	3.11	-1.3
- Logistics	1.85	1.92	2.15	2.18	2.88	7.0
CIF price in United Kingdom	5.43	5.11	5.24	5.58	5.99	1.8

Source: prepared by the authors on the basis of data from the Office of the National Superintendent of Customs and Tax Administration (SUNAT) of Peru, the United States Department of Agriculture and the United Nations Commodity Trade Statistics Database (COMTRADE).

CIF: cost, insurance and freight.
FOB: free on board.

V
Conclusions

Peru has been the unchallenged global leader in asparagus exports in recent years. Its export destinations have been tending to diversify, although sales to the United States still predominate, albeit with a negative trend (see figure 1).

The changes detected in the international trade position of Peruvian asparagus have been very important, providing the basis for a new model known as a complex adaptive system forming part of the fifth technological revolution.

In the first place, there is structural atomization, with a low level of economic concentration (see table 7), particularly in the case of asparagus exports to the United States and Europe, the main trading destinations. The atomization of the export sector is due to the increase in the number of firms (see table 9) and the declining market share of the leading firms, which have been diversifying into other exportable products (table grapes, avocados, pomegranates and blueberries), Camposol is an example. Studying importers also reveals this process of atomization (see table 8) in seaborne cargoes, particularly for sales to the United States market. This can also be seen in the case study dealing with fruit exports from Chile.

Another issue that arises is the dissimilarity of the main exporters' trade policies (see figure 3), which bears out the segmented market paradigm. Structural atomization and dissimilarity in trade policies are elements that support the notion of a complex adaptive system and, with it, a novel process of adaptation to changes in world trade as a characteristic of this new technological revolution.

The competition for Peru comes from Mexican asparagus, a "rising star" (see figure 18) in a number of countries in the first half of the year, examples being the United Kingdom, the Netherlands (see figure 10) and Spain (see figure 14), and all year round in the United States (see figures 6 and 7), one factor in this being the exchange rate of the Mexican peso against the United States dollar (see figure 2).

The bulk of Peru's sales is made in the second half. Sales growth has tailed off in Spain (see figure 17), while the country has some small but growing competitors in the Netherlands (see figure 13: Germany and Spain) and the United Kingdom (see figure 21: Netherlands).

The market dynamic, competition from Mexico, rising logistics costs, exchange-rate movements and the dissimilarity of exporters' trade policies show that in this complex adaptive system, there have been a need to take ever more and better decisions, and that timely, strategic information is a key factor. Even climate change is increasingly influencing the asparagus business in both producing and consuming areas, whether owing to temperatures or to patterns of rainfall or drought. Unquestionably, one constraint on Peru's asparagus model, besides short-term climate factors, is the availability of water, despite public policies on infrastructure for improving irrigation systems.

In the face of these challenges, it is worth mentioning that there are institutions which are making efforts to innovate technologically, but are acting in isolation and not visualizing the need to do so throughout the chain. However, the National Agricultural Innovation Institute (INIA) is the body that heads the National Agricultural Innovation System (SNIA), and public policies should therefore be designed to strengthen it, with private-sector participation being vital to prioritize actions and resource usage. Although there are successful cases of teamwork between the public and private sectors, examples being the Peruvian Asparagus and Vegetables Institute, the Frío Aéreo civil partnership and consultants specializing in logistics and quality control, these all being bodies that work with the new paradigm of flexible, strategic information and knowledge, there is still work to be done on sectoral linkage and on the development of markets such as Germany and Japan. Trade agreements are another important public policy achievement, with sights now set in China and India.

Complementary application of modern methodologies, developed particularly in the fifth technological revolution to study the Peruvian asparagus model and thereby guide strategic decision-making in the sector, is proving to be an efficacious, efficient and effective tool. These methodologies are succeeding in measuring what they are designed to measure and delivering results based on accessible international trade data, although perhaps the firm-level detail indicates that not all countries are taking the trouble to prepare them, making it difficult to carry out a disaggregated analysis exporter by the exporter. These methodologies

are making an important contribution of up-to-date knowledge that is necessary for understanding the changes and adaptation processes in international trade that are most closely linked to competitiveness, given how dynamic and complex this is. This methodological package consists of the FTCI, which can be used to examine exports of a product (i.e., the FTPI, which serves to put a value on changes in exporters' sales), and the TradeCAN competitiveness matrix for researching imports of a product in a particular market, with competition being assessed via changes in sales volumes and prices.

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The forestry and cellulose sector in the Province of Concepción, Chile: Production linkages between the Secano Interior and industry in Greater Concepción, or an enclave economy?

Gonzalo Falabella and Francisco Gatica

ABSTRACT

This article deals with the interaction between supply chains and territory, identifying two types of development: the "enclave" type of the rain-fed farming economy in the inland area known as the Secano Interior, and the "potential linkage" between this enclave and the greater metropolitan area of Concepción. The benefits of the forestry and cellulose supply chain, which is of global importance, are not spreading through its territory, which remains underdeveloped. Greater Concepción, the country's second most important industrial conurbation, has not succeeded in establishing a positive connection with its hinterland via its economic networks or with the forestry and cellulose chain of the Secano Interior. This article is based on economic flow data from the 2008 input-output matrix, on surveys carried out as part of a National Fund for Regional Development project (FNDR, 2008) and on studies of Chile and its development types (Falabella, 2000 and 2002). It argues for a need to create a territorial political platform for economic development to facilitate the restoration of production linkages.

KEYWORDS

Economic development, regional development, forestry industry, pulp and paper industry, industrial development, industrial statistics, input-output analysis, Chile

JEL CLASSIFICATION

O18, O38, O43

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I
Introduction[1]

The descriptive title of this article is the question from which the present investigation starts out. It discusses the difference between, on the one hand, the combined hegemonic capacity for joint development of the greater metropolitan area and industry of Concepción and the forestry and cellulose chain; or, conversely, the breaking of this link. The implication of the latter is enclave development in the forestry and cellulose industry, with all its consequences for the Secano Interior of the Bío-Bío Region, and a lack of positive linkages between this enclave and the industrial development of the conurbation. This is a central issue for regional development and, by analogy, that of the whole country.

Prior to 1973, the forestry and cellulose chain had not attained the higher economic level that would come later with the help of privatization, export orientation and production development (reforestation and forestry outsourcing without collective bargaining rights, among other things).[2] These public policies did not, however, bring about the kind of synergistic regional development that could nurture basic industry (coal, oil, steel and cellulose) and domestic consumption (textiles, metallurgy, glass and cement) and the exploitation of low-cost natural resources (forestry, fisheries and agriculture) in a manner combining State and private ownership.[3]

The upheaval after 1973 led in the territory to a shift away from a situation of linked development in a number of sectors to one of rapid growth in the forestry and cellulose chain, in the so-called productive restructuring process (Rojas, 1995), which drastically altered the region's economic geography.

The immediate prospect is for the development, successful as far as it goes, of the forestry and cellulose sectors. However, this leaves open the question as to whether what is taking place is development tied via positive production linkages to the greater metropolitan area, or rather the diagnosis must once again be of an "enclave" where the chain tends to outsource routine work locally or purchase low-complexity inputs, creating few positive spillovers for the surrounding area.

Regional actors are unable to "think regionally" (Rojas, 2002), which limits the scope for joint development. Why? Because of the shift from a developmentalist State and actors to one that is more concerned with the success of each chain, in a new liberal export-led model.

The failure in the process has been the inability of the greater metropolitan area to exploit opportunities to develop its many well-consolidated forward, backward and sideways linkages. This is especially so as regards the Hualpencillo-Talcahuano steel and metallurgy sector and the potential for the region's universities and State public policy to provide science and technology support, even though funding from the Production Development Corporation (CORFO) and the National Fund for Regional Development (FNDR)[4] was brought under exclusive regional control, by contrast with the situation in the rest of the country. Examples are Innova Bío-Bío and the Regional Council for Science and Technology (CORECYT), which have served as models for the rest of the country (OECD, 2010).

Later studies have highlighted the expansion and "Chilenization" of the forestry and cellulose chain exporting chips and timber for building, but without the metallurgical production linkages of the Brazilian cellulose industry, although Bercovich and Katz (2003) state in their study that the Chilean chain is the next most dynamic in the Latin America region.

Why is Chile presented as being second only to Brazil in regional development, but far from having the continuous linkages of the Brazilian forestry sector?

This question and its analysis point to two factors influencing Chilean forestry development: (i) State encouragement for privatization and exporting, combined with an expanding global market, and (ii) the absence

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[2] Nacimiento has a world-class forestry complex, but is relatively underdeveloped. See Galdames, Menéndez and Yévenes (2001).

[3] An interesting review of the different models of industrialization and a century of Chilean public policy can be found in Meller (1998). There is a type of urban and social development that is directly linked to the import substitution model. The paradigmatic case of "production hubs" is that of the Huachipato Steel Company and its network of interconnected firms. This structure changes significantly with the shift from an industrialization model to an export-centred one. In this context, the emergence of export fishery and forestry activities in the Bío-Bío Region entailed the destruction of import substitution firms, enmeshed as they were in the local economic fabric (Rojas, 1995).

[4] See FNDR (2008).

in Chile, unlike Brazil, of encouragement for import substitution subsequent to the military coup. In addition, the binomial political system in operation since the dictatorship creates deadlock between the Government and the opposition in Congress, with the result that it has been possible to expand external trade liberalization under numerous free trade treaties, but governance has become more and more fragile.

In summary: an economy that has been almost entirely export-led, resulting in the destruction of import substitution industry and a failure to achieve more complex and varied development of a national forestry industry, and a "deadlocked" political system that has entrenched the current growth model.

The study by Bercovich and Katz (2003) gives preference to Brazil over Chile because of the absence in the latter of a cellulose industry with its own industrial base, something that was developed in Brazil. In Chile, the primary forestry chain was expanded with the development of a light wood construction industry (boards, panels, laminates, etc.) and a cellulose industry. But this is an imported industrial base rather than a locally developed one as in Brazil, and is furthermore serviced from abroad.

The contention of the present study, which goes beyond the scope of this report in terms of the data dealt with, is that between the principal chains of the greater metropolitan area and the forestry-cellulose-light wood manufacturing chain, notwithstanding the existence of well-developed universities and a regional government with resources of its own (Falabella, 2002), the situation is not so much one of joint development as one of parallel growth with few positive regional development partnerships between chains, government and universities.

The political authorities in the territory where the forestry sector is located have organized into the Association of Municipalities for Local Economic Development (AMDEL), with a membership of six communes. These are seeking to approach the region on a territorial basis, and need to link up with Greater Concepción, their immediate neighbour, to achieve their own development (Gatica, 2008). However, this requires a matching commitment from the regional government, the universities and the industrial conurbation of Greater Concepción and a willingness by the two leading firms in the forestry and cellulose sectors to move away from their enclave situation.

This article highlights the gap in the development required in a major industrial sector in Chile (exemplified by the case of the Bío-Bío Region) if it is to transcend its enclave development of natural resources. New processes based on information and communication technologies (ICTs), which are mainly concentrated in the Metropolitan Region, point up the lack of similar economic linkages.[5] Otherwise, there have only been initial advances with export value added (Muñoz, 2002), something that has historical roots (Cardoso and Faletto, 1979; Fanjzylber, 1990) and is still widespread in Latin America (ECLAC, 2012; Ocampo, 2013).

[5] Current hypothesis of the authors: FONDECYT project No. 1130296 on the still weak associated development of information and communication technology (ICT) sectors with the other chains in the Metropolitan Region, on the basis of preliminary data from 70 firms and the input-output matrix, particularly the total intermediate use quadrant.

II

Is the development of the Bío-Bío Region being led by Greater Concepción?

1. Exports

Overall, the Bío-Bío Region has a highly concentrated exporting structure, one in which innovation has focused on bringing increased efficiency to existing chains by achieving greater economies of scale, without there being any significant diversification of the export basket.

In 2010, the forestry sector accounted for 77% of the main products exported by the region's industry. Other products were not exported in significant volumes and only accounted for 23% of the total. This reflects a sectorally concentrated export structure, a situation that has remained structurally unchanged for the last 20 years.

Again, although the Bío-Bío Region has been losing competitiveness, as it accounts for just 7.2% of the country's gross domestic product (GDP) while the Metropolitan Region generates 43.6%, a number of diagnoses have confirmed the existence of several science and technology hubs in the region, which also has advanced human capital (CEUR, 2010). However, this knowledge has not shifted the region's natural resource-intensive production towards an economic structure with greater innovation and knowledge that is capable of stimulating higher growth and lowering the unemployment rate.

If consumption of logs is taken (see table 1), the forestry sector of the Bío-Bío Region accounts for 57.2 % of the national total, with 76% of regional volume being generated by cellulose pulp (40%) and sawn timber (36%). When the percentages are compared with the 2004 figures, pulp turns out to have increased its share while sawn timber has undergone a substantial 16 percentage point drop. Thus, a "productive reorganization" has been taking place in the sector, with the production of cellulose, chips (deriving from pulp production and including high-quality native timber chips for making fine paper) and boards rising, while the shares of saw and pulp logs for export, cases and posts and poles have been falling. The region's contribution to the country's production of cases and poles is smaller, being of the order of 18.8% and 33.6%, respectively.

Nonetheless, the forestry industry of the Bío-Bío Region increased its consumption by 1.3 million solid cubic metres between 2004 and 2010, which is evidence of its growth.

Meanwhile, export figures (see table 2) indicate that, taken all together, the forestry-cellulose-light wood industry sector still accounts for three quarters of the regional total, led by the cellulose sector (over 30%) since the 1990s. It is in this sector that Chile, after Brazil, is a Latin American leader, but the industrial component associated with it (machinery and equipment) is underdeveloped, even though it is the partner sector for the exports with the greatest potential for learning and technology diffusion (Gatica, 2010).

In summary, the forestry chain does not have strong production ties to Greater Concepción, even though its machines and tools make it a regionally important sector, and the most dynamic part of the chain, namely pulp and cellulose, uses technology that is wholly imported and serviced from abroad (Katz, Stumpo and Varela, 1999).

TABLE 1

Log consumption by location of industry, 2004-2010[a]

(Solid cubic metres without bark)

	Bío-Bío Region 2004	Percentages	Bío-Bío Region 2010	Percentages	Whole country in 2010	Percentages	Region/country (*percentages*)
Pulp	5 649 869	30.6	7 857 973	39.7	12 759 465	36.9	61.6
Sawn timber	9 610 444	52.0	7 058 736	35.7	12 245 568	35.4	57.6
Boards	1 288 883	7.0	2 070 560	10.5	3 535 173	10.2	58.6
Chips[b]	1 585 436	8.6	2 669 226	13.5	5 656 021	16.4	47.2
Saw logs for export	63 061	0.3	1 894	0.0	2 760	0.0	68.6
Pulp logs for export	119 680	0.6	23 852	0.1	24 398	0.1	97.8
Cases[c]	68 674	0.4	19 800	0.1	105 600	0.3	18.8
Posts and poles[d]	86 739	0.5	77 579	0.4	230 630	0.7	33.6
Total Bío-Bío Region	18 472 786	100.0	19 779 620	100.0	34 559 616	100.0	57.2

Source: prepared by the authors on the basis of Central Bank of Chile, *Indicadores económicos y sociales regionales de Chile, 1980-2010*, Santiago, Chile, 2012.

[a] Volumes of logs processed in the timber industry by region.
[b] Pulpwood chips, including high-quality native timber chips for making fine paper.
[c] Consumption by the case industry using logs exclusively for the production of cases (for winding machines, for example).
[d] Consumption by manufacturers of poles and posts (impregnated and sulphated).

TABLE 2

Exports from the Bío-Bío Region, July 2011
(Values FOB in millions of dollars)

Product	July 2011	July 2010	Change (*percentages*)	July 2011 total (*percentages*)
Cellulose	178.4	147.4	21.0	37.0
Sawn timber	52.6	57.4	-8.3	11.1
Plywood	32.4	31.4	6.8	6.8
Fibreboard	29.6	20.4	44.8	6.2
Woodchips	26.7	18.3	46.3	5.6
Wood moulding profiles	16.4	18.2	-9.6	3.5
Fishmeal	14.2	40.3	-64.9	3.0
Roll paper	12.7	13.8	-7.9	2.7
Frozen whole jack mackerel	8.0	4.0	101.9	1.7
Raspberries, blackberries, mulberries	6.9	4.0	73.5	1.5
Condensed milk	5.6	5.8	-2.3	1.2
Polyethylene	5.3	0.0	-	1.1
Tinned jack mackerel	5.0	3.1	61.0	1.1
Petrol	4.8	0.0	-	1.0
Wooden doors	4.6	2.7	60.8	1.0
Subtotal	403.2	366.7	9.9	85.1
Other (plastic, rubber, etc.)	70.5	57.4	22.9	14.9
Total	473.6	424.1	11.7	100.0

China	United States	Japan	Netherlands	Italy
73.7	37.3	39.9	32.3	31.5

Source: National Institute of Statistics (INE), *Boletín Regional Exportaciones*, year 20, issue 201, July 2011.

2. The isolation of the Secano Interior and the policy response

The membership of the Association of Municipalities for Local Economic Development (AMDEL) (see box 1) currently consists of six municipalities in the Secano Interior, these being Santa Juana, San Rosendo, Hualqui, Florida, Yumbel and Cabrero. Its origins lie in a productive development product and predate the Bío-Bío Regional Development Strategy of 2000, which established nine planning territories as an FNDR prioritization methodology.

The heterogeneity of population growth can be contrasted by taking the demographic situation in 1992 and projections for 2020. Greater Concepción is clearly a gainer when it comes to population (see figure 1). In 1992, it had some 669,000 inhabitants, while projections for 2020 put the figure at about 872,000. The opposite applies in the Secano Interior (comprising the six municipalities of AMDEL), whose population was about 85,000 in 1992 and is projected at 105,000 for 2020.

The population pyramid for the Secano Interior shows a "regressive structure", with heavy migration of the young (20- to 45-year-olds) and a contraction in the number of children and young people aged under 15, in accordance with the national trend. Population

BOX 1

The emergence of the Association of Municipalities for Local Economic Development (AMDEL)

In 1995, the Technical Cooperation Service (SERCOTEC) of the VIII Region implemented the Programme of Support for Municipal Management of Productive Development, focusing on capacity-building for territorial administrations (municipalities) to stimulate local economic activity by generating the right local conditions.

As a result of the initiative, in July 1998 the Municipal Support Project for Local Economic Development (PROFO Municipios) was created with the support of the Office for the Under-Secretary for Regional and Administrative Development (SUBDERE), comprising the municipalities of Coelemu, Laja, Penco, Tomé and Yumbel.

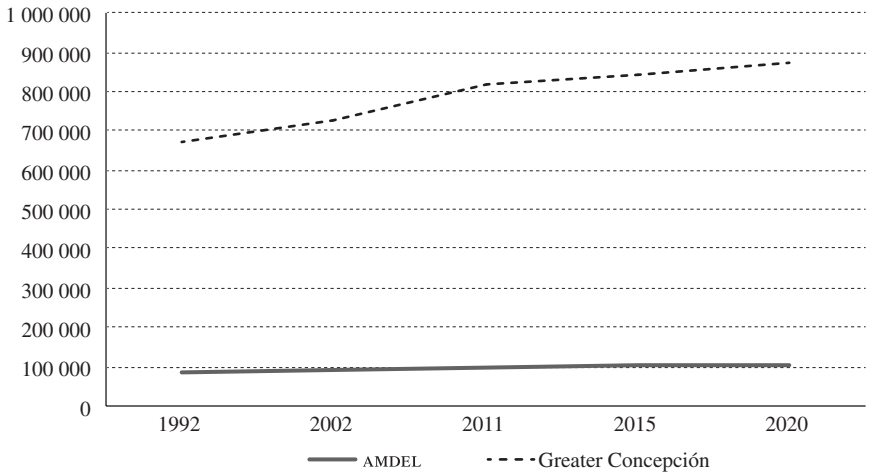
A new PROFO Municipios was set up in 2001, this time with a membership of eight municipalities: Cabrero, Florida, Hualqui, Nacimiento, Penco, San Rosendo, Santa Juana and Yumbel. Following internal restructuring, in 2006 Penco and Nacimiento left the Association of Municipalities for Local Economic Development (AMDEL), leaving it with the membership it has today.

Source: prepared by the authors on the basis of [online] www.amdel.cl.

FIGURE 1

Population by planning territory

(Number of inhabitants)



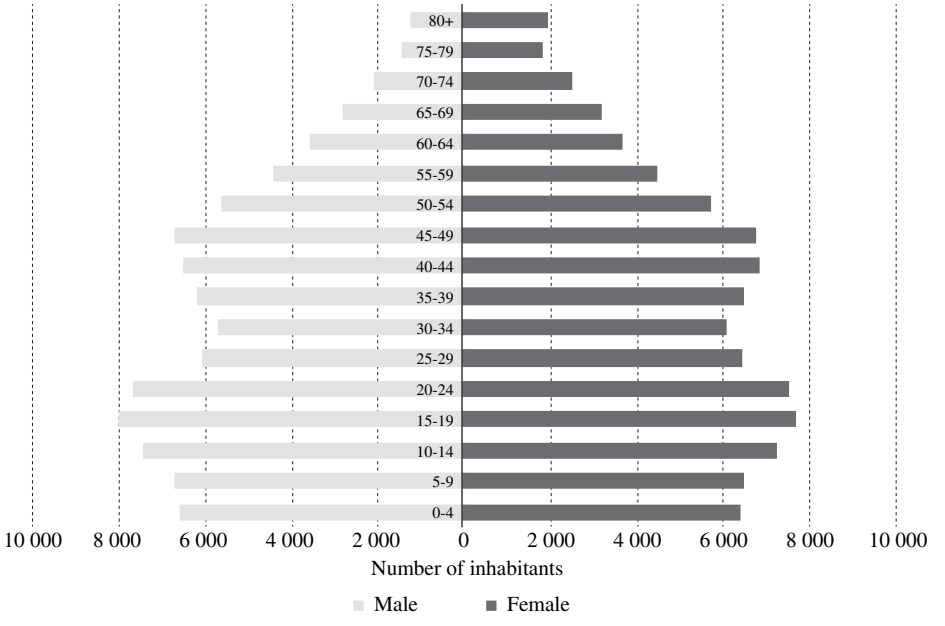
Source: prepared by the authors on the basis of data from the National Institute of Statistics (INE) and F. Gatica and A. Yévenes, "Planificación económica territorial y empleo: Análisis de las relaciones existentes entre rubros económicos priorizados en el Programa de Desarrollo Territorial y las potencialidades en la generación de empleo en la Región del Bío-Bío", *Taller de Empleo Regional*, No. 22, Concepción, University of Bio-Bio, 2005.

AMDEL: Association of Municipalities for Local Economic Development.

FIGURE 2

Population pyramid for the Secano Interior

(Estimated population of the AMDEL municipalities in 2010)



Source: prepared by the authors on the basis of population pyramids, data from the National Institute of Statistics (INE) and F. Gatica and A. Yévenes, "Planificación económica territorial y empleo: Análisis de las relaciones existentes entre rubros económicos priorizados en el Programa de Desarrollo Territorial y las potencialidades en la generación de empleo en la Región del Bío-Bío", *Taller de Empleo Regional*, No. 22, Concepción, University of Bio-Bio, 2005.

AMDEL: Association of Municipalities for Local Economic Development.

growth is lower, and there is a ratio of one inhabitant in the Secano Interior to every nine in Greater Concepción. This has been an unbalancing factor when it comes to prioritizing intraregional public investment projects.

Thus, the data support the diagnosis that the Pencopolitan[6] area or Greater Concepción is better positioned. Its autonomous income (before State subsidies) is 41% higher than the regional average, and it has a lower proportion of indigent people. In the communes of the Secano Interior, dominated by forestry, autonomous income is a third lower than in Greater Concepción, and the proportion of indigent people is far above the regional average, as shown by different reports of the Territorial Information Management Unit (UGIT, n/d).

Given this asymmetry, it can be deduced that the wealth of the conurbation has not stimulated the development of the Secano Interior, where the forestry-cellulose export chain is concentrated. The connections are not strong enough, and the result has been "dual development" in the territory (forestry sector/greater metropolitan area).

This "dual development" is even found within AMDEL, and more specifically in the commune of Nacimiento, where the Santa Fe forestry industrial complex of the Compañía Manufacturera de Papeles y Cartones (CMPC) operates. This commune had unemployment rates of 15.3% in 2000, 11.5% in 2003, 11.6% in 2006 and 15.2% in 2009, according to the National Socioeconomic Survey (CASEN). This is indicative "of a depressed labour market and the impact of the global crisis" (Municipality of Nacimiento, 2012), particularly the negative effects on production linkages and employment in the cellulose industry concentrated there (Galdames, Menéndez and Yévenes, 2001).

[6] This is referred to as the Pencopolitan area because the city originally founded in what is now known as Concepción was built in the city now known as Penco, on the shore of the Pacific Ocean, and was moved to the current site following the 1570 tsunami. Nevertheless, the adjective Pencopolitan has subsisted for the initial site.

III
Methodology

The aim is to identify economic networks around the forestry sector and, in parallel with this, visualize economic flows between Greater Concepción and the Secano Interior.

1. First item: the input-output matrix around the forestry sector

To identify the degree of productive connection around the forestry sector with all other supply chains, use is made of the input-output matrix constructed by the Central Bank of Chile (2008), and particularly the national intermediate use quadrant (user prices).

It is important to note that the national matrix is being used and there are differences in purchasing profiles that may vary from region to region. There is currently no up-to-date regionalized matrix available.[7] As mentioned, however, the forestry sector of the Bío-Bío Region accounts for 57% of the country's log consumption. There should therefore be no significant difference between the national input-output matrix and the regional one (to be constructed), except for some diversion of purchases from the regional forestry industry to specialized suppliers in the country's capital.

The following are analysed:

- The percentage of purchases made by each forestry subsector. The aim is to identify which subsector has the highest level of backward linkages, and this is done on the basis of purchase volumes, irrespective of linkage type in terms of value added.
- The distribution of forestry sector purchases and the level of sales specialization. The main inputs sold to the forestry sector are identified, together with the percentage of sales wholly dedicated to meeting the needs of this sector. This approach makes it possible to deduce what type of relationship there is with the surrounding economy.
- The distribution of purchases by activity. The aim, essentially, is to identify the "main backward linkage" by forestry subsector. This makes it possible to visualize the production fabric

[7] What is currently available is a regional input-output matrix that is a projection employing the RAS method, allowing a rough picture to be formed of a region's trade flows from the national matrix generated in 1996 (Pino and Parra, 2011). Here, innovation processes may explain the emergence of new product and activity lines. In summary, although the matrix is not regionalized, its value lies in it being an up-to-date snapshot of an activity concentrated in regions VII, VIII and IX of the country.

developed around each subsector, identifying the relationship between value added and the type of purchase made.

2. Second item: economic flows between Greater Concepción and the Secano Interior

With FNDR financing, origin and destination surveys were conducted among agricultural units, families, micro, small and medium-sized enterprises, and different landscape units[8] within the AMDEL communes[9] to identify local economic circuits. The findings are used to analyse the main forward linkages for each landscape unit. It should be noted that this analysis does not follow a traditional sectoral logic but rather a territorial approach, identifying the geographical patterns of particular product networks.

The analysis is carried out on two levels:

- A graphic representation is generated from the main economic flows of the Secano Interior, on the basis of which three types of networks are identified: (i) the tree type, where all economic flows go to the regional capital; (ii) the axis type, structured around roads; (iii) the star type, where an activity in the territory is the focus for economic flows. Identifying these patterns serves as a guide for orienting public policies in the territory.
- For each commune, the main product purchased by Greater Concepción is identified. The main flows of labour, forestry products, agricultural products and tourism services are identified. A line of development and a public policy to pursue it is suggested for each case.

This is a preliminary approach, since the full information needed to gauge the whole relationship between supply chains and territory is not available. Consequently, the final overlay between the two dimensions will be analytical and oriented towards generating public policies to restore linkages in production fabrics.

[8] A "landscape unit" means everything presenting itself to view as a homogeneous whole. It is basically a subcommunal division, instrumental for the purposes of analysis, that is used to identify areas which for geographical, historical, productive and identity reasons, among others, have a homogeneous internal unity setting them apart from others.

[9] See Gatica (2008).

IV
The field study

1. Input-output ratios around the forestry chain

Reviewing the 2008 input-output matrix (see table 3) for what can be classified as forestry sectors shows that cellulose production is the activity employing the largest quantity of Chilean-sourced inputs, accounting for 29% of purchases, mainly of energy. At a second level of importance are wood planing and sawmills, which account for 20% of purchases, mainly of unprocessed wood. At a third level are silviculture, with 17% of purchases, and the manufacture of wood products, which takes 15% of Chilean-sourced inputs; in this last case, 28.5% of purchases are by-products from the chain itself.

The demand for inputs from sectors with greater value added is sharply lower, and this is directly associated with the volume of activity. Thus, paper and cardboard packaging, other paper items and furniture each account for 6% of Chilean-sourced purchases. For this last activity, the main purchases are of general services and by-products from the chain.

TABLE 3

Purchases by each subsector

(Percentages of the total)

Activity	Share
Silviculture and timber extraction	17
Wood sawing and planning	20
Manufacture of wood products	16
Manufacture of cellulose	29
Manufacture of paper and cardboard packaging	6
Manufacture of other paper and cardboard items	6
Manufacture of furniture	6
Total intrasectoral purchases	100
Sectoral purchases as a share of all purchases of products involved in the chain	5.1

Source: prepared by the authors on the basis of Central Bank of Chile, "Matriz de insumo-producto de 2008" [online] www.bcentral.cl.

Note: prepared from the national intermediate use quadrant (user prices).

In conclusion, there is a disparity in the demand for Chilean-sourced inputs between industries producing industrial commodities and those with a higher level of differentiation, and this is connected to the volume of activity, affecting the linkages forged between the sector concerned and the rest of the local economy.

Lastly, forestry sector purchases nationwide represent 5.1% of the total. There is a flow of inputs within the vertically integrated chain that is not valued. These intra-chain transactions are particularly strong in forestry complexes, where firms try to reduce operating risks by internalizing processes from the forest to the final point of sale.

The most important inputs are natural resources, which account for 30.9% of the sector's purchases (see table 4). These inputs are quite highly dedicated or specialized, with 68.3% of sales being to the forestry industry. Ranking next behind these are intra-chain by-products or transactions, with 16.3% of sales going to the forestry sector and a lesser degree of specialization (33.5%).

In summary, natural resource and intra-chain transactions account for 47.2% of forestry sector purchases. This is also a complexity indicator, and what it reveals is a type of activity that tends to create production networks of low complexity around it.

This diagnosis is consistent with the concentration of activity in two major business groups with a high degree of vertical integration, Celulosa Arauco y Constitución (CELCO) and Compañía Manufacturera de Papeles y Cartones (CMPC). Because the operations of these two groups take place essentially in the Bío-Bío Region, it is appropriate to use the national input-output matrix to deduce the main linkages at the regional level. The forestry industry in the VII, IX and X regions follows the same pattern, with homogeneity being more in evidence than any likelihood that an emerging activity might appear.

TABLE 4

Distribution of forestry sector purchases and degree of sales specialization
(Percentages)

Main products sold to the forestry industry	Forestry sector purchases	Specialization (sales to the forestry industry as a share of the economy-wide total)
Primary inputs: conifers, eucalyptus, other silvicultural products	30.9	68.3
Intra-chain by-products or transactions: sawn timber, chipboard, cellulose, packaging	16.3	33.5
Energy: petrol, gas, electricity	14.7	5.5
Chemicals: pesticides, plastics, other chemicals	5.5	9.6
Iron and steel products and installation of machinery and equipment	3.9	5.5
Cargo transport, railways, ports and storage	10.7	8.2
General services: financial, insurance, real estate, rental, information technology, legal and accountancy, engineering, other	14.8	2.7
Other inputs, goods and services	3.2	0.4
Total forestry chain inputs	100.0	5.1

Source: prepared by the authors on the basis of Central Bank of Chile, "Matriz de insumo-producto de 2008" [online] www.bcentral.cl.

Note: prepared on the basis of the national intermediate use quadrant (user prices).

At a second level of importance are energy, which accounts for 14.7% of inputs, and general services, representing 14.8%. A large group can be identified here: finance, insurance, real estate, rental, information technology, legal, accounting and engineering. The degree of specialization in the forestry industry is relatively low for these products, ranging from 5.5% in the case of energy to 2.7% in that of services.

Lastly, there are inputs whose importance for the chain is low, including chemicals, iron and steel, and other products, whose sales shares are 5.0%, 3.9% and 3.2%, respectively.

A low degree of sales specialization in a specific sector limits the scope for generating interactive learning processes by shaping the development of the production cluster on the basis of a main or critical chain. There is thus a need to investigate the subclassifications of the matrix to a higher level of detail and identify the degree of specialization, as this information does not exist at present.

Table 5 shows the main purchases for each activity within the forestry chain. It is interesting for the analysis to identify the main backward link. Broadly, the following are identified:

- Silviculture: 82.6% of purchases are primary inputs such as conifers and eucalyptus, and this makes it the activity with the highest concentration of inputs. This is the production situation of almost all the communes analysed in this study.
- Sawmills: the main backward linkage is to primary inputs (46.3%). Purchases are more diverse, however, and include in particular intra-chain by-products (19.1%), transport services (14.3%) and general services (12.8%).
- Manufacture of wood products: the main backward linkages are to by-products in the same chain (28.5%), followed by general services, which account for 22.7% of purchases.
- Cellulose manufacturing: a change can be seen here, with the main backward linkages being to energy first (32.9%) and the primary input second (20%). This production activity has higher levels of backward vertical integration, with production being highly concentrated in two large business groups, CELCO and CMPC.
- Manufacture of paper and cardboard packaging: here once again there is a concentrated structure, with 49.6% of purchases being accounted for by the main backward linkage, to chain by-products, followed a long way behind by general services, with 20.2% of purchases.
- Manufacture of other paper products: this is an "atypical" activity whose main purchases are of general services. This activity as a whole accounts for just 6% of the sector's total purchases.
- Furniture manufacturing: this accounts for a small share (6%) of total transactions and its main backward linkage is to general services, which account for 26.4% of purchases. Its higher value added means that the other inputs, goods and services item accounts for 16.1% of purchases, making it an outlier relative to the other activities.

From these preliminary data, it can be seen that the siting and development of the forestry chain do not present linkages. Three features determine the development of the chain-territory nexus in this case.

TABLE 5

Distribution of purchases by activity

(Percentages)

	Silviculture and timber extraction	Wood sawing and planing	Manufacture of wood products	Manufacture of cellulose	Manufacture of paper and cardboard packaging	Manufacture of other paper and cardboard items	Manufacture of furniture
Primary inputs: conifers, eucalyptus, other silvicultural products	82.6	46.3	12.8	20.0	0.0	0.0	1.3
Intra-chain by-products or transactions: sawn timber, chipboard, cellulose, packaging	0.3	19.1	28.5	9.4	49.6	16.2	20.3
Energy: petrol, gas, electricity	5.0	4.8	10.7	32.9	6.6	16.7	3.3
Chemicals: pesticides, plastics, other chemicals	3.8	0.3	6.9	6.8	10.0	6.0	12.2
Iron and steel products and installation of machinery and equipment	3.3	0.5	2.6	4.3	1.7	11.2	12.3
Cargo transport, railways, ports and storage		14.3	14.2	13.9	7.3	10.1	7.9
General services: financial, insurance, real estate, rental, information technology, legal and accountancy, engineering, other	2.9	12.8	22.7	10.6	20.2	36.0	26.4
Other inputs, goods and services	2.1	2.0	1.7	2.0	4.7	3.9	16.1
Total forestry chain inputs	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: prepared by the authors on the basis of Central Bank of Chile, "Matriz de insumo-producto de 2008" [online] www.bcentral.cl.

Note: prepared on the basis of the national intermediate use quadrant (user prices). The main backward linkages (over 20%) are shaded in grey.

- Concentration in two companies and reduced production variety. One factor shaping development prospects is the high concentration of land ownership in two large companies (over 2 million hectares). This is a hindrance to diversification (the furniture industry, for example). The current incentive framework encourages concentric backward development of the value chain, permitting greater control of forest ownership. This yields economies of scale with low operating risks. The chain has extended into the energy sector (Colbún) and the forestry sector abroad, rather than into industrial linkages with greater demand for locally developed technology.
- The remoteness of dialogue forums. The high ownership concentration of the forestry business makes territorial actors more remote from corporate management located in the national capital. This makes it less likely that public-private linkages will be generated at the territorial level.
- Asymmetries in strategic positions, determined by familiarity with one part of the value chain or another. Each inhabitant's perception is shaped by everyday familiarity with a particular "part" or link in the chain. The consequence is that there is no systemic overview when policies for the sector in the territory come to be implemented. Interventions usually ignore the communes' differing roles in a higher accumulation circuit, which is what makes it hard to connect global territories and territorial negotiating dynamics.

For a single territory and activity, then, four types of development can be identified: (i) there are "enclaves" with a very low capacity for diffusion in the territory; (ii) processes of "delinkage" can be identified in the old agricultural networks as a result of forestry expansion (Guerrero, 2012); (iii) there has been "dual development" dividing large businesses belonging to the CMPC and CELCO groups from small independent sawmills; (iv) there is scope for developing a "potential centre" that uses innovation to generate new networks connecting these enclaves with the local production fabric.

2. The gravitational pull of Greater Concepción on economic networks in the Secano Interior of the Bío-Bío Region

(a) *The gravitational pull on the Secano Interior*

Greater Concepción is a structured urban system that has a clear division of labour within it (Hernández, 1982) as a result of its history, which has left its mark on the forces structuring its development.[10] Two processes stand out in recent decades:

- Productive restructuring, in the terms set out in the first part of this study, which meant that the same space contained cities with so-called "emerging" (export-oriented) industries and others containing so-called "declining" industries, oriented mainly towards domestic consumption (Rojas, 1995). It should be recalled that the conurbation became home to production hubs of national importance. Specifically, the facilities of the Petrox petrochemical complex and the Huachipato steel company are sited in Talcahuano-Hualpén. These industries generated a network of suppliers in the metallurgy and industrial maintenance sector, and urban developments were implemented for workers' housing and social services (sports clubs and so on).

  The 1980s were a time of "easy exporting" (based on a weak exchange rate and low-cost natural resources) and in the 1990s the export model was intensified by the signing of numerous free trade agreements.

  Thus, the original diagnosis of the 1970s (Hernández, 1982) became entrenched in the conurbation, with some communes now having unemployment rates well in excess of the national average, particularly Coronel with unemployment of 10.4%, Lota with 9.8% and Talcahuano with 8.9% in the three-month period from May to July 2011 (INE, 2011b). The national unemployment rate is 7.5%,[11] and the communes named have had persistent structural unemployment for almost two decades.
- There has been a change in economic specializations, with a restructuring of the role played by towns within the greater metropolitan area: (i) Penco, Coronel and Lota have been changing from industrial communes with import substitution factories into "dormitory towns"; (ii) Concepción remains the decision-making centre; (iii) San Pedro de la Paz, although a new commune, has been developing a mixed role as a dormitory town and services platform.

[10] Historically, the construction of the urban system has had some elements of the evolutionary approach (see Fischer, 2009), with today's systems being the outcome of a combination between variety and selection of the best routine generated in the course of history. A biological approach to the territorial structure provides a way of understanding reconstruction processes, the setting of boundaries or borders, and network analysis, among other things.

[11] See INE (2011b).

Nonetheless, the greater metropolitan area of Concepción, which runs from Lota in the south to Tomé on the northern coastline, is a relevant unit of analysis that calls for a different way of understanding the public policies acting in this territory. A metropolitan government whose sphere exceeds that of an individual commune without encompassing a whole region has become increasingly necessary, with institutions at this level having a key role to play in areas such as the transport network, territorial planning and the health and education systems.

The goal at this point is to identify how the gravitational pull exerted by Greater Concepción is attracting economic flows from the communes, especially the forestry communes of the Secano Interior grouped into AMDEL, and how the incorporation of these may be relevant to the design of public policies in the territory.

Ultimately, the gravitational pull of Greater Concepción will also shape the territory of AMDEL and affect economic flows, generating positive and negative externalities in processes such as the changing viability of certain businesses, perhaps because of proximity to markets; increased pressure on some factors of production such as land or natural resources; the forced relocation of some firms because of location costs;[12] the growing phenomenon of "second homes" and the floating population that results; and an increased tendency towards migration from countryside to city, among other processes.

(b) *Creating economic networks to spread development*[13]

The study of local economic circuits for the Secano Interior used family, farm, micro and small enterprise and origin-destination surveys to identify the main flows. The study was carried out at the level of intracommunal spaces (landscape units) and the questions concerned annual flows with some commercial value.

Broadly, charting the main economic flows of the Secano Interior (AMDEL) reveals the influence of Greater Concepción on sales generated in this territory.

The zone experiencing the greatest gravitational pull from the conurbation is identified. This covers a large part of the communes of Santa Juana and Hualqui, with the commune of Florida also partially affected. Greater geographical proximity to Greater Concepción generates externalities associated with the opening of new markets and labour mobility.

It is possible to find communes that are not so directly influenced by Greater Concepción, such as Yumbel, San Rosendo and Cabrero. In these cases, there are economic networks centred on the conurbation, but the major flows go in a different direction.

Greater abstraction of the flows linking the two territories allows three major network types to be identified:

(i) Tree type networks: those which converge on Greater Concepción and where, in spatial terms, the links in the chain may be located at different geographical points of the territory with a value adding logic. An example is the flow of honey that may be produced in the rural part of some commune in the Secano Interior but packaged in the communal capital and ultimately sold in Greater Concepción.
Here, public policy can operate by transferring technology and organization to encourage the forging of chains in the territory with their different links, so that products reach the conurbation with greater value added. The wealth of a territory can always be spread by improving the competitiveness of local production, not merely by redirecting sales to other sectors, something that is known as "trickle-down theory".

(ii) Star type networks: with these, economic flows in the territory have a clear centre, without intermediate nodes. This is the case with the economic networks that have been arising around urban Cabrero. In their territorial dimension they can be likened to the example of the company town.
Such hubs must be used to develop "production pyramids" (Scott, 1998), where new production fabrics are generated from the parent business (such as the forestry complex) with firms that supply the main sector, so that valuable interactive learning processes arise. In addition, though, selling relationships can be established with other production sectors, giving rise to a sector that is "pivotal" in development.

(iii) Axis type networks: these arise or are structured around roads, acting as a force linking together the agricultural chains within the Secano Interior. Thus, public-sector initiatives can help provide outlets for products by siting sales points that have an identity and can attract passing trade.
However, labour also travels along these axes every day, especially workers from the Florida, Hualqui and Santa Juana area. The territory takes on a role

[12] These are cost-intensive businesses that begin to have increasing difficulty expanding their plants as they grow, which affects their economies of scale. This is compounded by increased pressure (because of greater traffic and pollution) to relocate businesses to certain outlying areas (Méndez, 1999).

[13] An extract from the findings of FNDR (2008) is being worked with here.

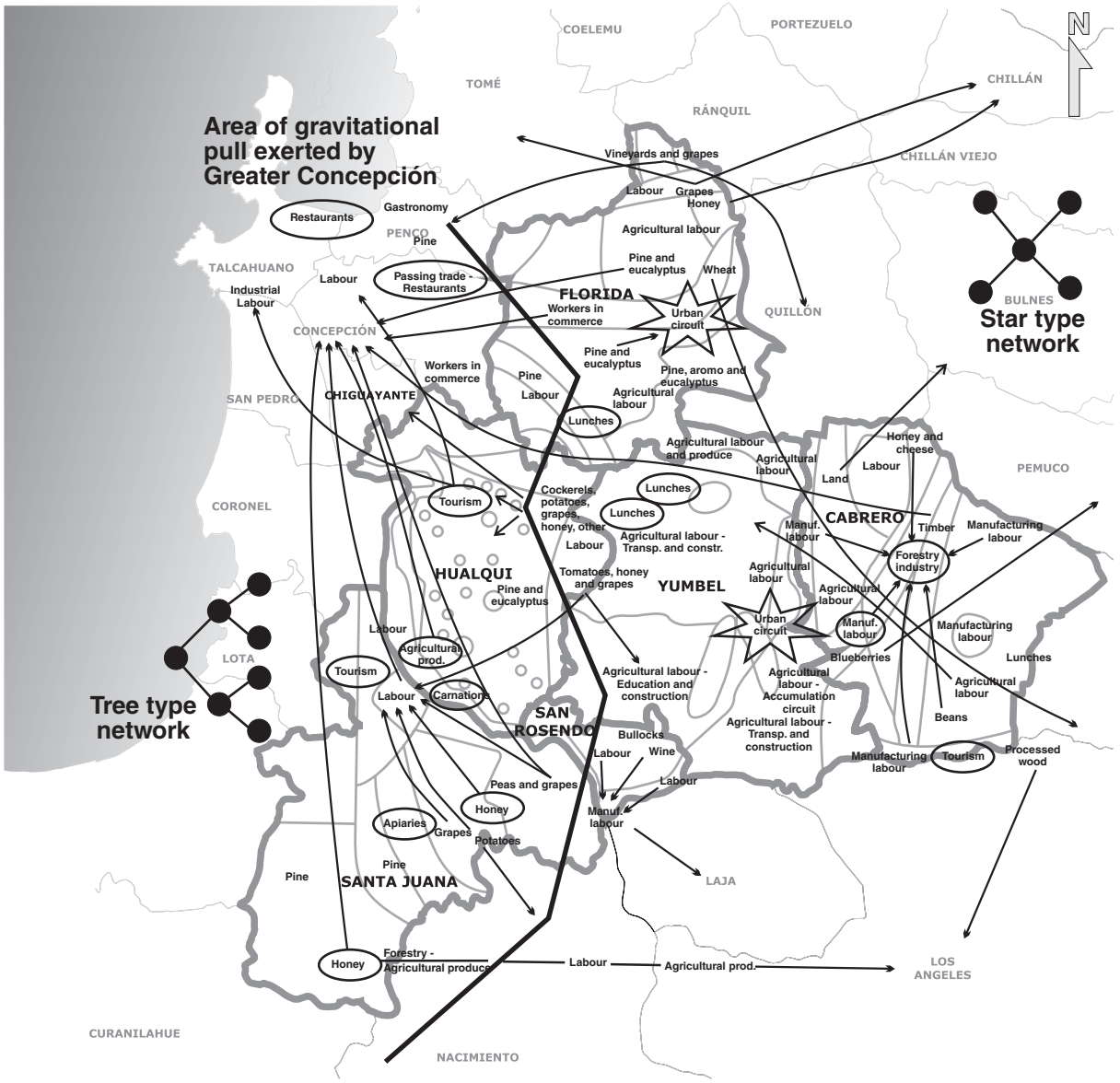
as a supplier of (low-skilled) labour for Greater Concepción. These are workers who continue to live in the communes of the Secano Interior but do some of their family shopping at local retail outlets. Accordingly, a public policy initiative is to use targeted instruments to enable this local workforce to increase its working skills so that rising wages stimulate local demand.

A more precise picture of the networks in the two territories is provided by table 6. The first thing that comes out is the importance of the flow of labour. Almost all the communes of the Secano Interior are suppliers of labour to Greater Concepción. The great variety of sectors also emerges clearly, with workers employed variously on personal services, commercial activity, transport and, lastly, manufacturing.

MAP 1

Principal economic networks at the landscape unit level

(Territories forming part of AMDEL)



Source: prepared by the authors from the findings of the National Fund for Regional Development (FNDR) project "Estudio Básico de los Circuitos Económicos Locales BIP 20179020-0", Regional Government of the Bío-Bío Region.

AMDEL: Association of Municipalities for Local Economic Development.

Tree, star and axis type networks provide orientation for public policies in the territory. They are guides enabling the supply of products or services to be better connected with the interior of the AMDEL territory and with demand from Greater Concepción in categories such as labour, forestry, agriculture and tourism. This is a more "micro" view of the economy, allowing the links in production fabrics to be restored in order to provide a corrective to "dual development".

In conclusion, the communes of the Secano Interior are not just suppliers of agricultural produce to Greater Concepción but also provide labour, despite the distances

TABLE 6

Principal economic flows from the AMDEL communes to Greater Concepción

Product	Commune of origin	Main flow	Line of development from a public policy perspective
Labour	Florida	Workers in commerce	Improvements to AMDEL local circuits with a view to enhancing the employment skills and incomes of local workers who travel to work in Greater Concepción, activating local purchases.
	Hualqui	Workers in commerce	
	Hualqui	Workers providing personal services (domestic workers and cleaning services)	
	Santa Juana	Workers providing personal services	
	San Rosendo	Transport workers	
	Yumbel	Transport workers	
	Florida	Workers providing personal and commercial services	
	Hualqui	Manufacturing workers	
Forestry	Florida	Monterey pine and eucalyptus	Need for Greater Concepción to be an innovation hub in the forestry chain. Coexistence with forest-friendly activities. Cabrero is currently becoming an industrial hub.
	Hualqui	Monterey pine and eucalyptus	
	Cabrero	Monterey pine, eucalyptus and processed wood (including dried and treated)	
Agricultural produce	Santa Juana	Agricultural produce (peas, grapes, potatoes and honey)	Linkage of agricultural chains so that products reach Greater Concepción with greater value added. Exploitation of "passing trade" around roads to forge agricultural chains.
	San Rosendo	Agricultural produce (quince, plum, peach)	
	Florida	Agricultural produce (white grapes)	
	Hualqui	Agricultural produce (red and white grapes, honey, hens, carnations)	
	Yumbel	Agricultural produce (red wine)	
Tourism	Hualqui	Tourist activities (swimming pools)	Organization and improvement of local businesses. Ability to generate competitive tourism circuits.
	Santa Juana	Tourist activities (camping on the River Lía)	

Source: prepared by the authors from the findings of the National Fund for Regional Development (FNDR) project "Estudio Básico de los Circuitos Económicos Locales BIP 20179020-0", Regional Government of the Bío-Bío Region.

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between the communal capitals and the regional capital (a one or two hour journey on public transport).

A second type of economic flow is associated with the forestry chain in its silvicultural and manufacturing phases. Monterey pine and eucalyptus currently move from Hualqui and Florida to Greater Concepción.

More highly processed production takes place in Cabrero, with remanufacturing that produces boards, chipboard, veneer and doors, among other things. Most in evidence is the sale of treated wood to Greater Concepción for building purposes. Much of the output of the Cabrero forestry complex is exported.

There is obviously a need for an active policy to link the forestry chain with the territory. Inland in the Secano Interior, perceptions of the forestry chain depend on the type of activity specifically located in the commune. The perceptions of inhabitants in areas where forestry plant is installed are different from the perceptions of those in areas where only silvicultural activity goes on (forestry and trucking). Consequently, it is vital to link up the forestry chain in all its heterogeneity with the different territories.

One key to the development of the Secano Interior is for Greater Concepción to exercise a competitive leadership role within a possible forestry cluster. The priority should be to create a cellulose industry with a Chilean industrial base or a joint venture with foreign capital. At present, this industry depends wholly on imports and servicing from abroad. Paradoxically, the initial development of production capacities in Nacimiento fell off over time as

inputs and spare parts were imported for cellulose plants (Galdames, Menéndez and Yévenes, 2001).

In the case of agricultural production, products and origins show a high level of dispersion; the exception is Cabrero, where there are no major agricultural flows going to Greater Concepción. The kind of products usually identified are white grapes, red grapes, fruit, honey and carnations, among others. Their importance lies in the fact that they feed part of the population of the conurbation (poorer inhabitants who do not buy in supermarkets but at informal markets), but they are also a vital component of family incomes, especially in the traditional agricultural zone where soil is depleted and technology use lags greatly.

In short, there is scope for technology transfer in the Secano Interior, but even more important is the ability to organize the supply chain centred on Greater Concepción.

Lastly, there is the tourism and recreational activity around Greater Concepción, where the Secano Interior receives visitors. The main focus here is Hualqui, where there are swimming pools and various campsites that actually operate as a development project. There is also the commune of Santa Juana, with camping facilities along the Lía river and swimming pools in the vicinity of the communal capital. Public policy should be aimed at organizing local businesses and improving quality standards, identifying different tourism circuits connected with operators and institutional customers in Greater Concepción, examples being older adults, corporate welfare services and social welfare funds (*cajas de compensación*), among others.

3. A necessary "feedback loop"[14] for territorial economic development

The Secano Interior can develop as and when Greater Concepción, and specifically the city at its heart, becomes a competitive, innovative and sustainable participant in global economic flows (and the city is an attractive location for more complex and inclusive investments), linking the forestry-cellulose-light wood manufacturing chain with the industrial machinery manufacturing industry, which favours accumulation circuits in the conurbation.

If this is achieved, the greater wealth of the provincial capital will spread to the territory of the Secano Interior via the different economic networks (of the tree, axis and star type), most of which rely on transactions involving agricultural produce, tourism, flows of labour or just passing vehicle trade.

Thus, the spread of wealth will not just be driven by the existence of economic networks involving the communes of the Secano Interior, but will also be the result of an improvement in the technological, productive and organizational capabilities that enable this territory to connect virtuously with the conurbation.

There are two bottlenecks here that will have to be dealt with to even out capabilities and generate networks that can spread development to the territorial level:

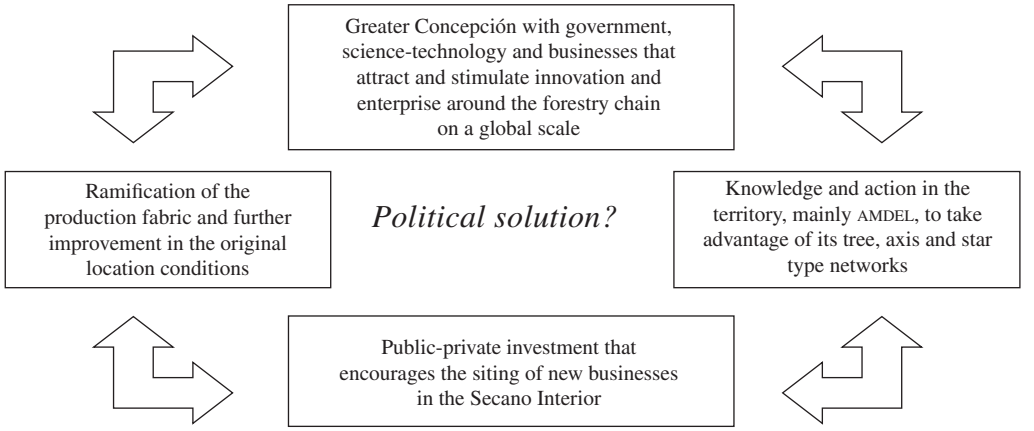
- The marked intraregional centralization of public-sector action. Living in a conurbation means that policymakers have a blind spot when it comes to prioritizing projects, something that is accounted for by different electoral pressures (number of votes), lack of confidence in the capabilities of territorial teams, the presence of interest groups and the absence of any clear social oversight of investment "decision-makers and implementers", among other problems (Lahera, 2008).
- The distance between managers of firms in the territory and the different municipal administrators and local social actors. This is not just a geographical factor but also involves divides in technological know-how and development logics, something that tends to make the Bío-Bío Region (where production plants are located) and its surrounding area remote from the central economic direction of the national capital.

If these "bottlenecks" in public- and private-sector intraregional centralism can be dealt with, there will be a virtuous and more competitive relationship with the conurbation, resulting in the siting of new firms in the Secano Interior on the basis of the tree, axis and star type networks arising from this and a productive ramification based on new products of growing complexity generated by different innovation processes (see diagram 1). This could be accompanied by encouragement from the regional government for the establishment of new businesses in the conurbation and a return by the universities to their old regional development activity. This process is a form of positive "feedback loop" requiring a systemic vision of development (O'Connor and McDermott, 1997), with focused but strategic public policy initiatives that can have a "leverage effect" which positively triggers linked development.

[14] The concept of "feedback" is understood as a "closed cause-effect loop". The idea comes from systems thinking where "all parts of a system are connected directly or indirectly so that changing a part the effect will spread to all others, which experience a change and in turn end up affecting the original part". Thus, the influence returns modified to the original part, which generates feedback (see O'Connor and McDermott, 1997).

DIAGRAM 1

Positive feedback loop for productive linkage



Source: prepared by the authors.

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V

Conclusion: delinking and politics

In two territorial studies, Falabella (2000 and 2002) proposes a regional definition centring on the role of the Concepción-Talcahuano intercommune and its extension between Lota and Tomé as the axis of a "potential linkage" in the region. This highlights the gap discussed in this paper, but also provides the lineaments of a potential that likewise concerns it. Development is potential and as yet unachieved because of the abandonment of a pro-industry policy in Chile and the existence of three strong leading actors operating "in parallel" but as yet unconnectedly: (i) the country's most autonomous regional government, (ii) robust exporting chains (with the forestry chain undoubtedly foremost) and (iii) a system of large regional universities that are considerable institutions but unconnected with one another (OECD/World Bank, 2010). The study emphasizes the regional industrial linkage gap as a possible manifestation of a national problem.

The contention of this study is that by developing the organization of economic civil society (on the basis of AMDEL), a start can be made on dealing with the lack of territorial linkages with Greater Concepción. This requires a greater political contribution (as necessary as political reform of the binomial system), participation and decentralization to bring the two leading business groups into the mainstream of the country's overall development; forestry-cellulose development in this case, and development of agroindustry, mining or salmon farming in others.

This study has identified the main flows connecting Greater Concepción with the territory of the Secano Interior. Consistently with this, public policies need to be designed to narrow the gaps between the two territories. The theoretical and empirical arguments put forward in this study clearly establish that market forces by themselves, with a State that implements orthodox neoliberal policies, result in a widening of territorial differences. Even the discretionary decision by the Chilean State to use Decree Law 701 to shore up a forestry sector made up principally of two large conglomerates exacerbated the disconnection from the local economic fabric and generated negative externalities which hindered the development of alternative production activities (one example being the rising prices of production factors such as land for agriculture, energy and infrastructure use).

In this context, AMDEL is becoming a political platform that can be used to exert pressure with a view to decentralizing decision-making power within the region and the country, bringing projects directly to ministerial decision-making circles. It is in this mesoeconomic

space that a comprehensive view is taken of processes that can affect a number of communes, with a need to work intersectorally and by implementing economies of scale and different public policy approaches. The election of regional councillors for the first time may produce a major ally, as may the change in the binomial electoral system that has produced deadlock in Parliament since the return to democracy in 1990. All this, together with greater citizen participation, decentralization and accountability, can make public policies more responsive to the challenges of the territory by bringing them closer to the problems and ensuring social oversight.

Hitherto, the relationship between the conurbation and the Secano Interior has been that of an ill-matched marriage. If they both forge competitive networks, however, the development of one territory can have knock-on effects on the other. The path followed by these communes will not be of the traditional agricultural type but one of renewed linkage that needs a different level of political organization if it is to be realized, as discussed in the public-private partnership literature (Devlin and Moguillansky, 2009).

For Greater Concepción to take part in global flows, there needs to be a metropolitan government that is not in thrall to the traditional division of region and province and the demands of the global forestry chain alone. This is even more important in the greater metropolitan area. For this group of communes to develop, however, there needs to be a new space of influence. The inhabitants of the regional capital go to the communes of the Secano Interior, buy their products, have their second homes there and enjoy the peace and quiet of the countryside. All this can make the metropolis an attractive place for capturing skilled human capital and with it, new business projects.

AMDEL is a sociopolitical creation that offers a new kind of associative space; it has followed an evolution from economic and territorial diagnosis to a role as an instrument of change to achieve progress towards synergistic and harmonic development. Its way to development lies ahead, and progress will depend vitally on its regional and national political alliances and support from the technical know-how of the universities so that the delinking of the forestry-cellulose chain in the Secano Interior from industry in the conurbation of Greater Concepción can be reversed.

The industrialization gaps discussed in this article —the missing link in Chilean development since 1973— plus the subsequent natural resource export boom and the recent impetus given to chains rich in information and communication technologies (ICTs) are the central issue for regional development and require a national project that is constructed from the territories outward.

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