ELSEVIER
www.elsevier.com/locate/worlddev

World Development Vol. 34, No. 4, pp. 631–646, 2006

0305-750X/$ - see front matter

doi:10.1016/j.worlddev.2005.09.007

Unemployment and the Real Exchange Rate in Latin America

ROBERTO FRENKEL
CEDES, Buenos Aires, Argentina

and

JAIME ROS *
University of Notre Dame, IN, USA

Summary. — Today unemployment rates in several Latin American countries are similar or even higher than the highest unemployment rates among OECD economies. Open unemployment has become, for the first time in the region's history, a major dimension of the employment problem. This paper examines the role of the real exchange rate (RER) in the recent unemployment performance of Latin America. It presents a model of the determinants of unemployment, the channels through which the RER influences unemployment performance, as well as the stylized facts and empirical results about this relationship giving special attention to the cases of Argentina, Brazil, Chile, and Mexico.

Key words — unemployment, real exchange rate, Latin America

1. INTRODUCTION

The early 1990s marked the turning point in the recent economic development of Latin America. The radical change in the international economic environment, with the implementation of debt relief programs and the resumption of capital inflows to the region, put an end to the negative transfer of resources abroad that characterized most of the previous decade. This made possible the success of stabilization programs that brought inflation under control, the recovery of investment and the resumption of economic growth. Yet, the region's unemployment rate increased during the decade, reaching an average level of the order of 10% of the labor force, and in several South American countries unemployment rates actually skyrocketed (see Table 1). That is, after the decade of stabilization and growth resumption, unemployment was slightly higher than in 1990, at the end of the "lost decade" following the debt crisis of the early 1980s. Today unemployment rates in several Latin American countries are similar or even higher than the highest unemployment rates among OECD economies. Open unemployment has become, for the first time in the region's history, a major dimension of the employment problem.

This paper examines the role of the real exchange rate (RER) in this employment and unemployment performance. Section 2 presents a model of the determinants of unemployment and discusses the channels through which the RER influences unemployment performance. Section 3 presents the stylized facts and empirical results about the relationship between the

* This paper grew out of research on the RER and unemployment carried out independently by the two authors. Preliminary results of this research are presented in Frenkel (2004) and Ros (2004). The authors are grateful for comments to Francisco Rodriguez and three anonymous referees, and to Seok-Hyeon Kim, Martín Rapetti, and Daniel Kampel for excellent research assistance. Final revision accepted: September 23, 2005.

Table 1. *Urban unemployment (%)*

	1990	2002
Mexico	2.7	2.7
Guatemala[a]	6.3	3.1
Honduras	7.8	6.1
El Salvador	10.0	6.2
Ecuador	3.8	6.6
Dominican Republic[a]	8.9[b]	6.6
Costa Rica	5.4	6.8
Brazil	4.3	7.1
Panama	12.1	8.6
Bolivia	7.3	8.7
Chile[a]	7.8	9.0
Peru	8.3	9.4
Trinidad and Tobago	20.1	10.4
Nicaragua	7.6	12.9
Paraguay	6.6	14.7
Venezuela[a]	10.4	15.8
Colombia	9.7	16.5
Uruguay	8.5	17.0
Argentina	7.4	19.7
Average	8.8	10.4

Source: See Appendix A.
[a] National unemployment rate.
[b] 1991.

RER and the employment performances in Latin America giving special attention to the cases of Argentina, Brazil, Chile, and Mexico. Section 4 concludes.

2. THE DETERMINANTS OF UNEMPLOYMENT AND THE INFLUENCE OF THE RER

In this section, we present an analytical framework to examine unemployment and discuss the mechanisms by which the RER affects employment performance. We distinguish three channels. The first one is the macroeconomic channel, pointing to the role of the RER in the determination of the activity and employment levels in the short run. The second is the labor intensity channel. This channel focuses on the role of the RER in affecting the labor intensity of the economic process, that is, the influence of the RER on the employment generation ability of a given activity level or rate of output growth. The third is the development channel. It points to the influence of the RER on economic growth and consequently, on the speed of generation of new jobs. While the first and third channels have received some (modest) treatment in the economic literature, the second channel has been much less explored.

(a) *A model of the determinants of unemployment*

The analytical framework combines a two-sector open economy model with the Harris–Todaro approach to unemployment (except for the fact that the wage differential between the formal and informal sectors is here endogenous rather than exogenous as in Harris & Todaro, 1970). It draws on the model in Ros and Skott (1998), modified to examine the determinants of unemployment (rather than the dynamic effects of trade liberalization and currency overvaluation). Some of its properties are similar to those of models based on the "capital shortage hypothesis" (Malinvaud, 1980; Rowthorn, 1995, 1999) extended to include the role of the RER.

The economy has two sectors. A formal sector producing a single traded good (T) coexists with a non-traded goods informal sector (N) where workers earn the average product of labor. Technology in the traded goods sector is described by a standard Cobb–Douglas production function:

$$T = AK_T^a L_T^{1-a}, \tag{1}$$

where T is the production of traded goods and K and L refer respectively to the capital stock and employment.

Employment in the traded goods sector (L_T) is determined by profit maximization under competitive conditions and price-taking behavior. This implies

$$L_T = [(1-a)A(p_T/w_T)]^{1/a} K_T, \tag{2}$$

where p and w denote prices and wages. We shall assume that p_T is determined by the world market price of the traded good (p^*) and the nominal exchange rate (e): $p_T = ep^*$.

Non-traded goods production (N) is generated by the informal sector under conditions of diminishing returns to labor and, to simplify, we assume away the use of capital in this sector so that labor (L_N) is the only input:

$$N = L_N^{1-d}, \quad 0 < d < 1. \tag{3}$$

Workers who do not find a job in the formal sector become openly unemployed or work in the informal sector earning an income equal

to the value of the average product of labor. Thus

$$L_T + L_N + U = L, \tag{4}$$

$$w_N = p_N L_N^{-d}, \tag{5}$$

where U is open unemployment and L is the total labor force.

Despite easy entry into the informal sector, the existence of open unemployment can be explained along Harris–Todaro lines: the perceived probability of finding a (well paid) job in the formal sector is higher for an unemployed worker than for a worker in the informal sector. Then, the unemployment rate (u) in the formal sector is determined by the following equation:

$$u = U/(L_T + U) = h(w_T/w_N), \tag{6}$$

where the h function is influenced by structural characteristics of the labor market. [1]

On the demand side, the following conditions are satisfied. Workers do not save and the propensity to save out of profits (s) is constant. Thus

$$P_N C_N + p_T C_T = w_N L_N + w_T L_T + (1-s)P, \tag{7}$$

where C denotes consumption and P is total profits given by

$$P = a p_T T = [a/(1-a)] w_T L_T. \tag{8}$$

The non-traded good is used for consumption only. Equilibrium requires then

$$N = C_N. \tag{9}$$

The utility function has a constant elasticity of substitution (σ) between T and N goods so that

$$C_T/C_N = B(p_N/p_T)^{\sigma}. \tag{10}$$

We now turn to the determinants of equilibrium unemployment. We first derive expressions for the demand and supply for labor in the non-traded goods sector. For given values of p_T, w_T, and K_T, Eqn. (2) determines L_T. Using (3), (5), and (7)–(9), the value of C_T can be found as a function of w_T/p_T and K_T:

$$C_T = [(1-a)A]^{1/a}[(1-sa)/(1-a)] \times (w_T/p_T)^{-(1-a)/a} K_T. \tag{11}$$

Combining this expression for C_T with Eqns. (3), (9), and (10) yields an expression for the demand for labor in the informal sector as a function of K_T, w_T/p_T, and w_N/w_T:

$$L_N = L_N^{\mathrm{D}}(K_T, w_T/p_T, w_N/w_T), \quad L_{N1}^{\mathrm{D}} > 0, \;\; L_{N2}^{\mathrm{D}}, L_{N3}^{\mathrm{D}} < 0. \tag{12}$$

An increase in the capital stock, which raises L_T and C_N, generates a higher demand for labor in the informal sector. A higher product wage in the traded goods sector has the opposite effect by decreasing employment in the traded goods sector (and thus C_N). A narrowing of the wage differential (higher w_N/w_T) reduces the demand for L_N by increasing the relative price of the non-traded good.

Eqn. (12) is derived from the demand conditions for the non-traded good. From the supply side, Eqns. (4) and (6) yield an expression for the supply of labor to the non-traded goods sector:

$$L_N = L - L_T/[1 - h(w_T/w_N)].$$

Substituting from (2), we get

$$L_N = L_N^{\mathrm{S}}(K_T, L, w_T/p_T, w_N/w_T), \quad L_{N1}^{\mathrm{S}} < 0, \;\; L_{N2}^{\mathrm{S}}, L_{N3}^{\mathrm{S}}, L_{N4}^{\mathrm{S}} > 0. \tag{13}$$

A higher capital stock and lower product wage in the traded goods sector reduce the supply of labor to the informal sector by increasing employment in the formal sector. A larger labor force has the opposite effect, that is, other things being equal it increases the supply of labor to the informal sector. A smaller wage differential reduces unemployment and increases labor supply to the informal sector.

From (12) and (13), assuming equilibrium in the non-traded good market, we can solve for w_N/w_T as a function of K_T, L, w_T/p_T:

$$w_N/w_T = \Gamma(K_T, L, w_T/p_T), \quad \Gamma_1 > 0, \;\; \Gamma_2, \Gamma_3 < 0. \tag{14}$$

Finally, using (6) to eliminate w_N/w_T from (14) and solving for u:

$$u = U(K_T, L, w_T/p_T), \quad U_1 < 0, \;\; U_2, U_3 > 0. \tag{15}$$

The model features the property that formal sector unemployment is affected by the size of the capital stock as well as the total labor force. Capital accumulation reduces informal sector employment and raises the average product of labor in this sector. The result is a narrowing of the wage differential between the two sectors and a reduction in the unemployment rate. An

increase in the total labor force has the opposite effect by increasing underemployment in the informal sector and reducing the average product of labor there. Unemployment is affected negatively by the RER as it reduces the product wage in the traded goods sector (a higher RER meaning a more devalued domestic currency). The precise mechanisms involved are the subject of the following section. The pattern of trade, through its effect on technological parameters, is another possible influence on the unemployment rate.

Before turning to the analysis of the effects of the RER on unemployment, it is worth noting that unemployment in the model is partly an equilibrium phenomenon and partly a disequilibrium one. It is consistent with labor market equilibrium in the sense that the informal labor market clears and there is equalization of the labor incomes in the informal sector with the expected labor income in the formal sector. At the same time, unemployment has an important disequilibrium component to the extent that over the period considered there are no forces that make the nominal wage in the formal sector (and thus the wage differential between the two sectors) return to a long run equilibrium value.

(b) *The effects of the RER on unemployment*

The model in the previous section can be briefly summarized in (unemployment, informal employment) space. Combining Eqns. (6) and (12) yields the equation of an upward sloping curve relating unemployment to the demand for informal labor: a higher wage in the informal sector, which reduces the wage differential and reduces unemployment, has the effect of reducing the demand for informal labor as it increases the relative price of the non-traded good. Combining Eqns. (6) and (13) yields the equation of a downward sloping curve relating unemployment to the supply of labor to the informal sector: a higher wage in the informal sector, which reduces the wage differential, has the effect of increasing labor supply to the informal sector through the reduction of unemployment (Figure 1).

(i) *The macroeconomic channel*

Ever since its origins in the 1930s and 1940s, open economy macroeconomics has acknowledged the relationship between the RER and employment, especially in its Keynesian versions that allowed the existence of involuntary unemployment. The traditional argument involved the competitiveness improvement of domestic firms resulting from a depreciated exchange rate. Given other determinants of aggregate demand, a depreciated RER leads to higher net exports and consequently, higher demand on domestic activities and higher levels of output and employment.

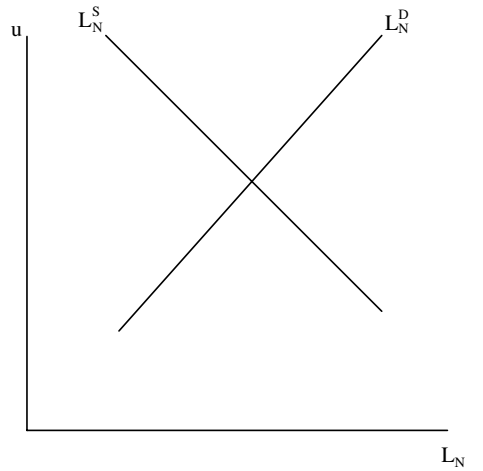

Figure 1. *Determination of unemployment and informal employment.*

In our analytical framework, a real devaluation (understood as an increase in e given w_T) shifts the (horizontal) demand curve facing tradable good producers and expands the level of output and employment in the tradable goods sector while improving the trade balance. In addition to this direct effect on the demand for tradable goods, there is a multiplier effect on the non-traded goods sector. The increase in formal employment raises consumption demand for the non-traded good. The L_N^D curve shifts outwards (see Figure 2). The result is a fall in the unemployment rate as the wage differential between the two sectors narrows (given the increase in the demand for and prices of non-traded goods). Moreover, there is a supply side effect of the higher demand for employment in the formal sector. This higher employment reduces the supply of labor to the informal sector. The L_N^S curve shifts inwards, leading to a narrowing of the wage differential and a fall in the unemployment rate.

This argument on the employment effects of the RER relies on a comparative static exercise that assumes other factors of aggregate demand unaltered. This effect is usually well founded. [2]

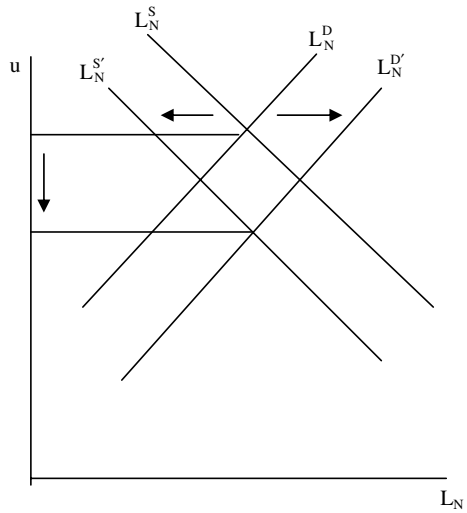

Figure 2. *Effects of an RER devaluation on unemployment.*

However, a real devaluation has many complex impacts. The net result may be different in different cases, depending on the real and financial structures of the countries and also, on the particular situation of the economy at the time when the devaluation is implemented. An expansion in the activity and employment levels will be observed only if other simultaneous negative effects do not predominate.

Thus, the argument must be qualified with the well-known potential contractionary effects of devaluation. Among others, these include the redistribution of income toward higher savings propensity sectors caused by the fall in real wages, the effects of the fall in the real value of the money stock as a consequence of higher prices, and the negative financial effects on debtors in international currency, if those are higher than the positive wealth effect on international currency assets holders (Díaz Alejandro, 1963; Krugman & Taylor, 1978). It is important to stress that the potential existence of contractionary effects of devaluation does not question the positive relation between the RER and employment described by the traditional macroeconomic argument. The contractionary effects overlap with the expansionary effects of expenditure-switching. In any case, if idle capacity and unemployment exist, and the dominance of the contractionary effects can be predicted, the real devaluation should be implemented together with fiscal and monetary expansionary policies (instead of contractionary ones). The analyses that highlighted the potential contractionary effects of devaluation pointed precisely to the characteristics that the policies complementing the devaluation should have.

(ii) *The labor intensity channel*

Part of the increase in employment in the formal sector of the economy is not the result of a higher level of demand for tradable goods but rather the effect of the RER on the labor intensity of output. This effect results from the role played by the RER in the determination of relative prices. In our model, the RER determines the value of wages measured in international currency, which is the most relevant labor cost in tradable activities. The increase in labor intensity of the traded goods sector as a result of a higher RER takes place either through the adoption of more labor-intensive techniques or the reallocation of labor and investments toward labor-intensive tradables. But the effects on labor intensity are not limited to this channel. The RER is an important factor of the labor/capital goods relative price in developing countries, because capital goods have a significant portion of imported components. It is also the main variable determining the imported inputs/labor relative price. Significant changes in these relative prices, caused by changes in the RER, should be expected to affect the employment/output ratio. As a result of the higher employment (for a given level of aggregate demand), the curves L_N^D and L_N^S shift accordingly, reducing the unemployment rate.

The influence of the RER on unemployment through the employment/output ratio is not a short run effect. The variation of the employment/output ratio takes place via changes in the structure of output—among firms and sectors—and also via changes in the production basket of each firm and sector, changes in technology, and changes in the organization of production. The effects arise from a restructuring process in which individual firms and the whole economic activity adapt to a new set of relative prices. The adaptation process is guided by the incentives generated by the new relative prices. For instance, a more depreciated RER encourages tradable activities that were not profitable before. But a more depreciated RER also encourages the more intensive use of labor, because the relative price of this production factor (the price of labor measured in the international currency) has fallen. In the opposite direction, a more appreciated RER reduces the level of

protection of local tradable activities. The production of some goods may turn unprofitable and some firms may be forced to close. But an appreciated RER also encourages surviving firms to preserve competitiveness by reducing the utilization of labor, because the relative price of this production factor has gone up.

The influence of the RER on the employment/output ratio is not restricted to the tradable goods sector. The effect can also be seen in the non-tradable goods sector. Non-tradable activities are not exposed to international competition, but relative prices also affect the relative utilization of labor. If capital goods used by the non-tradable sector have a significant import component, competition in the local market will drive firms to reduce their relative utilization of labor in contexts of RER appreciation and to increase it in contexts of RER depreciation.

Both in the cases of RER appreciation and RER depreciation, changes will take place only if the new set of relative prices is expected to last for a relatively long period. Even in the case when those expectations are firmly established, one should not expect the changes in the employment/output ratio to take place swiftly because they involve restructuring processes in firms and sectors. So, given a significant change in the RER, it should be expected that the aggregate effects take place as a gradual adjustment process.

(iii) *The development channel*

This channel points to the influence of the RER on the rate of economic growth and consequently, on the rate of employment generation. In our model, this effect is straightforward. If the rate of capital accumulation in the tradable goods sector is a positive function of profitability, and profitability in the tradable goods sector depends positively on the RER (because a higher RER reduces the product wage in the traded goods sector and increases the profit rate there), then a higher RER will lead to faster growth of the traded goods sector.

In effect, a competitive RER operates as an industrial policy designed to distort relative prices in favor of tradable goods activities. To see why, consider a recent paper by Woo (2004) reviewing the historical debate on industrial policies. Woo describes the domestic relative price of exports and imports with the equation

$$PI/PX = PWI(1+t)/PWX(1+s),$$

where PI is the domestic price of imports; PX, the domestic price of exports; t, the effective tariff rate; s, the effective subsidy rate; PWI, the international price of imported goods and PWX, the international price of exported goods.

In an import substitution industrialization strategy (ISI), $t > s$ and $t > 0$. Consequently, $PI/PX > PWI/PWX$. Thus, ISI strategies distort prices toward the production of importables. On the other hand, in what Woo calls export promotion industrialization (EPI), $s = t$ with $t > 0$. Consequently, in EPI strategies $PI/PX = PWI/PWX$. The domestic relative price of exports and imports equals the international relative price, because the effective subsidy to exports is similar to the effective protection rate on imports.

The equalization of domestic and international relative tradable prices also characterizes a free trade setting, because in this setting $t = s = 0$. If the incentives regime is neutral in both the free trade setting and EPI, why should we assume the costs and administrative complications of industrial policies? The rejection of industrial policies and the promotion of free trade would be both justified. Woo rejects that conclusion because he argues that EPI objective is to distort domestic relative prices toward tradable activities against non-tradable activities. This is easy to show by defining the domestic (PT) and international prices of tradable goods (PWT):

$$PT = aPI + (1-a)PX,$$

$$PWT = aPWI + (1-a)PWX.$$

Let PN be the domestic price of non-tradable goods. In an EPI strategy, the domestic price of tradable goods is $PT = (1+t)PWT$. Consequently, the tradable/non-tradable relative price in EPI is $PT/PN = (1+t)PWT/PN$; while in a free trade setting this price would be $PT/PN = PWT/PN$.

As can be seen, Woo's synthesis of the industrial policies debate characterizes the EPI strategies with a pattern of incentives that is similar to that established by a competitive RER. Indeed, the RER determines the relative prices of exports, imports, and non-tradable goods. A more depreciated domestic currency is equivalent to a uniform tariff on imports. As in the EPI strategy, a depreciated domestic currency does not distort relative prices against exports because it simultaneously implies a "subsidy" to exports (an income transfer) of the same

size. [3] A more depreciated domestic currency implies the distortion of the domestic tradable/non-tradable relative price in favor of tradable activities: the combination of higher protection of local activities competing with imports with higher competitiveness of exporting activities.

In spite of this obvious role of the RER, development economics has not focused on exchange rate regimes and exchange rate policies. The discussion of these issues concentrated on short run macroeconomic problems, while long-term analyses focused more on external and financial sustainability rather than on growth and employment. Williamson (2003) points to that omission. In the search for an exchange rate policy with development objectives, Williamson reconsiders arguments by Balassa (1971), who believed that exchange rate policy was a key for development. If the RER is competitive enough to encourage entrepreneurs to sell in the international market, then firms will invest and hire local labor force and the economy will grow. This approach emphasizes the importance of preserving a competitive RER to promote the profitability of tradable activities and encourages firms to invest and expand production and employment. Both Balassa and Williamson, as most of development thought, attribute to the expansion of the tradable sector the generation of externalities that favor modernization and growth in other sectors of the economy.

Rodrik (2003) has also recently highlighted the importance of a competitive RER in the development process. Rodrik's reexamination of development strategies suggests that successful paths are based on two factors. The first is an ignition factor in the short run, able to push the rates of growth, as a necessary initial condition. Given this initial condition, the second factor is the creation of institutions and the implementation of policies able to sustain high rates of growth in the long run. The policies should be country specific, depending on each country's particular context and situation. However, in looking for a more general ignition factor, he points to the effectiveness of sustained RER depreciation in driving investment and growth. [4] Rodrik's argument in favor of a competitive RER gives importance to its easy implementation and to its market-friendly quality, because it is a way of subsidizing all non-traditional (mostly tradable) sectors, without administrative costs and without risking rent-seeking behavior and corruption.

A recent study by Polterovich and Popov (2002) presents cross-country regressions showing that the rapid accumulation of foreign exchange reserves (FER), associated with policies intended to sustain depreciated exchange rates, leads to export-led growth. Countries with rapidly growing FER/GDP ratios exhibit higher investment/GDP ratios, higher trade/GDP ratios, higher capital productivity, and higher rates of growth. [5] The authors' explanation of these results points to the positive effects on investment of the higher profitability in the tradable sectors. The impact of investment on growth is amplified by the higher productivity of the invested capital, mostly in sectors submitted to international competition. The development of tradable activities generates specialization economies and learning externalities that are capitalized by less dynamic sectors. Rodrik, Polterovich, and Popov also praise the easy implementation of RER development policy and its advantages *vis-à-vis* policies involving administrative costs and the risk of corruption.

3. THE RER, EMPLOYMENT, AND UNEMPLOYMENT IN LATIN AMERICA

(a) *Some stylized facts*

We look first at the comparative evolution of unemployment from 1990 to 2002 in 17 Latin American countries. Then we take a closer look at four of the largest economies of the region, Argentina, Brazil, Chile, and Mexico over the period 1980–2003 and focus on the role of RER in the evolution of unemployment.

Table 2 shows the behavior of unemployment and capital accumulation, GDP and labor force growth, the rate of appreciation of the RER, as well as the share of industrial exports and its change in 17 Latin American countries. The inclusion of these variables, with the exception of the last two, follows from the model of Section 2, assuming that GDP growth is closely correlated with capital formation. The share of industrial exports and its change are included to capture the effects of the pattern of trade specialization on the labor intensity of the growth process. The table also includes for 12 countries with available data, the rate of expansion of formal manufacturing employment.

Capital formation and GDP growth proceeded at faster pace in countries with unemployment declines or moderate increases,

Table 2. *Unemployment changes and their determinants*

	Change unemployment, 1990–2002	Capital formation	GDP growth	Labor force growth	Real appreciation	Share industrial exports	ΔIndustrial exports	Growth man. empl.
El Salvador	−3.8	6.0	4.2	3.4	2.59	70.1	33	
Guatemala	−3.2	3.0	3.9	3.3	1.25	55.45	16.9	5.8
Dominican Republic	−2.3	3.8	5.8	2.6	1.53	91.2	7.8	
Honduras	−1.7	7.5	3.0	3.7	−2.73	54.2	48.8	
Mexico	0.0	1.7	3.0	2.7	1.18	79.45	17.7	4.4
Peru	1.1	3.1	4.1	2.9	3.43	57.55	1.3	−3.7
Chile	1.2	11.6	5.7	2.2	1.22	58.9	1.6	0.0
Costa Rica	1.4	4.2	4.8	2.7	−0.21	57	27.8	0.0
Bolivia	1.4	5.0	3.5	2.6	−2.06	41.15	5.7	
Average[a]	−0.7	5.1	4.2	2.9	0.69	62.8	17.8	1.3
Ecuador	2.8	0.2	1.7	3.1	−0.44	18.1	11.6	−2.2
Brazil	2.8	0.7	2.7	1.9	−1.99	70.45	4.9	−2.4
Nicaragua	5.3	−0.1	2.8	3.9	−0.77	41.1	24	6.2
Venezuela	5.4	−0.7	1.1	3.0	5.72	44.55	−8.9	−7.6
Colombia	6.8	6.4	2.5	2.7	2.37	36.65	7.9	−2.7
Paraguay	8.1	2.9	1.8	3.1	0.04	32.3	20.6	
Uruguay	8.5	1.9	2.0	1.2	3.06	63.45	−0.3	−8.3
Argentina	12.3	2.6	2.7	2.1	7.38	52.35	−4.3	−3.2
Average[b]	6.5	1.7	2.2	2.6	1.92	44.9	6.9	−2.9

Growth rates refer to averages over the 1990–2002 period, except when data were available only for a different period. See Appendix A for sources and definitions.
[a] Countries with unemployment reductions or moderate increases.
[b] Countries with unemployment increases.

lagging investment behavior being a clear feature of countries that recorded significant increases in unemployment. This suggests a clear role for investment behavior in explaining the diversity of unemployment experiences. Interestingly, labor force growth was faster in countries with unemployment reductions. The fast growth of the labor force in a number of Central American economies did not represent an insurmountable obstacle to reduce the unemployment rate.

Real appreciation was a pervasive phenomenon during the 1990s as 11 out of our 17 countries recorded an appreciation of the RER and on average both groups of countries feature such process. This real appreciation of national currencies proceeded at a pace that was almost three times faster on average in countries with significant increases in unemployment quite in conformity with expectations based on the model.

The role of the pattern of trade is also apparent in Table 2. Countries with reductions or moderate increases in unemployment have a much larger and more rapidly increasing share of industrial exports. As illustrated by Table 2, there is a sharp contrast between the patterns of trade specialization in the Northern and Southern parts of the region and a close correlation between these patterns and the evolution over time of the unemployment rate. In Northern Latin America, which by and large recorded reductions in unemployment, labor-intensive manufactures dominate and have an increasing share in total exports. South American countries, which with no exceptions suffered from increases in unemployment, have larger shares of primary exports. The role of the different patterns of structural change is confirmed by the correlation between the evolution of unemployment and the rate of growth of manufacturing employment. Countries with unemployment reductions or moderate increases recorded an expansion of manufacturing employment that sharply contrasts with the dismal manufacturing employment performance of countries with increasing unemployment rates. The central importance of industrial employment in determining the evolution of unemployment can be explained by the relative immobility of industrial workers given that their skills are often specific to industrial work

and given also the geographic concentration of industrial employment (see Rowthorn & Glyn, 1990, on the subject). All this suggests that these different patterns of structural change, and their effects on unemployment, appear to be closely related with the pattern of trade specialization and the impact of real appreciation on the tradable sectors of the economy.

Overall, this comparative analysis suggests that the sharp increases in unemployment in several South American countries are associated to the processes of deindustrialization that have taken place in the 1990s in this part of the region together with a poor economic growth performance. Just as in a number of European countries in the 1970s and 1980s (as found by Rowthorn & Glyn, 1990), the rise in unemployment has the character of an industrial slowdown. In the case of South America this slowdown, which has been accompanied by sharp declines in manufacturing employment (see Table 2), appears related to two main factors operating throughout the 1990s, the processes of real appreciation that took place as a result of massive capital inflows and the reorientation of the trade pattern toward natural resource intensive activities that followed the adoption of trade liberalization programs. This pattern of trade has proven to have little employment generation effects. By contrast, in Mexico, Central America, and the Caribbean, trade liberalization encouraged the development of labor-intensive manufacturing that in most cases prevented the increase and contributed to the reduction of unemployment despite the presence of processes of real appreciation.

We now turn to the time series evolution of unemployment in Argentina, Brazil, Chile, and Mexico. The histories of these four countries are characterized by both abrupt changes in the RER and by relatively long periods in which the RER remained relatively stable at either appreciated or depreciated levels. So, they provide a particularly favorable context for the observation of the real effects of the RER. Abrupt changes in the RER make effects stronger and facilitate their observation. Relatively long periods of appreciation or depreciation allow the full materialization of the effects of the RER on employment, as on other aspects of economic performance. In Chile, for instance, a long period with a relatively stable depreciated RER—from the mid-1980s to the mid-1990s—followed a phase of acute appreciation. The cases of Argentina, Brazil, and Mexico show long periods of RER appreciation. The Mexican case in the 1990s provides an uncommon opportunity to observe the effects of a depreciated RER in the second half of the decade after a period of appreciation during the first half of the decade.

Figure 3 provides information about the medium and long run trends in the unemployment rates. In each country, unemployment rates series have been transformed into indexes with base 100 in 1991. Then, the trends of those indexes have been calculated with the Hodrick–Prescott filter. Consider first the changes between the beginning and the end of the 1980–2003 period. Between those starting and ending points, unemployment rates in Argentina increased sharply, they remained more or less at the same level in Brazil, while in Chile and Mexico, they fell significantly. The countries' unemployment long-term records are inversely correlated with the growth performances in the period. In 1980–2003, Argentina grew by 0.9% per year; Brazil 2%; Mexico 2.4% and Chile 4.5%. But, in spite of this correlation, it seems pretty obvious that the differences in average growth are insufficient to explain the differences in the long-term unemployment performances.

The changes observed in the unemployment trends over the period are suggestive of other factors contributing to the long-term results. As can be seen in the graph, the Chilean unemployment trend is negative during 1984 and 1994–95 and positive from then on. The negative trend phase matches with the relatively stable depreciated RER period, and the turning point in the 1990s coincides with the appreciation of the RER. Brazil's trend is negative in the 1980s and positive in the 1990s, when trade opening and appreciated RER policies were implemented. Mexico's unemployment trend shows two turning points. The first is at the end of the 1980s, when the stabilization program with appreciated RER was initiated and the unemployment trend becomes positive. The second turning point is in 1995, when the RER was depreciated and unemployment trend sign turns to negative. Even in Argentina, where the unemployment trend is always positive, an increase in the trend can be seen in the beginning of the 1990s, coinciding with the initiation of the long appreciated RER phase.

The negative correlation between the RER and the unemployment rate in each country can easily be seen in Figures 4–7. In these graphs, the unemployment rates, the GDP,

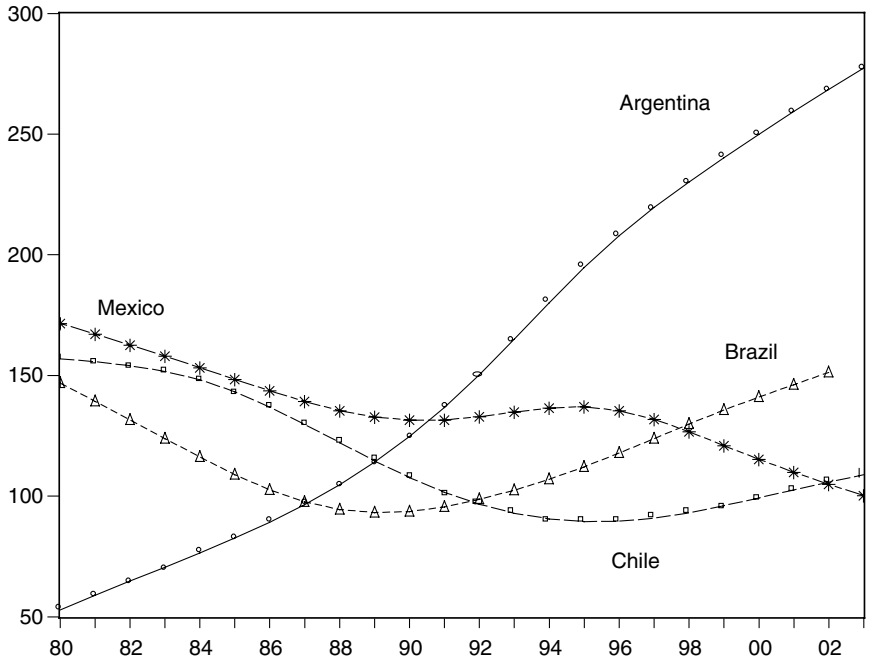

Figure 3. *Unemployment trends: Hodrick–Prescott filtered indexes 1991 = 100. Sources: See Appendix A.*

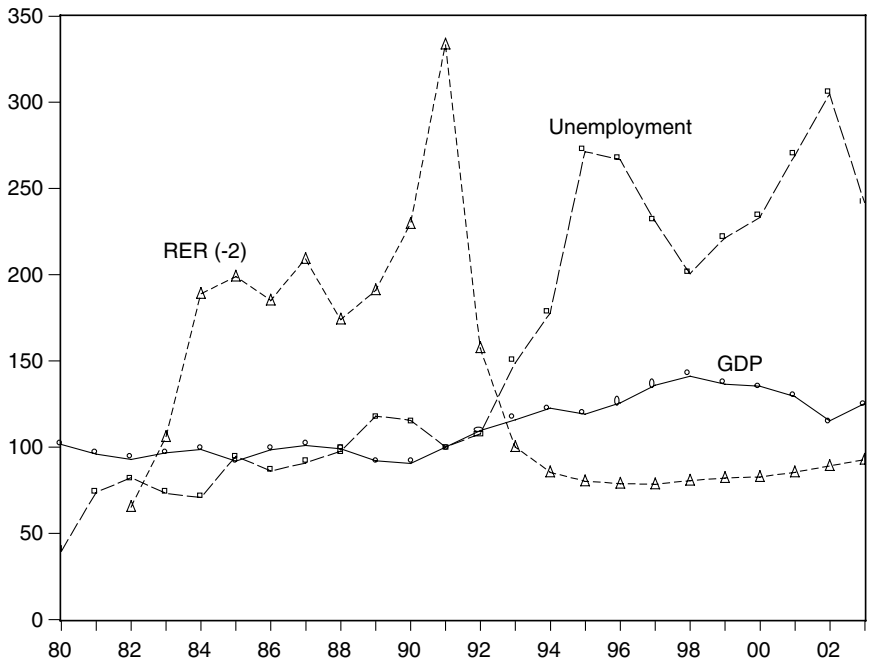

Figure 4. *Argentina. Unemployment rate, RER, and GDP (indexes 1991 = 100). Sources: See Appendix A.*

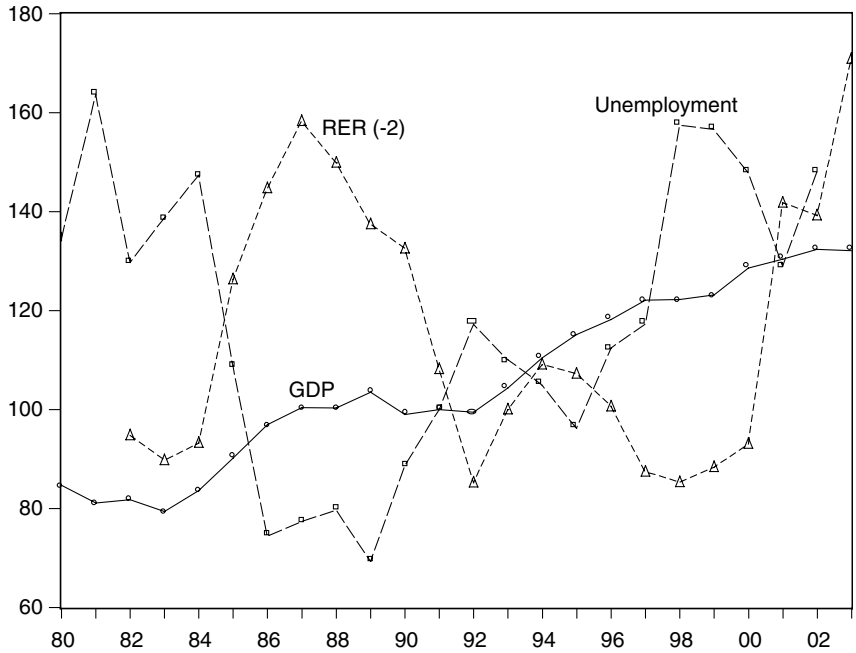

Figure 5. *Brazil. Unemployment rate, RER, and GDP (indexes 1991 = 100). Sources: See Appendix A.*

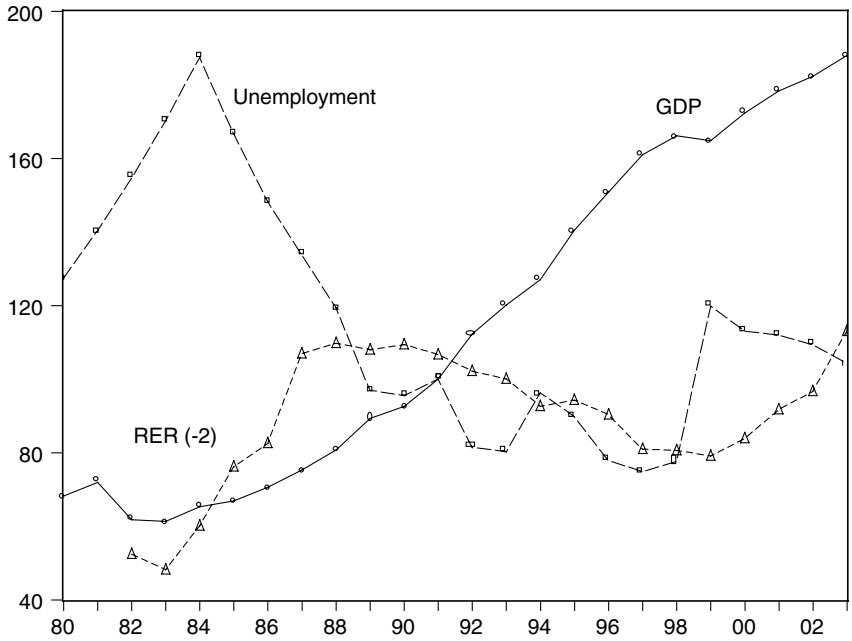

Figure 6. *Chile. Unemployment rate, RER, and GDP (indexes 1991 = 100). Sources: See Appendix A.*

and the RER are depicted as indexes with base 100 in 1991. The line $RER(-2)$ shows the RER lagged two years. The graphs suggest a strong negative correlation between the

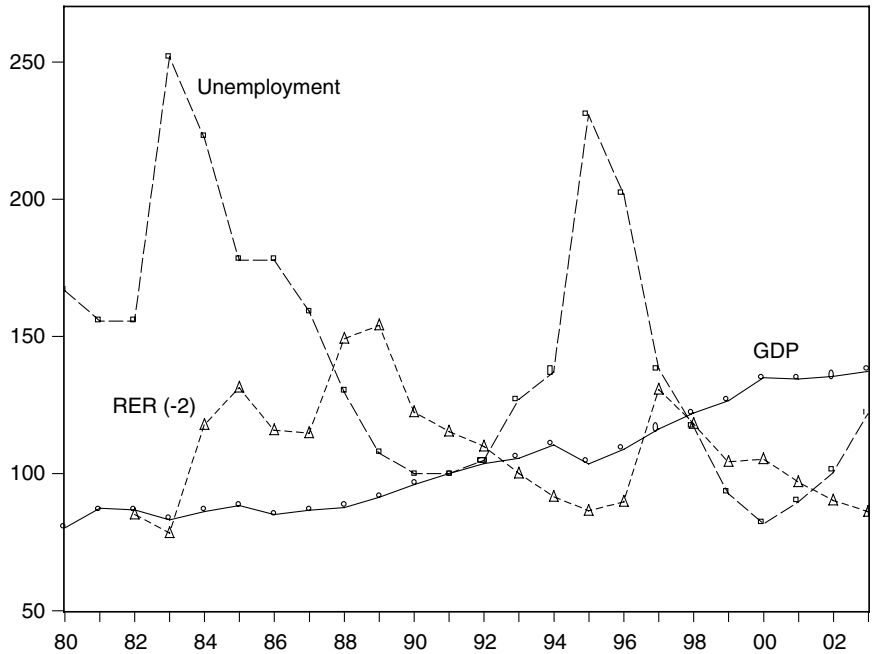

Figure 7. *Mexico. Unemployment rate, RER, and GDP (indexes 1991 = 100). Sources: See Appendix A.*

unemployment rates and the RER with a two-year lag in each of the four countries. Although it may be true that the four graphs tell us more than 1,000 words, we provide econometric support to this finding in the following subsection.

(b) *Econometric results* [6]

(i) *The sample of 17 Latin American and Caribbean countries during the period 1990–2002*

We turn first to the sample of 17 Latin American and Caribbean countries for which data are available for each year of the period 1990–2002. Following the analytical framework of Section 2, the econometric model to be estimated relates the unemployment rate (U) to GDP (as a proxy for the capital stock, for which data are not available for the full period, and to capture the short run adjustment process that is ignored by the model), the RER lagged two years [$RER(-2)$], [7] the size of the labor force (LF), and the share of industrial exports ($INDX$):

$$\log U = g \log GDP + e \log RER(-2) + l \log LF + x \log INDX + \varepsilon,$$

where ε is a stochastic disturbance and, in addition, a vector of country dummy variables for each country has been included to control for the permanent different levels of the national unemployment rates associated to differences in the measurement of unemployment as well as in the structure of the labor market (captured in the model by the h function). [8] Table 3 presents the OLS estimates of this country specific effects model. The results strikingly sup-

Table 3. *Determinants of unemployment: fixed effects model*

Variable	
Log *GDP*	-1.23^{***} (5.50)
Log *LF*	2.04^{***} (5.33)
Log *RER*	-0.57^{***} (5.58)
Log *INDX*	−0.13 (0.76)
Adjusted R^2	0.79
Number of observations	221
Number of countries	17

Dependent variable is Log urban unemployment.
Absolute t-values are shown in parentheses.
*Significant at the 10% level.
**Significant at the 5% level.
***Significant at the 1% level.

port the implications of the model of Section 2, with all the coefficients having the expected signs and all but that of the industrial exports share being highly statistically significant.

(ii) *Argentina, Brazil, Chile, and Mexico from 1980 to 2003*

We now turn to our four countries (Argentina, Brazil, Chile, and Mexico) for which data are available for each year of the period 1980–2003. The basic model is

$$\log U = g \log GDP + e \log RER(-2) + x\,TIME + k + \varepsilon.$$

The variables U (the unemployment rate), GDP, and RER do not need further explanation. The variable $TIME$ (the time trend) is included to capture any autonomous trend in the unemployment rate resulting from the growth of the labor force and deindustrialization processes. k is a constant and ε is a stochastic disturbance. The estimations are based on annual data for the 1980–2003 period.

Consider first the estimation with pooled data for the four countries. The estimation includes again country dummy variables to control for the permanent different levels of the national unemployment rates. The estimated model is

$$\log U = g \log GDP + e \log RER(-2) + x\,TIME + bDB + cDC + mDM + k + \varepsilon,$$

where DB, DC, and DM are dummy variables for Brazil, Chile, and Mexico. The coefficients b, c, and m estimate the systematic difference in the explained variable between each of the countries and Argentina. The OLS estimates are

$$g = -1.49\ (6.46), \quad e = -0.56\ (6.06), \quad x = 0.06\ (6.86).$$

Absolute t values are shown in parentheses.

All coefficients are highly significant (at 1% level) and the size of the g and e coefficients are remarkably similar to those obtained in the 17-country sample. The estimate of g is negative, as expected. It indicates that, on average in the four countries, a 10% increase in GDP is associated with a 14.9% unemployment rate fall. The negative sign of the e coefficient indicates the negative relation between the lagged RER and the unemployment rate (a positive relation between the inverse of the RER and unemployment). The magnitude of the effect is important. On average in the four countries, a 10% appreciation (depreciation) of the RER is associated with a 5.6% increase (fall) in the unemployment rate two years later. The significance and value of x indicates that there is a 6% per year autonomous upward trend in the unemployment rate (not explained by GDP and the RER).

The countries' time series allows separate estimations of the model in each of the countries. So, with each time series of country annual data, in the period 1980–2003, we estimated the model:

$$\log U = g \log GDP + e \log RER(-2) + x\,TIME + k + \varepsilon.$$

The OLS estimates are presented in Table 4. Except for Argentina, where it is not significant, g is significant and negative in all the countries. The lagged effect of the RER on the unemployment rate estimated by e is highly significant, negative and has considerable magnitude in the four countries. The estimations also indicate significant and important upward autonomous trends in the unemployment rate in the four countries.

Table 4. *Time series estimation of the model*

	g	e	x
Argentina	−0.42 (0.80)	−0.31 (3.01)*	0.07 (6.89)*
Brazil	−2.86 (2.31)**	−0.47 (2.15)**	0.08 (2.68)**
Chile	−3.20 (9.78)*	−0.88 (6.96)*	0.18 (8.79)*
Mexico	−4.44 (2.87)**	−0.86 (2.31)**	0.09 (1.96)***

Absolute t-values are shown in parentheses.
* Significant at the 10% level.
** Significant at the 5% level.
*** Significant at the 1% level.

4. CONCLUSIONS

The emergence of mass unemployment in several South American countries and the persistence of high unemployment in other countries of this part of the hemisphere has a variety of causes including a slow process of capital accumulation, a tendency to real currency appreciation, and a pattern of trade specialization oriented toward natural resource intensive products. Capital formation recovered from the dismal performance of the 1980s but remained in many countries below the growth of the labor force. The pattern of trade, oriented toward primary exports and natural resource intensive manufactures has on the other hand shown a limited capacity of employment absorption. This paper has focused on the role of the RER in the unemployment performance of Latin America. It highlighted first the channels of influence of the RER through its effects on aggregate demand and the level of output, the rate of growth of output, and the labor intensity of the production process. Moreover, it contributed a substantial amount of empirical evidence showing that the hypothesis of an important influence of the RER on unemployment cannot be rejected. Since the GDP variable captures the indirect effects of the RER on employment—via the level and rate of growth of output, the remaining effect shown by the results should be mainly attributed to the labor intensity channel. The two years lag between the changes in the RER and the changes in the unemployment rate is consistent with the hypotheses presented in the paper about the ways in which the labor intensity of the economy adapts to a new set of relative prices.

NOTES

1. In the simplest case, informal sector workers have a negligible probability of moving straight into a formal sector job, and formal sector jobs are allocated randomly among workers outside the informal sector. This case yields the simplest Harris–Todaro labor market equilibrium condition: $[L_T/(L_T + U)]w_T = w_N$ which implies a special case of (6): $u = U/(L_T + U) = 1 - w_N/w_T$. The general h function in (6) avoids the simplifying assumptions that jobs are allocated randomly among workers outside the informal sector and that the probability of finding a formal sector job while working in the informal sector is negligible. It also allows for less than 100 turnover rates in the formal sector.

2. The condition on the exports and imports elasticities is generally satisfied in the international trade of middle income economies.

3. It used to be an open economy macroeconomics textbook exercise to demonstrate the equivalence between a devaluation and the imposition of a tariff on imports and a subsidy to exports.

4. He quotes as examples the depreciated and stable RER policies implemented by Chile as from 1984 and by Uganda as from 1987.

5. As examples they quote the development strategies of Japan, Korea, Singapore, and, more recently, China.

6. Other empirical analyses supporting the hypothesis of a strong influence of the RER on unemployment include Damill, Frenkel, and Maurizio (2002) examination of the effects of RER appreciation on the Argentine labor market during the convertibility period, Tokman and Martínez (1999) analysis of the effects of exchange rate policies and trade opening on manufacturing industry employment in the experiences of lasting RER appreciation in Argentina, Brazil, and Mexico in the 1990s, Frenkel and Ros (2004) comparison of the influence of the RER on manufacturing industry employment in Argentina and Mexico in the 1990s, Damill and Frenkel (2003) examination of the employment effect of a depreciated RER in Argentina, after the collapse of the Convertibility regime in 2001, and Díaz (1995) analysis of the role of exchange rate policy, intended to preserve a competitive RER, and the rise in tariffs, as crucial factors in the employment recovery in Chile in the second half of the 1980s.

7. We have tried different lag structures and found that the two-year lag provides the best fit in the 17-country sample and each of the four countries considered in the empirical analysis.

8. On the influence of the structure of the labor market in Latin American and OECD countries, see Aid and Tzannatos (2002).

REFERENCES

Aid, T., & Tzannatos, Z. (2002). *Unions and collective bargaining: Economic effects in a global environment*. Washington, DC: The World Bank.

Balassa, B. (1971). Trade policies in developing countries. *American Economic Review, 61*(2), 178–187.

Damill, M., & Frenkel, R. (2003). Las medidas recientes de política salarial y el contexto macroeconómico. Paper prepared for OIT and the Ministry of Labour Argentina Republic.

Damill, M., Frenkel, R., & Maurizio, R. (2002). *Argentina: A decade of Currency Board. Analysis of growth, employment and income distribution*. Geneva: International Labor Organization.

Díaz, A. (1995). *La industria chilena entre 1970–1994: de la sustitución de importaciones a la segunda fase exportadora*. Santiago, Chile: CEPAL.

Díaz Alejandro, C. (1963). A note on the impact of devaluation and the redistributive effects. *Journal of Political Economy, 71*(6), 577–580.

Frenkel, R. (2004). Real exchange rate and employment in Argentina, Brazil, Chile and Mexico, Mimeo. Paper prepared for the G24, CEDES, Buenos Aires.

Frenkel, R., & Ros, J. (2004). Unemployment, macroeconomic policy and labor market flexibility: Argentina and Mexico in the 1990s. Working paper no. 309, The Kellog Institute, University of Notre Dame.

Harris, J., & Todaro, M. (1970). Migration, unemployment, and development: A two sector analysis. *American Economic Review, 60*(1), 126–142.

Krugman, P., & Taylor, L. (1978). Contractionary effects of devaluation. *Journal of International Economics, 8*(August), 445–456.

Malinvaud, E. (1980). *Profitability and unemployment*. Cambridge: Cambridge University Press.

Polterovich, V., & Popov, V. (2002). *Accumulation of foreign exchange reserves and long term growth*. Moscow, Russia: New Economic School.

Rodrik, D. (2003). Growth strategies. NBER Working Paper 10050, National Bureau of Economic Research, Cambridge, USA.

Ros, J. (2004). Latin America's unemployment experience since 1990. University of Notre Dame, Mimeo.

Ros, J., & Skott, P. (1998). Dynamic effects of trade liberalization and currency overvaluation under conditions of increasing returns. *The Manchester School of Economic and Social Studies, 66*(4), 466–489.

Rowthorn, R. (1995). Capital formation and unemployment. *Oxford Review of Economic Policy, 11*(1).

Rowthorn, R. (1999). Unemployment, wage bargaining and capital–labour substitution. *Cambridge Journal of Economics, 23*(4), 413–425.

Rowthorn, B., & Glyn, A. (1990). The diversity of unemployment experience since 1973. In S. Marglin, & J. Schor (Eds.), *The golden age of capitalism*. Oxford: Clarendon Press.

Tokman, V., & Martínez, D. (1999). *Productividad y empleo en la apertura económica*. Lima, Peru: OIT.

Williamson, J. (2003). Exchange rate policy and development, paper prepared for the International Policy Dialogue (IPD) Capital Market Liberalization Task Force, Columbia University, Barcelona, Spain, June 2–3.

Woo, W. T. (2004). Missed growth goes to Washington: the poor and the brightest, prepared for the conference "Stability, growth and the search for a new development agenda: Reconsidering the Washington consensus" organized by the FONDAD, Santiago, March 29–30.

APPENDIX A. DEFINITIONS OF VARIABLES AND DATA SOURCES

A.1. *The sample of 17 Latin American countries*

The following definitions and data sources refer to variables used in the empirical analysis of the sample of 17 countries.

Capital stock: Net fixed standardized capital stock. Source: A. Marquetti, Extended Penn World Tables (August 2002) (http://homepage.newschool.edu/~foleyd/epwt/). The *growth rate of the capital stock* is the percentage annual increase in the capital stock, estimated as the regression coefficient in the regression of the log of the capital stock against a time trend over the period 1990–98.

GDP: GDP at market prices in millions of US dollars at constant 1995 prices. Source: CEPAL. The *rate of growth of GDP* is the percentage annual increase in GDP, estimated as the regression coefficient in the regression of the log of GDP against a time trend over the period 1990–2002.

Growth of manufacturing employment: Percentage annual increase in formal manufacturing employment, 1990–2000. Figures for Chile and Mexico refer to total manufacturing employment. Source: CEPAL, Economic Survey of Latin America and the Caribbean, 2000–01.

Labor force: Total labor force. Source: World Bank, World Development Indicators. The *growth rate of the labor force* is the percentage annual increase in the total labor force, estimated as the regression coefficient in the regression of the log of the labor force against a time trend over the period 1990–2002.

Real exchange rate: Weighted average (with import shares) of bilateral RERs. Source: CEPAL, Economic Survey of Latin America and

the Caribbean, various issues. The *rate of appreciation of the RER* is the percentage annual increase in the inverse of the RER estimated as the regression coefficient in the regression of the log of the inverse of the RER against a time trend over the period 1988–2000.

Share of industrial exports: Non-primary exports as a share of total exports of goods, average 1990 and 2000. Source: Jose Antonio Ocampo, Lights and shadows in Latin American structural reforms, CEPAL, mimeo, 2003.

Urban unemployment: Open urban unemployment rate (except for Chile, Dominican Republic, Guatemala, and Venezuela, for which only national unemployment rates are available). Source: CEPAL, Economic Survey of Latin America and the Caribbean, various issues, and Jurgen Weller for Colombia, Dominican Republic, Ecuador, and Panama (based on national sources, excludes disguised unemployment). For these four countries various years of the 1990s were extrapolated using the unemployment series including disguised unemployment. The *change in urban unemployment* is the increase in urban unemployment rate from 1990 to 2002. Data for Dominican Republic refers to 1991–2002.

A.2. *The four-country sample (Argentina, Brazil, Chile, and Mexico)*

A.2.1. *GDP*

Argentina: GDP index at constant 1986 prices (1980–92) and 1993 prices (1993–2003). Source: Ministerio de Economía.

Brazil: GDP index at constant 2002 prices. Source: Banco Central do Brasil (BCB).

Chile: GDP index at constant 1986 prices (1980–96) and 1996 prices (1996–2003). Source: Banco Central de Chile and ECLAC.

Mexico: GDP index at constant 1980 prices (1980–87) and 1993 prices (1988–2003). Source: INEGI and ECLAC.

A.2.2. *Real exchange rate*

Argentina: Bilateral with United States, deflated by consumer prices. Source: Centro de Economía Internacional (CEI), Cancillería Argentina and Bureau of Labor Statistics, USA.

Brazil: Bilateral with United States, deflated by consumer prices. Source: Centro de Economia Internacional (CEI), Cancillería Argentina and Bureau of Labor Statistics, USA.

Chile: Bilateral with United States, deflated by consumer prices. Source: Centro de Economía Internacional (CEI), Cancillería Argentina and Bureau of Labor Statistics, USA.

Mexico: Bilateral with United States, deflated by consumer prices. Source: Centro de Economía Internacional (CEI), Cancillería Argentina and Bureau of Labor Statistics, USA.

A.2.3. *Unemployment rate*

Argentina: Urban unemployment/active population. Source: Encuesta Permanente de Hogares (EPH), INDEC.

Brazil: Unemployment/active population. Source: IBGE and Fundación Getulio Vargas.

Chile: Unemployment/active population. Source: INE.

Mexico: Urban unemployment/active population (from 1980 to 1984 unemployment for large cities). Source: INEGI and ECLAC.