TANGO WITH THE GRINGO: THE HARD PEG AND REAL MISALIGNMENT IN ARGENTINA

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Abstract

Between 1990 and 2001 the Argentine peso appreciated by 80 percent in real terms, and its overvaluation has been singled out as one of the main suspects in the debate on the causes of the Argentina collapse of late 2001. This paper assesses the degree of real misalignment in Argentina over the Convertibility period using a model in which the equilibrium real exchange rate is defined as the value consistent with (i) a balance of payments position where any current account imbalance is financed by a sustainable flow of international capital (external equilibrium), and (ii) traded / nontraded sector productivity differentials (internal equilibrium). Empirical implementation of the model suggests that the initial real appreciation of the peso, between 1990 and 1993, was consistent with the productivity increases that Argentina enjoyed following the stabilization of the economy after the hyperinflation of the late 1980s. But after 1996 a widening gap opened between the observed real exchange rate and that consistent with a sustainable net foreign asset position. Our estimates indicate that in 2001 the peso was overvalued by over 50 percent. The model allows us to assess how much of the overvaluation resulted from Argentina's inadequate choice of anchor currency and how much from a divergence of fundamentals between the US and Argentina, ultimately due to the maintenance of policies inconsistent with the peg. We find that both factors played a role in the overvaluation accumulated between 1977 and 2001 that preceded the collapse of the Convertibility regime.

I. Introduction

In late 2001, after many months of recession and mounting financial turmoil, Argentina was forced to abandon its currency board. The demise of the decade-old dollar peg was accompanied by a financial crisis of unprecedented severity, and followed by a dramatic devaluation of the peso. From the 1 peso = 1 US dollar exchange rate of the Convertibility decade, the Argentine currency had steadily depreciated up to nearly four pesos per dollar by mid 2002 before recovering towards three pesos per dollar at the end of that year.

The causes of the financial collapse, as well as its implications for macroeconomic and, especially, exchange rate policy, have attracted considerable attention. A number of observers have underscored the role of fiscal imbalances in precipitating the crisis, while others blame self-fulfilling default expectations in international financial markets[1]. In this debate, the trajectory of the real exchange rate of the peso has played a prominent role. Between 1990 and 2001, Argentina's real effective exchange rate appreciated by almost 80 percent. In spite of the productivity gains that Argentina probably achieved over the 1990s –a result of the stabilization and reform of the economy after the hyperinflation of the late 1980s– a majority of observers concur that the real exchange rate had become overvalued by 2001, especially after the devaluation of the Brazilian real in 1999 and coinciding with the persistent appreciation of the US dollar at the end of the decade.

However, the extent of the peso overvaluation, as well as its significance in triggering off the crisis, remain disputed[2]. Furthermore, assessments of peso misalignment advanced by various observers are typically based on rough comparisons between the actual and past values of some measure of the real exchange rate –that is, they implicitly rely on a PPP– like assumption that the equilibrium real exchange rate is constant over time.

In this paper we go beyond that crude approach and develop a formal analytical model for the study of the equilibrium real exchange rate. We implement the model empirically to assess the misalignment of the Argentine peso. Thus, the paper is most closely related to the literature on real misalignment and equilibrium exchange rates[3].

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[1] Fiscal imbalances are particularly stressed by Mussa (2002) and Teijeiro (2002). On the role of investor expectations see Stiglitz (2002) and Sachs (2002).

[2] The view that by 2000-2001 the peso was significantly overvalued has been stated, among others, by Calvo *et al.* (2002), Corden (2002), Hausmann and Velasco (2002), Roubini (2001), Rodrik (2002), Sachs (2002) and Stiglitz (2002). Most of these authors do not provide a specific estimate of the magnitude of the overvaluation, although Sachs (2002), for example, places it in the 30-40 percent range. A lone dissenter is Schuler (2002).

[3] See Williamson (1994), Wren-Lewis and Driver (1998), Baffes *et al.* (1999), MacDonald and Stein (1999), or MacDonald (2000) for recent contributions on equilibrium exchange rates.

Our approach extends the literature along several dimensions. First, the model we construct is capable of encompassing two leading approaches to real exchange rate determination[4]. On the one hand, it assigns a role to productivity differentials, along the lines of the Balassa-Samuelson hypothesis. In our framework productivity differentials explain the evolution of the price of non-tradables relative to tradables. Since such price determines the allocation of resources within the economy, this captures what we may label the 'internal equilibrium' of the economy. On the other hand, the model also assigns a role to current account sustainability [as in Frenkel and Mussa (1985)], which can be viewed as the 'external equilibrium' of the economy.

Second, to assess empirically the degree of real misalignment, we rely on an orthogonal decomposition of the observed exchange rate series into a permanent component, which captures long-run movements, and is therefore identified with the equilibrium real exchange rate, and a transitory component, which captures equilibrium-reverting movements and thus corresponds to the short-run deviation from equilibrium or misalignment[5].

Third, our framework allows us to go beyond measuring misalignment and assess the factors behind the observed real exchange rate trajectory. On the one hand, we gauge the roles of those domestic factors related to the internal and external equilibrium respectively. This permits us to assess the contribution of structural reforms and spending decisions to the real exchange rate path. On the other hand, we also examine how the peg to the US dollar contributed to the misalignment of the peso. The fact that trade with the US accounted for only a small fraction (around 15 percent) of Argentina's total trade, and an even smaller share of its GNP (less than 3 percent) has led some observers to conclude that the US dollar was the wrong anchor currency for Argentina, and that this inadequate choice is largely to blame for the misalignment of the peso at the end of the 1990s[6]. Our empirical calculations allow us to evaluate this assertion.

The rest of the paper is organized as follows. Section 2 offers a brief overview of the main existing approaches to the equilibrium real exchange rate. Section 3 lays out the analytical model, and section 4 describes the empirical strategy for its implementation. Section 5 reports the empirical results, and assesses the estimated equilibrium real exchange rate as well as its main determinants. Section 6 goes one step beyond and examines the impact of the recent evolution of the US dollar in the overall misalignment of the peso. Finally, section 7 concludes.

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[4] The model follows along the lines of Alberola *et al.* (2002).
[5] Huizinga (1987) and Clarida and Gali (1994) also interpret the permanent component of the real exchange rate as a measure of equilibrium.
[6] See Alesina, Barro and Tenreyro (2002), whose analysis shows that on the basis of observed macroeconomic comovement the Euro would have been a less-inadequate choice of anchor for Argentina's hard peg.

II. Exchange rate appreciation and misalignment

After decades of monetary mismanagement, the hard peg to the dollar that Argentina adopted under the Convertibility regime in 1991 quickly led to nominal stability and financial deepening[7]. In the process, however, the peso experienced a large real appreciation. Figure 1 shows that throughout the Convertibility decade the real effective exchange rate (REER) of the peso remained consistently above[8] its historical average over the period 1960-2000, by a margin that ranged between 15 and 50 percent. This persistent appreciation has led many observers to conclude that the peso was overvalued, particularly at the end of the decade.

There is broad consensus among economists that large real overvaluations have negative macroeconomic consequences. Their correction requires at best the adoption of painful adjustment programs, and may lead at worst to an abrupt currency collapse and a major financial crisis. In addition to the Argentine episode, there are numerous other examples of abrupt currency collapses in recent memory, including Mexico (1994), East Asia (1997), and Brazil (1999). In each of these episodes, a few observers had warned of the impending collapse in view of what they perceived as an unsustainable overvaluation of the currency[9].

More generally, analyzing the evidence from a sample of 93 countries over 1960-94, Goldfajn and Valdés (1999) conclude that once a currency appreciates significantly, a smooth return to equilibrium becomes highly unlikely. In their sample, 85 percent of the cases in which currencies reached a misalignment of 25 percent or more ended abruptly with a collapse of the nominal exchange rate. This is particularly relevant for the Argentine case, in which much of the policy discussion in the run up to the crisis, and even *ex post* analysis, has centered on the question of whether the authorities might have succeeded in salvaging the Convertibility regime, achieving whatever real depreciation was necessary through nominal deflation[10]. The answer to this question therefore depends, among other things, on the actual degree of overvaluation of the peso in the final years of Convertibility.

Assessing the degree of misalignment, however, is not straightforward. The most popular method relies on the purchasing power parity (PPP) doctrine. In its absolute form, it

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[7] However, financial deepening under Convertibility was accompanied by an increasing degree of financial dollarization which, according to many observers, made the financial system vulnerable and helped precipitate the financial crash. See for example De la Torre and Schmukler (2003).

[8] Throughout we define the real exchange rate so that an increase is an appreciation.

[9] Dornbusch and Werner (1994) and Werner (1997) examine the case of Mexico, and Chinn (1998) that of East Asia.

[10] In this vein, it has been argued that a course of action preferable to the one that eventually emerged would have involved full dollarization, letting nominal price adjustment realign subsequently the real exchange rate. The feasibility of such strategy has been widely debated; see Roubini (2001) and De la Torre and Schmukler (2003).

maintains that after conversion into a common numeraire a basket of goods should cost the same at home and abroad; i.e. the equilibrium real exchange rate should equal 1. A weaker version of PPP, sometimes referred to as relative PPP, holds that changes in nominal effective exchange rates must compensate for the inflation differential between a country and its trading partners, implying that the equilibrium real exchange rate is constant over time (although it may not equal 1).

Based on the relative PPP notion of the equilibrium real exchange rate, which in Figure 1 is measured by its long-term average, the peso would have been undervalued in 1990, but would have become increasingly overvalued after the introduction of the Convertibility Law and the currency board in 1991. The PPP-based overvaluation peaked initially in 1993 at about 40 percent, declined later through 1996 to about 14 percent, and rose again to exceed its average historical level by almost 50 percent in 2001. Thus the PPP approach would point towards a persistent and significant overvaluation over the whole decade.

However, the PPP approach to exchange rate misalignment can also be misleading. Rogoff (1996) presents evidence supporting a positive relationship between income and price levels. That is, a given a sum of dollars converted into a less developed economy currency at the nominal exchange rate will buy a larger basket of commodities and services than can be bought in the US. Krugman (1978) and Frenkel (1981) also find that deviations of exchange rates from their PPP equilibrium (both absolute and relative) are large, fairly persistent and with little tendency to revert towards a fixed long run equilibrium level. There are two well-documented factors that can contribute to the empirical failure of PPP. The first one is the existence of non-traded goods. The second is imperfect substitutability between traded goods produced in different countries. We shall taken them in turn.

If the exchange rate is viewed as the relative price of traded goods, then the existence of non-traded goods is irrelevant. But if the exchange rate is viewed as an asset price (i.e., the price of one national money in terms of another) then the appropriate price index has to be broader, given that the value of money is given by the reciprocal of the general price level, which includes both traded and non-traded goods and services.

The introduction of non-traded goods poses a challenge for the PPP hypothesis, if for example there are productivity biases as noted by Balassa (1964) and Samuelson (1964). The Balassa-Samuelson hypothesis postulates that under fairly general assumptions non-traded goods prices will be lower in the country with lower productivity in the traded goods sector (usually the poorer country). As a result, a basket of traded and non-traded goods will be cheaper in the lower wage (i.e. the poorer) country. By the same token, increases in relative productivity will be associated with an increase in relative prices, that is, an appreciation of the real exchange rate.

The same result can arise without international productivity differences if there are instead demand asymmetries or endowment biases. For example, Genberg (1978) argues that if the income elasticity of demand for non-traded goods is greater than unity, under the assumption of unbiased productivity growth the relative price of non-traded goods will rise with income. Bhagwati (1984) proposes instead a model which predicts lower price levels in poorer countries if they are labor-abundant relative to rich countries. Under the assumption of similar consumption tastes across countries (which rules out preference biases towards non-tradable goods that could raise wages enough to offset the endowment disparity), wages and the price of labor-intensive non-tradable goods will be relatively lower in poorer countries.

Thus, in addition to productivity asymmetries, demand asymmetries and factor endowments may also drive the relative price of non-tradables. In reality, the empirical failure of PPP may be due, at least in part, to differences in endowments (poorer countries are usually more labor abundant than rich countries) and demand biases (services usually represent a larger share of the consumption basket in richer economies). But productivity biases still seem an integral part of the model: richer countries would be so because of higher labor productivity. Empirical evidence pointing in this direction is reported by De Gregorio *et al.* (1994) or Alberola and Tyrväinen (1998), who find a strong link between changes in the price of non-tradables and changes in productivity differentials between tradables and non-tradables in OECD countries, as predicted by the Balassa-Samuelson hypothesis.

For the Argentine case, Figure 2 plots the real exchange rate and two series that capture international productivity differentials over 1990-2000[11]. The first is overall labor productivity in Argentina relative to its main trading partners. The second is the ratio of non-tradable prices to tradable prices, again measured relative to Argentina's main trading partners. According to the Balassa-Samuelson argument, this relative price differential between countries should be driven by their respective tradable-nontradable productivity differentials.

Inspection of the figure reveals a remarkably similar pattern for both measures of productivity differentials. Regardless of which one is used, casual empiricism would seem to support the Balassa-Samuelson hypothesis, as Figure 2 suggests a very close correlation between the productivity series and the real exchange rate. During the first years of the currency board, following the stabilization of the economy after the hyperinflation of the late 1980s, the graph shows that Argentina enjoyed significant productivity increases relative to her trading partners, which may help explain the sharp real appreciation of the peso between 1990 and 1993. Relative productivity stalled after 1993 and this process was accompanied by a parallel correction in the REER until 1996. After 1996 productivity starts recovering

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[11] In the figure, the two relative productivity series have been rescaled (to zero mean) for ease of comparison.

(according to relative prices until 2000 and according to relative labor productivity until 1998) and the real exchange rate appreciates again, although during this period the appreciation outpaces the relative productivity gains. All in all, however, the real exchange rate seems to have evolved roughly in line with productivity differentials, at least until 1995.

Aside from non-traded goods, the other main factor that can lead to the breakdown of PPP is the lack of perfect substitution between domestic and foreign traded goods. The Balassa-Samuelson hypothesis is based on the assumption of perfect substitutability between traded goods produced at home and abroad, but in reality traded goods produced in different countries are not identical, and the relative price of foreign and domestic tradables (i.e. the terms of trade) shows significant time variation. This in turn may result in substantial changes in the real exchange rate over time.

To account for this variability of exchange rates, Mussa (1984) proposed a model of exchange rate determination, which can be summarized as follows. On the one hand, changes in the exchange rate affect the trade balance, the current account balance and its stock counterpart, the country's net foreign asset position[12]. Under this approach to exchange rate determination, the exchange rate must be consistent with an external position where any current account imbalance is financed by a sustainable flow of international capital, which in turn is determined by the desired stock of foreign asset and liabilities among nations. A country may run current account deficits (surpluses) and therefore decumulate (accumulate) assets in the adjustment process towards its desired stock. Such imbalances would be due to cross-country differences in the propensities to save and invest, which are assumed independent from exchange market developments. In the long-run, however, when assets are at their desired levels, the current account and the exchange rate should be consistent with a stable net foreign assets-output ratio [see the empirical applications in Broner, *et al.* (1998), Alberola *et al.* (1999), and Alberola and López (2000)].

Figure 3 reviews the evolution of the stock of Net Foreign Assets (NFA) relative to GNP for Argentina over 1990-2001[13]. Inspection of Figure 3 reveals that during the 1990s Argentina witnessed a steady increase in its foreign liabilities: the NFA stock fell from about -15 percent of GNP in the early 1990s to close to -40 percent of GNP at the end of the decade. Figure 3 also indicates that the decline in the country's net asset position accelerated after the Asian crisis of 1997. Before 1997 Argentina was adding liabilities at a rate of about 1 percent of GNP per year, but after 1997 it started adding about 4 percent of GNP per year. If the real exchange rate had adjusted to this reduction in wealth, it should have depreciated, leading to a trade balance surplus to compensate for the interest payments

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[12] Changes in the net foreign asset position, and therefore in the net wealth of the country, also affect the real exchange rate, through the wealth effect on consumption.

[13] See Section IV for a description of the procedure used in the computation of the net foreign asset position.

associated with the increasing liabilities. Such adjustment did obviously not take place, and therefore the disparate evolution of net foreign asset holdings and the observed real exchange rate in the late 1990s suggests that a gap opened between the actual exchange rate and the one that would have been consistent with a sustainable NFA / GNP ratio.

To examine these issues more rigorously, the next section develops a theoretical framework that incorporates the two ingredients reviewed above, productivity differentials and asset equilibrium. Importantly, the approach combines both theoretical strands without restricting the exchange rate to be determined by either one of them alone.

III. The Economic Model

Consider two economies, each producing two goods: one tradable (denoted by the subscript T in what follows) and one non-tradable (N). The (log) real exchange rate (q) is defined as the relative price of two consumption baskets at home and abroad:

$$q = p-(s + p^*), \tag{1}$$

where s is the (log) nominal exchange rate, defined as the price of foreign currency in terms of domestic currency, and p and p^* are the (log) domestic and foreign price indices respectively. Throughout we use asterisks to denote foreign variables. An increase in q represents an appreciation of the real exchange rate.

The consumer price index (CPI) for each country is a weighted-average of the exportable, non-tradable, and importable prices, all expressed in the currency of the respective country:

$$p=(1-\alpha_N-\alpha_T)p_T+\alpha_N p_N +\alpha_T (s+p_T^*) \tag{2}$$
$$p^*=(1-\alpha^*_N-\alpha^*_T)p^*_T+\alpha^*_N p^*_N +\alpha^*_T (p_T -s),$$

where the αs are the weights of the respective goods in the consumer basket. Substituting these expressions in (1), assuming that $\alpha_N=\alpha^*_N$, and rearranging terms we obtain

$$q = (1-\alpha_T -\alpha^*_T)q_X+\alpha_N q_I, \tag{3}$$

where $q_X=p_T-(s+p_T^*)$ is the relative price of domestic tradables in terms of foreign tradables, and $q_I=(p_N-p_T)-(p^*_N-p^*_T)$ is the price of non-tradables relative to tradables across countries. Here q_X captures the competitiveness of the economy, and as we shall explain shortly it is related to the evolution of the foreign asset position. Since sustainable capital flows eventually lead to the desired stocks of assets and liabilities across countries, the equilibrium level of q_X is associated with the external equilibrium of the economy. On the other hand, the cross-country differential in relative tradable-nontradable prices q_I is related to productivity differentials. Since these prices determine the allocation of resources across sectors in a

given country, the equilibrium level of q_I can be associated to the internal equilibrium of the economy.

The equilibrium exchange rate is attained when both q_X and q_I are at their equilibrium values, and thus follows from internal and external equilibrium:

$$\bar{q} = (1 - \alpha_T - \alpha_T^*)\bar{q}_X + \alpha_N \bar{q}_I \qquad (4)$$

with the bars denoting equilibrium values. We next characterize the internal and external equilibrium of the economy.

III.1 Internal equilibrium

The differential behaviour of sectoral relative prices between countries determines the evolution of the internal real exchange rate. Sectoral prices are in turn related to the evolution of sectoral productivity. These notions can be illustrated using a simple model with two production factors, labor (L) and capital (K). Output in each sector is determined by a Cobb-Douglas production technology:

$$Y_N = A_N L_N^{\delta} K_N^{1-\delta} \qquad (5)$$
$$Y_T = A_T L_T^{\theta} K_T^{1-\theta},$$

where $0<\theta,\delta<1$ represent the intensity of labor in each sector. Labor is perfectly mobile between sectors (but not across countries), implying nominal wage equalization:

$$W_T = W_N = W. \qquad (6)$$

Labor is paid the value of its marginal product $\partial Y_i/\partial L_i = W/P_i$. Under Cobb-Douglas technology the ratio of marginal productivities is proportional to the ratio of average productivities:

$$\frac{\partial Y_T / \partial L_T}{\partial Y_N / \partial L_N} = \frac{\theta Y_T / L_T}{\delta Y_N / L_N}. \qquad (7)$$

From (7) it follows that the (log) sectoral price differential is equal to the labor productivity differentials plus a drift capturing the relative intensity of labor. Expressing with lower case the natural logarithms of sectoral labor productivities, (7) reduces to

$$\bar{p}_N - \bar{p}_T = log(\theta/\delta) + (y_T - y_N). \qquad (8)$$

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Neglecting constant terms and denoting $n = (y_T - y_N) - (y^*_T - y^*_N)$, the internal equilibrium exchange rate is just:

$$\bar{q}_I = \bar{n} , \qquad\qquad\qquad (9)$$

III.2 External equilibrium

Portfolio models of real exchange rate determination (Mussa 1984) focus on asset equilibrium, as defined by the attainment of agents' desired foreign asset stock. Over time, the accumulation of net foreign assets (F) is given by the current account balance (CA), which equals the trade balance (XN), plus the net income that residents receive (or pay) on F:

$$\Delta F = CA = XN + i^* F \qquad\qquad\qquad (10)$$

where i^* is the international interest rate, which is assumed given. It will be more convenient to focus on the trajectory of the foreign asset stock relative to GNP, which can be written

$$\Delta f = ca = xn + (i^* - g) f \qquad\qquad\qquad (11)$$

where f and xn denote the ratios to GNP of the respective uppercase variables, and g is the rate of GNP growth. If the Marshall-Lerner condition holds, an increase in the relative price of domestic tradables q_X shifts consumption toward foreign tradables and worsens the trade balance. Consistent with this interpretation, it is plausible to assume that the trade balance as a percentage of GNP (xn) is given by:

$$xn = -\gamma q_x, \qquad\qquad \gamma > 0. \qquad\qquad (12)$$

The capital account deficit reflects the desired rate of accumulation of net foreign assets by the home country, which is assumed to depend on the divergence between the current level of assets as a percentage of GNP (f) and the desired equilibrium level ($\bar{f}$), itself determined by exogenous factors such as saving preferences and demographics which will not be modelled here

$$\Delta f = a(\bar{f} - f) \qquad\qquad a > 0 \qquad\qquad (13)$$

Equation (13) indicates that if the actual net foreign asset position is below its desired level, agents will accumulate assets to reach the target; conversely, if f is greater than $\bar{f}$ agents will be reduce their asset holdings until they reach $\bar{f}$.

Equating (13) and (11) after using (12), and solving for q_x we get:

$$q_x = [a/\gamma] \ (f - \bar{f}) + [(i^* - g) \ / \ \gamma] f \qquad (14)$$

Equation (14) shows that the external real exchange rate depends on (i) the divergence between current and equilibrium asset holdings; and (ii) the current stock of net foreign assets f. Defining the equilibrium external real exchange rate $\bar{q}_X$ as that consistent with $f = \bar{f}$ (i.e. the exchange rate consistent with asset holdings at their equilibrium level) it follows that

$$\bar{q}_X = [(i^* - g)/\gamma] \ \bar{f}, \qquad (15)$$

III.3 The equilibrium real exchange rate

Substituting (9) and (15) into (3), we get the final expression for the equilibrium exchange rate:

$$\bar{q} = [(1 - \alpha_T - \alpha^*_T)(i^* - g)/\gamma] \ \bar{f} + \alpha_N \ \bar{n}. \qquad (16)$$

Observe that in principle both $(1 - \alpha_T - \alpha^*_T)(i^* - g)/\gamma$ and α_N should be positive, and thus the equilibrium real exchange rate appreciates in response to both a higher long-run asset stock and a higher relative productivity differential[14].

IV. Empirical issues

The theoretical model outlined above identifies two fundamentals for the evolution of the real exchange rate[15]: the level of net foreign assets f and relative sectoral productivity (n). In this framework, a suitable empirical model for estimation would be

$$q = \beta_0 + \beta_F f + \beta_N n + u \qquad (17)$$

with slope parameters $\beta_F = (1 - \alpha_T - \alpha^*_T)(i^* - g)/\gamma$ and $\beta_N = \alpha_N$.

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[14] The assumption $i^* > g$ amounts to ruling out dynamic inefficiency.

[15] For a country like Argentina, where a large share of export are commodities, whose international price is given in foreign country, the evolution of equilibrium real exchange rate could be also influenced by the evolution of the prices of exportable commodities. Also, the interest rate differentials has been used in this type of literature as long-run exchange rate fundamentals. Here we focus on this extremely parsimonious approach which allows for a neat interpretation of the results. See Gay and Pellegrini (2003) for a wider model to estimate equilibrium exchange rates in Argentina.

At this stage, one would be tempted to think that if a long-run cointegration relationship between the real exchange rate and its fundamentals can be found, it will automatically yield an estimate of the equilibrium rate. However, for this to be true, one would have to observe the *equilibrium* levels of the fundamentals, and then apply a cointegration analysis to them. Unfortunately, we can observe only the actual values of the variables, and therefore some further econometric manipulation is needed to estimate the equilibrium real exchange rate.

Intuitively, the observed exchange rate can be decomposed into two components: the first one, when the fundamentals are at their steady state levels, would be the equilibrium exchange rate

$$\bar{q} = \beta_0 + \beta_F \, \bar{f} + \beta_N \, \bar{n} \tag{18}$$

The second component, when the fundamentals are away from their respective steady states, would correspond to the deviation of the exchange rate from its equilibrium level.

$$\hat{q}_t = \beta_0 + \beta_F \, \hat{f}_t + \beta_N \, \hat{n}_t \tag{19}$$

where $\hat{f}_t$ and $\hat{n}_t$ denote deviations of the fundamentals from their equilibrium values.

Our strategy for estimation of the equilibrium real exchange rate is based on the econometric decomposition of the observed real exchange rate into a transitory and a permanent component. The estimated equilibrium exchange rate is taken to be the permanent component, while the transitory component reflects deviations from equilibrium. In what follows, we first relate the equilibrium exchange rate with the concept of cointegration, and then show how cointegration allows for the extraction of the two unobserved components from the observed exchange rate and fundamental series.

In order to understand the link between equilibrium and cointegration, it is useful to depart from the PPP view, which implies a constant value for the equilibrium real exchange rate $\bar{q}$ or, in econometric terms, that q_t is integrated of order zero ($I(0)$). Failure of PPP to hold does not necessarily imply that no equilibrium exists, but rather that the equilibrium may be time-varying. In our case, if q, f, and n are cointegrated, then u in (17) will be $I(0)$, and an equilibrium real exchange rate will exist. In other words, q will fluctuate around a time-varying equilibrium characterized by the long-run cointegrating vector $[1, -\beta_F, -\beta_N]$.

As noted above, the time-varying equilibrium exchange rate cannot be inferred by simply imposing the cointegration vector on the observed values of the explanatory variables. In this regard, cointegration among a set of variables presents a very desirable property: it allows for the decomposition of the relationship among the variables into two components: a permanent or secular $I(1)$ component, which describes the long-run properties of the

relationship, and can be identified with a time-varying equilibrium path; and a transitory *I(0)* component, which corresponds to deviations from the permanent component and represents departures of the fundamentals from their steady state values.

The decomposition of the observed series into their permanent and transitory components requires identification of the basic properties of the latter. We follow Gonzalo and Granger (1995) and derive a decomposition where the transitory component does not Granger-cause the permanent component in the long run, and where the permanent component is a linear combination of contemporaneous observed variables. In other words, the first restriction implies that a change in the transitory component will not have an effect on the long-run values of the variables[16]. The second restriction makes the permanent component observable and implies that all the information necessary to extract it is contained in the contemporaneous observations of the variables.

Let us consider the 3x1 vector $x_t = [q_t, f_t, n_t]'$ which under the null hypothesis of one cointegration vector admits the following representation:

$$\Delta x_t = D_1 \Delta x_{t-1} + ... + D_{p-1} \Delta x_{t-p+1} + \Pi x_{t-p} + e_t, \qquad (20)$$

where e_t is a vector white noise process with zero mean and variance Σ and Π is 3 x 3 matrix with rank 1. Given that Π is not full rank, it can be written as the product of two rectangular matrices α and β of order 3 x 1 such that $\Pi=\alpha\beta'$. In turn, β is the cointegration vector and α is the factor-loading vector. Next, we can define the orthogonal complements $\alpha_\perp$ and $\beta_\perp$ as the eigenvectors associated with the unit eigenvalues of the matrices *(I- α (α' α)$^{-1}$ α')* and *(I- β (β' β)$^{-1}$ β')*, respectively. Notice that $\alpha'_\perp \alpha = 0$ and $\beta'_\perp \beta = 0$. With this notation we can write

$$x_t = \beta_\perp (\alpha'_\perp \beta_\perp)^{-1} \alpha_\perp x_t + \alpha(\beta'\alpha)^{-1} \beta' x_t, \qquad (21)$$

where $\beta_\perp (\alpha'_\perp \beta_\perp)^{-1} \alpha_\perp x_t$ captures the permanent component and $\alpha (\beta' \alpha)^{-1} \beta' x_t$ the transitory component. Gonzalo and Granger (1995) show that the transitory component defined in this way does not have any effect on the long-run values of the variables, which are captured by the permanent component.

The identification of the permanent component with equilibrium implies that

$$\bar{x}_t = \beta_\perp (\alpha'_\perp \beta_\perp)^{-1} \alpha_\perp x_t \text{ and } \hat{x}_t = \alpha(\beta'\alpha)^{-1} \beta' x_t,$$

from where an estimate of the equilibrium exchange rate and its deviation follows directly.

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[16] In essence, this decomposition rules out hysteresis in the real exchange rate.

A final issue to consider in this section is the extent to which the statistical model can yield additional knowledge regarding the theoretical model. As noted above the theoretical model encompasses the Balassa-Samuelson hypothesis and the balance of payments approach. It is therefore natural to enquire if the data provide support for both views, for one of them only, or for neither. This can be assessed by constructing test statistics for the following hypotheses on the cointegration vector:

Balassa-Samuelson approach: $\beta_F = 0$

Under the null $\beta_F = 0$, the real exchange rate would be determined only by the Balassa-Samuelson model, and would evolve according to relative productivity differentials. Under the null, the test statistic, which we denote BASA, is distributed as a $\chi 2(1)$.

Balance of payments approach: $\beta_N = 0$

The case $\beta_N = 0$ corresponds to a situation in which either n does not enter the model or $\alpha_N = 0$ (i.e., the economy is fully tradable). The Balassa-Samuelson effect then plays no role as determinant of the real exchange rate. The test statistic, that we denote BOP, is distributed as a $\chi 2(1)$ under the null.

PPP: $\beta_F = \beta_N = 0$

If $\beta_F = \beta_N = 0$, the real exchange rate is stationary, as posited by the PPP approach. Econometrically we should find a cointegration vector of the form [1, 0, 0]. Under the null, the test statistic, denoted PP, is distributed as a $\chi 2(2)$. Notice also that it would be possible to discriminate further between absolute and relative PPP, depending on whether the cointegration vector is centered around 0 (absolute PPP) or not (relative PPP).

V. Misalignment and its sources

In this section we estimate the equilibrium real exchange rate for the Argentine peso. The sample covers the period 1960-2001 and the data are annual. We first describe the construction of the series and then present the results.

V.1 Data

Empirical estimation of our model requires data on three variables: the real effective exchange rate q, the stock of net foreign assets as a percentage of GNP f, and relative sectoral productivity n. We use a CPI-based index of the real effective exchange rate

(henceforth REER)[17], whose weights are based on Argentina's bilateral trade flows averaged over the period 1998-2000. We construct weights for 40 trading partners which combined account for 90 percent of Argentina's trade. Figure 4 reports the weights corresponding to a higher level of aggregation distinguishing only five trading partners: Europe, United States, Asia, Mercosur and the rest of the World (ROW). Mercosur is Argentina's main trading partner, accounting for almost 40 percent of her total trade. Within Mercosur, Brazil is the leading trading partner, with about 30 percent of Argentina's trade. Next comes Europe, with 25 percent (of which 23 percent corresponds to the Euro area). The US follows with 17 percent, and finally the rest of the world accounts for about 5 percent of Argentina's trade.

The stock of net foreign assets F can be computed by accumulating past current account balances:

$$F_t = \sum_{j=0}^{t} CA_{t-j} + F_0 \tag{22}$$

Of course, to implement this procedure we still need an initial value F_0. We take it from Broner *et al.* (1998), who estimate F_{1965} at US$-3,853 million; f is then computed as the ratio of F to the U.S. dollar-denominated GNP[18].

Finally, data on sectoral productivity or even for overall productivity are not available for Argentina and many of the partner countries for the sample period. However, we take advantage of the already robust evidence of a long-run relation between sectoral productivity and sectoral prices [see, among others, Canzoneri *et al.* (1999), Alberola and Tyrväinen (1999)] to use an index of relative sectoral prices as a proxy for sectoral productivities. More precisely, we use the comparative index of the relative price of non-tradable versus tradable goods devised by Kakkar and Ogaki (1999) for estimation purposes: we proxy n with the (log) ratio of Argentina's consumer price index (CPI) to the wholesale price index (WPI), relative to the corresponding ratio for Argentina's trading partners. The trade weights used in the computation are those used to construct the real effective exchange rate.

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[17] Results with GDP-based deflator (an alternative which would not include imported tradables in the computation of the index) yield very similar results.

[18] As a caveat, this way of measuring of the stock of net foreign liabilities does not take into account the default in the eighties which amounts to a haircut on the stock of liabilities. But note that this downward shift in the debt stock would also imply a higher risk premium on future Argentine debt (v.g an expected) upward shift in the parameter which relates n and the real exchange rate). Since this would imply both a time varying parameter and a somewhat arbitrary determination of the post-default net foreign asset position we consider that the gain from performing these adjustments is not evident.

V.2 Econometric Results

Table I reports the results of Johansen cointegration tests for Argentina using a VAR of order 3. Inspection of the table indicates that on the basis of the maximal eigenvalue test one can reject at the 5 percent level the null of no-cointegration in favor of the existence of one cointegration vector.

<div align="center">Table I. Cointegration</div>

Ho: r≤	Eigenvalue	Trace	λ-max	Critical Val 5% Trace	λ-max
2	0.0077	0.2619	0.2619	8.1800	8.1800
1	0.1769	6.8829	6.6211	17.9500	14.9000
0	0.4672	28.2870	21.4041[a]	31.5200	21.0700

Cointegration vector: $q = \beta_0 + 1.82f + 0.69n$

Loading Matrix: α= [-1.14 (s.e. .25) -.01 (s.e. .06) -.18 (s.e. .11)]'

PPP = 24.43[a]   BASA=16.91[a] BOP=23.99[a]

a. Indicates rejection of the null at the 5 percent.

The table also shows the cointegration vector β and the loading matrix α (whose standard errors are shown in parentheses). As predicted by the analytical model, the cointegration vector uncovers a positive relationship between the real exchange rate and the stock of net foreign assets and relative productivity growth. Also, the magnitude of the parameter estimates is comparable to that reported by Alberola *et al.* (1999), who apply a similar specification to 12 OECD currencies. Our estimate of β_F is slightly higher than those reported in that paper (which are always below 1), but this is consistent with a situation in which (i) Argentina has faced higher interest rates than OECD countries on its (negative) net foreign assets; (ii) the degree of openness of Argentina is lower than in OECD countries, so that the term $(1-\alpha_T-\alpha^*_T)$ is correspondingly larger; and (iii) Argentina's growth performance over the past four decades has been less successful than that of OECD economies.

As for the VAR loading factors shown in the table, we find that that the only loading factor significantly different from zero at the 5 percent level is the one for the real exchange rate equation. In other words, the error-correction term does not enter the equations for productivity and net foreign assets.

Table I also reports the BASA, BOP and PPP statistics described above. Recall that BASA is the test statistic for the null hypothesis that the real exchange rate follows the Balassa-Samuelson hypothesis alone, while BOP corresponds to the hypothesis that the Balance of Payments approach suffices to explain the time path of the real exchange rate.

The 5 percent critical value for both statistics is 3.84. In turn, the PP statistic tests the null hypothesis of PPP, and its 5 percent critical value is 5.99.

As shown in the table, all three statistics provide strong rejections of their respective null hypotheses. We take this as evidence that both the balance of payments approach and the Balassa-Samuelson hypothesis play a role in the determination of the real exchange rate, as predicted by the analytical model.

Using the estimated cointegrating vector and the loading factors, we can decompose the real exchange rate into its permanent and transitory components, following the methodology described in the previous section. As already noted, the permanent and transitory components are the empirical counterparts of the equilibrium real exchange rate and its deviation from equilibrium, respectively.

Figures 5 and 6 present the equilibrium exchange rate for the Argentine peso and the evolution of its misalignment (with 95 percent standard error bands[19]) since the inception of the currency board. In Figure 6, positive values imply an overvaluation of the multilateral rate, and negative values mean undervaluation.

The results reveal a large overvaluation of the peso at the end of the sample, reaching 53 percent[20] in 2001. This figure is somewhat higher than the overvaluation derived from a simple-minded PPP approach, which equals 43 percent in 2001. Likewise, the time profile of estimated misalignment derived from our model is quite different from that derived from the PPP approach. The PPP benchmark suggests that the real exchange rate was significantly overvalued throughout the period of analysis. In contrast, our estimations suggest that the peso was undervalued at the inception of the currency board (by about 20 percent), remained close to its equilibrium value from 1993 to 1997, and became grossly overvalued over 1998-2001.

The main ingredient behind this rising overvaluation in the final years of the sample is the depreciation of the equilibrium exchange rate after 1993, shown in Figure 5. In the model, the time path of the equilibrium real rate reflects the evolution of equilibrium foreign assets and productivity differentials. From Figures 2 and 3, we can conclude that the depreciation of the equilibrium real exchange rate after 1993 was mostly driven by Argentina's declining net foreign asset position relative to GNP, given that relative productivity, after a sharp increase in 1990-91, experienced only modest changes over the rest of the decade.

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[19] See Appendix I in Alberola *et al.* (1999) for the derivation of the bands.

[20] More precisely, this is the difference between the logs of the actual REER and its equilibrium counterpart. The other figures quoted in this section also refer to log deviations. We use these deviations rather than percentages to allow straightforward additive decompositions of overall misalignment into its various components.

In principle, the steady fall in the ratio of net foreign assets to GNP could have been due to substantial current account deficits, sluggish growth, or both. In fact, Argentina ran persistent current account deficits over the 1990s, averaging 3 percent of GNP, although their magnitude increased in the second half of the decade. As for growth, it averaged a high 6 percent per year in the first half of the decade, but in the second half (1996-2001) it declined to an average of 2 percent per year. Further, growth turned negative at the end of the period (1999-2001).

To disentangle the relative roles of sluggish growth and current account deficits in the observed evolution of the equilibrium real exchange rate, we performed two simulation experiments to assess the impact on the net foreign asset ratio of (i) maintaining a zero current account balance from 1991 to 2001; and (ii) 6 percent average growth over 1996-2001 (while keeping the original current account balance unchanged). In the first case, we find that the "virtual" net foreign asset position would have been consistent with a 3 percent overvaluation in 2001 or, in other words, the real exchange rate would have been nearly in equilibrium at the end of the period. In the second simulation we find a more modest effect on the equilibrium real exchange rate: we are able to wipe out just 7 percent of the 53 percent estimated overvaluation. This suggests that overspending, rather than sluggish growth, was the main driving force behind the steady depreciation of the equilibrium REER.

Finally, it is also interesting to view the degree of overvaluation of the peso that our estimates reveal for the final years of Convertibility in the light of the results obtained by Godfajn and Valdés (1999) from analysis of a large number of episodes of real overvaluation. As noted earlier, the evidence they report suggests the existence of a threshold of overvaluation beyond which correction of the misalignment without nominal devaluation becomes very unlikely. Indeed, in their sample few overvaluations exceeding 25 percent, and none above 35 percent, were undone without a collapse of the nominal exchange rate. Our estimates place the overvaluation of the peso in 2000 and 2001 well above those thresholds, suggesting that at such point the collapse of the Convertibility regime had become virtually unavoidable.

VI. The Currency Board: Wrong Peg or Diverging Fundamentals?

In the previous section we have estimated the misalignment of the real effective exchange rate of the peso and explained its trajectory on the basis of the fundamentals implied by our model. In this section we take a different perspective in order to assess the role of changes in the real exchange rates of other currencies in the misalignment of the peso. In this regard, a number of observers have attributed the bulk of the misalignment to the appreciation of the US dollar against Argentina's major trading partners –or, to put it differently, to the depreciation of the Euro and the Brazilian real (the currencies of Argentina's top two trading partners) at the end of the1990s. In contrast, other analysts assign most of the blame for the

collapse of Convertibility and the ensuing crisis to the adoption by the authorities of economic (particularly fiscal) policies inconsistent with the hard peg[21].

To assess these views, consider the following identity:

$$\hat{q}_A = \underbrace{(\overline{q}_\$ - \overline{q}_A)}_{\substack{\text{diverging} \\ \text{fundamentals}}} + \underbrace{(q_A - q_\$) + \hat{q}_\$}_{\text{inadequate peg}} \tag{23}$$

where we use the subscripts A and $\$$ to denote the Argentine peso and the US dollar, respectively. This is just a decomposition of peso misalignment into three terms. The first one captures the divergence between the equilibrium REERs of the dollar and the peso. In the context of Argentina's peg to the dollar, a nonzero value for this term implies a long-term divergence between the fundamentals of the anchor and client countries. To the extent that in the model presented earlier the fundamental determinants of the real exchange rate –the foreign asset position and relative productivity growth– can be affected by macroeconomic policies and structural reforms, we can relate this component of peso misalignment with persistent policy divergences between Argentina and the US, which in the long run are inconsistent with Argentina's dollar peg.

The other two terms in the right hand side of (23) capture the peso misalignment occurring even in the absence of policies inconsistent with the peg. Thus, we may view such misalignment as reflecting the inadequacy of the peg itself. It combines two items. One is the divergence between the actual REERs of the peso and the US dollar, captured by the second term on the right-hand side of (23). Since each REER can be expressed as a weighted sum of the bilateral real exchange rates of trading partners (where the weights are their respective trade shares), this term basically arises from differences between the trade structures of the US and Argentina. In practice, the key difference in their trade structures concerns Brazil, who is a major trading partner for Argentina but not for the US[22]. Hence, the time path of $(q_A - q_\$)$ is dominated by the real exchange rate of the Brazilian real, and we should expect this term to exhibit a significant increase in 1999 due to the abrupt devaluation of the latter currency.

The rest of the misalignment attributable to inadequacy of the peg, captured by the last term in the right-hand side of (23), is just the misalignment of the REER of the US dollar, which the peso inherits through the peg. The logic of this term is quite simple: absent policy divergences and asymmetries in trade structure (already captured by the first two terms in the right-hand side of (23) above), pegging to a misaligned anchor currency necessarily leads

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[21] See for example Mussa (2002).
[22] Brazil accounts for 30 percent of Argentina's trade, but only for 2 percent of US trade.

to misalignment. In practice, existing empirical studies[23] suggest that the dollar was overvalued after 1996-97, and thus we would expect this last term to add to the overvaluation of the peso in the final years of Convertibility.

To implement empirically the decomposition in (23) we need an estimate of the misalignment of the US dollar real effective exchange rate in order to capture the last term in the right-hand side of the expression. To construct such estimate, we build from the work of Alberola *et al*. (1999), who report multilateral misalignments for the period 1980-98 for twelve OECD currencies, by extending their sample to the period 1999-01. Figure 7 reports the estimated real misalignment of the dollar that results from this procedure. Inspection of the figure indicates that during the first half of the 1990s the dollar was slightly undervalued, but in 1996 there was a change in trend which lead to an increasing overvaluation. By 1999 the overvaluation was about 10 percent, and it rose to 15 percent in 2000 and over 20 percent in 2001[24].

Using Figure 7, we can calculate the decomposition in equation (23). Its results are shown in Figure 8, which reports the sources of the annual change in peso misalignment over 1993-2001 (with the changes measured by the first difference of the overall peso misalignment shown in Figure 6).

The figure shows some salient facts. First, except for 1993, diverging fundamentals made a positive contribution every year; that is, given other things, they invariably added to overvaluation. Thus, Argentina's economic fundamentals –in terms of productivity trends and spending relative to income– diverged persistently from those that would have been required to sustain the currency board. Ultimately, this suggests that the stance of macroeconomic policies and structural reforms was not tuned to the maintenance of Convertibility in the long run.

Second, the role of peg inadequacy in the overvaluation of the peso was more erratic. Its contribution was positive in 1993, became negative in 1994-95 –thus pushing the peso towards undervaluation– and then returned to positive values throughout the rest of the sample period. Thus, the 'wrong peg' did add considerably to overvaluation in the final years of Convertibility.

Further, the two components of this term –trade asymmetries and dollar overvaluation– also exhibited changing behavior over the period. Between 1994 and 1998 trade asymmetries had a negative contribution –i.e., they tended to render the peso undervalued. This is consistent with the appreciation of the Brazilian real over those years. However, its abrupt depreciation

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[23] See Alberola *et al.* (1999).
[24] Subsequently the dollar depreciated by about 10 percent on a trade-weighted basis between mid 2001 and mid 2002.

in 1999 added a substantial push towards peso overvaluation (about 11 percent, as already noted). After that year, the contribution of trade asymmetries was fairly modest. Finally, the misalignment of the dollar also made a contribution of changing sign to peso misalignment. But from 1996 on, as the overvaluation of the dollar developed, the contribution became positive and also added to peso overvaluation.

Figure 9 offers a different perspective on the same results. As we already saw, over 1993-97 the real exchange rate of the peso was roughly in equilibrium, and its overvaluation developed after the latter date. Figure 9 shows the contribution of the three ingredients under consideration to the cumulative change in the misalignment of the peso over 1993-97 and 1997-2001. The contrast between the two periods is revealing. During the first one, the misalignment of the peso barely changed. The figure shows that this was the result of two opposing forces: inconsistent fundamentals, that tended to render the peso overvalued (at a rate of 6.3 percent per year), and trade asymmetries, that worked in the opposite direction (by 6.1 percent per year). As a result, the net effect was almost negligible. Importantly, the contribution of dollar misalignment was small as well.

In contrast, in 1997-2001 all three ingredients worked in the same direction towards overvaluation of the peso. Diverging fundamentals continued to contribute close to 6 percent per year to the overvaluation. But the inadequacy of the peg had also a positive, and even bigger, impact, primarily through the increasing overvaluation of the dollar, which by itself added almost 5 percent per year to overall peso overvaluation, and also through the reversal in the effect of trade asymmetries, as the appreciation of the Brazilian real ended with its collapse in 1999.

VII. Conclusions

Argentina's Convertibility regime quickly led to nominal stability and financial deepening. However, it also allowed a large real appreciation to develop. Overvaluation of the peso has been underscored by many observers as one of the key ingredients in the Argentine crisis. This paper has assessed the degree of real exchange rate misalignment in Argentina over the Convertibility decade and has explored the main factors behind it.

The paper develops a model in which the equilibrium real exchange rate is that consistent with both a sustainable balance of payments position (external equilibrium) and the efficient use of domestic resources (internal equilibrium). Thus the model encompasses two leading views of real exchange rate determination –the balance of payments and the Balassa-Samuelson approaches. In the model, the fundamental determinants of the equilibrium exchange rate are the stock of net foreign assets and the relative productivity in tradable and nontradable goods vis-à-vis trading partners.

Empirical implementation of the model to the Argentine peso reveals that its real exchange rate exhibits a unit root, which constitutes evidence against the PPP hypothesis. Further, we find evidence supporting the presence of a cointegration relationship between the real exchange rate and its fundamental determinants, as predicted by our model. Finally, the data allow us to reject the hypotheses that either the balance of payments approach or the Balassa-Samuelson approach alone suffice to explain the evolution of the real exchange rate.

The results show that during the first years of the currency board, and coinciding with the stabilization of the economy after the hyperinflation episode of the late 1980s, Argentina enjoyed significant productivity increases relative to her trading partners, which may help explain the sharp real appreciation of the peso between 1990 and 1993. After the latter year, productivity stalled. We also note, however, the parallel process of foreign asset loss, which brought the stock of net foreign liabilities from 15 percent of GNP in the early 1990s to about 40 percent of GNP in 2001. In the model this implies a significant correction in the equilibrium real exchange rate.

According to our results, after 1997 the peso became increasingly overvalued. By 2001, the overvaluation exceeded 50 percent. Our framework allows us to assess whether this reflected primarily the pursuance of macroeconomic policies inconsistent with the dollar peg, or the inadequacy of the peg itself for the Argentine economy –either because the dollar was the wrong anchor given the Argentine trade structure, or because the anchor was overvalued. Over 1997-2001, the period in which the overvaluation developed, we find that both factors share the blame.

The paper's results also cast some light on the retrospective policy debate about whether Argentina's nominal peg could have been salvaged by letting deflation do its job to realign the real exchange rate. Given the international experience on how appreciations are reversed, the large magnitude of the overvaluation that the paper finds in the final years of Convertibility suggests that such course of action would have been very unlikely to succeed.

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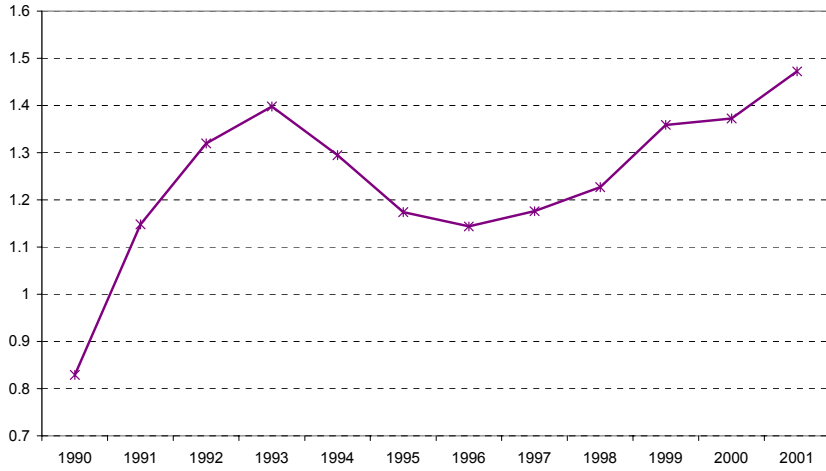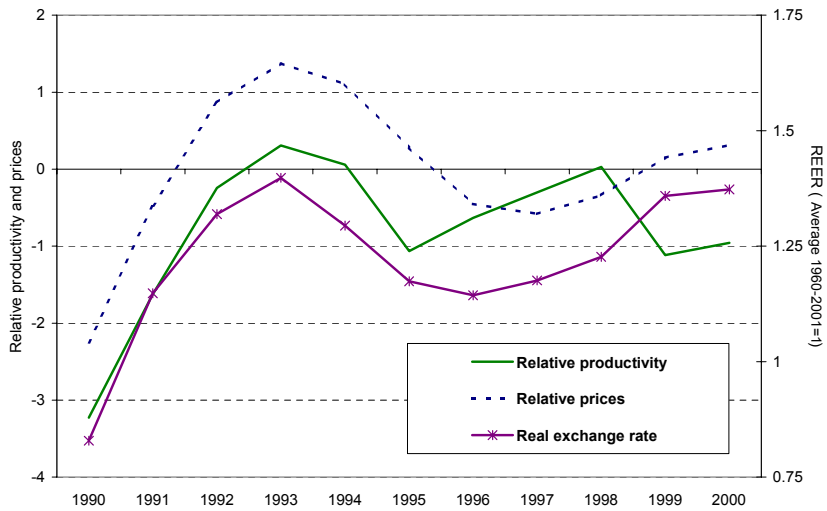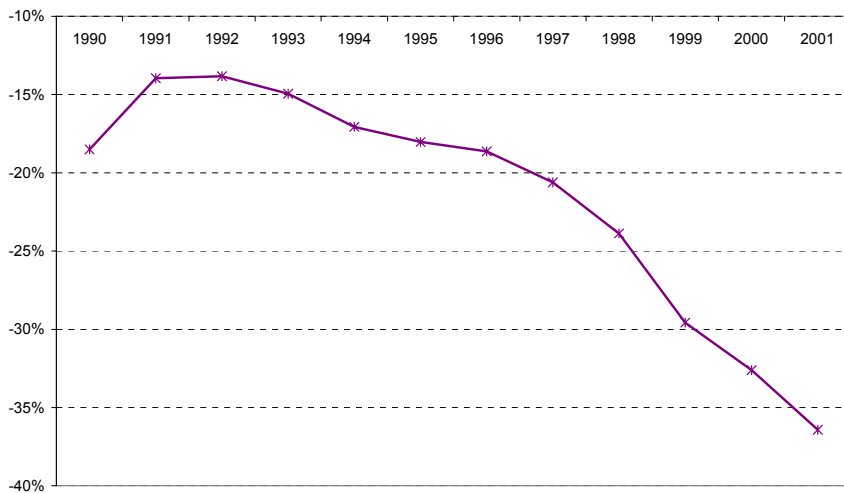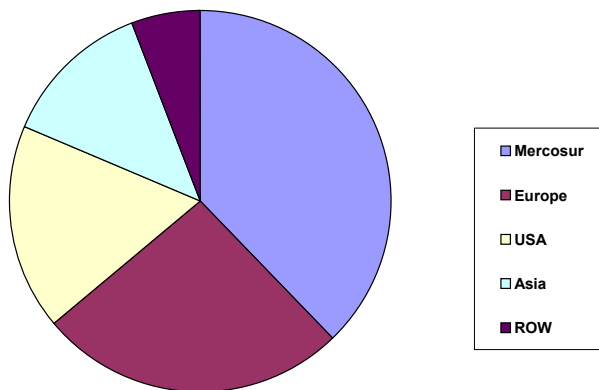**Figure 1. Real Effective Exchange Rate of the Peso**

Average REER
1960-2001=1

Figure 2. Relative Productivity, Prices, and the Real Exchange Rate

32

Figure 3. Net Foreign Assets
(Percent of GDP)

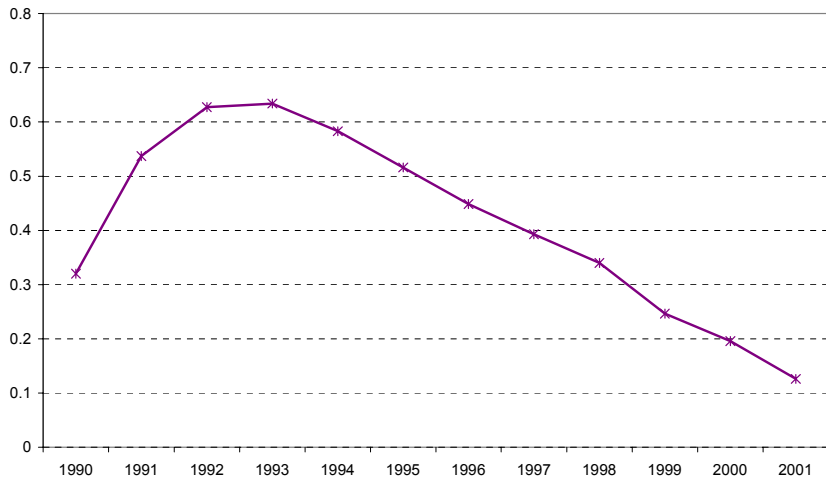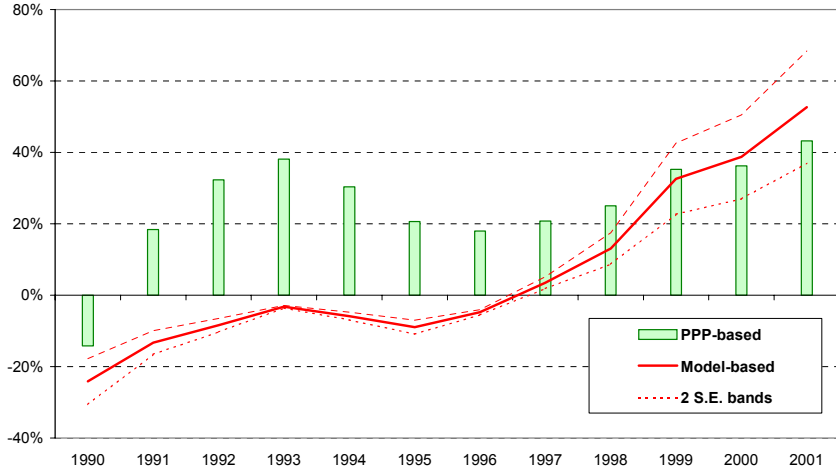**Figure 4. Argentina's Trade Structure, 1998 - 2000**
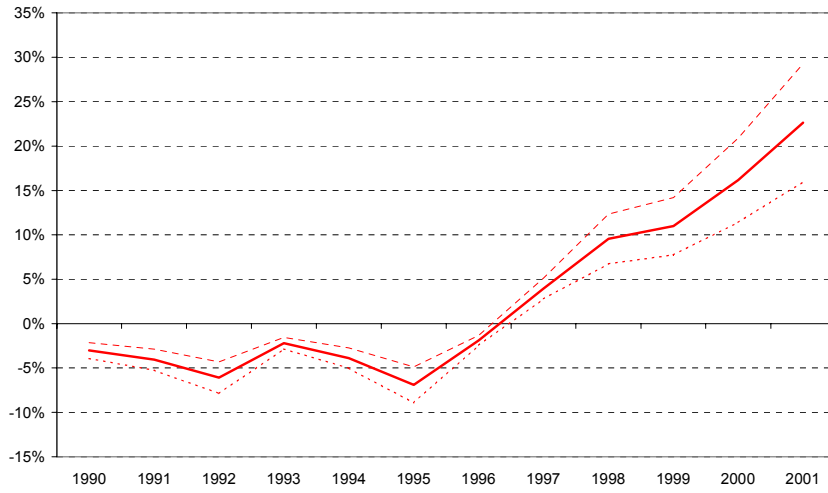**(Percent of total trade)**

Mercosur
Europe
USA
Asia
ROW

33

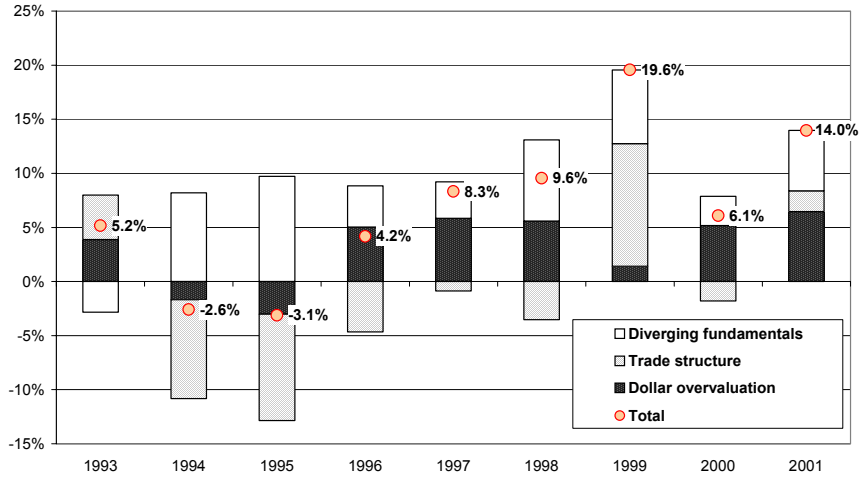**Figure 5. Equilibrium Real Exchange Rate**

Average REER
1960-2001=1

Figure 6. Estimated Real Misalignment of the Peso
(Percentages)

Figure 7. Estimated Real Misalignment of the U.S. Dollar
(Percentages)

Figure 8. Source of Peso Misalignment
(Annual contribution of each factor)

Figure 9. Sources of Cumulative Peso Overvaluation
(Percentages)

Legend:
- □ Diverging fundamentals
- □ Trade structure
- ■ Dollar overvaluation

1993-1997:
- 6.3%
- 1.5%
- -6.1%

1997-2001:
- 5.6%
- 2.0%
- 4.7%