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Exchange rate-based stabilization revisited: An analysis of its short-term impact on external equilibrium in Argentina (1991-1995)

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I. Introduction

A fixed exchange rate has frequently been used in stabilization programs as a nominal anchor. The main objective of these stabilization programs has been to curb the inflation rate. A recent experience with exchange rate-based stabilization programs (ERBS) has been made in Argentina which began in 1991. The program, called the Convertibility Plan, has been very successful in reducing inflation: Inflation rates have been brought down from double digit levels to single digit ones. However, with the introduction of the ERBS program the current account and the trade balance has been deteriorating significantly. In Argentina, the current account deficit can so far be financed by high capital inflows, but as these capital inflows consist mainly of “hot money”, a sudden change of investor’s confidence could lead to capital outflows, which could trigger a balance of payments’ crisis.

In this paper the link between the fixed nominal exchange rate and the consequent real appreciation of the currency on the one hand and the deterioration of the trade balance on the other hand shall be investigated for the rather short period of 1991-95 to gain insights into the implications and the riskiness of this type of stabilization. For analytical purposes one can distinguish between two types of riskiness linked to real exchange rate appreciations. 1) Riskiness in the short run, which implies that the appreciation of the real exchange rate causes the trade balance to deteriorate without delays. 2) Riskiness in the medium to long run, where no empirical underpinning of the negative effects of an appreciated real exchange rate on the real side of the economy (exports, import substitutes, nontradeables) can be found in the short run, a phenomenon which clearly contradicts medium to long run studies. The second type of riskiness is more problematic than the first because it might lead politicians to stick to ERBS for too long.

To approach the question of the riskiness of ERBS, a few common features of ERBS programs are set out at the beginning (Chap. II). Next, the Convertility Plan and the economic development in Argentina from 1991-95 are described (Chap. III). The empirical analysis follows in Chap. IV. The objective of this empirical section is to test the short term link between the real exchange rate and the trade balance. After presenting the underlying macroeconomic model, the econometric equations are described. In Chap. V the results are discussed, and in Chap. VI conclusions about the riskiness or rather the prevailing type of riskiness of ERBS programs are drawn.

II. Stylized Facts of Exchange Rate-Based Stabilization

Kiguel/Liviatian (1992) and Rebelo/Végh (1995) have compared different stabilization programs that made use of the exchange rate as nominal anchor. Among these programs are the “tablita”-policies of the late 1970s in Chile, Argentina and Uruguay, the Mexican stabilization plan of 1987 and the Israeli stabilization of 1985. Although these programs differed slightly in the details, they had *four common characteristics*: First, the rate of devaluation and the rate of inflation - being higher than the rate of devaluation - converged slowly. Consequently, the real exchange rate appreciated markedly. Second, the trade balance as well as the current account deteriorated significantly. High capital inflows were needed to balance the trade deficit. Since the capital inflows consisted mainly of “hot money”, the risk of a balance of payments’ crisis was very high. In fact, a few programs had to be given up when capital inflows suddenly diminished. A third characteristic of the programs was the economic boom in the early phase of the stabilization program. This boom was reversed in a later stage and became a recession. The last common feature of all stabilization plans was the crucial role of fiscal policy: A plan was more successful, if fiscal deficits were strictly reduced.

The stylized facts make it obvious that an ERBS policy bears some considerable risks[1]. One consists in the danger, that an unsustainable high trade deficit increases the probability of a balance of payments’ crisis and, consequently, the collapse of the stabilization program. As capital flows react faster to changes in the macroeconomic environment than trade flows, a sudden outflow of capital can lead to the abandonment of the exchange rate parity, if the central bank does not dispose of sufficient amounts of international reserves to intervene and maintain the parity. The experience of Mexico in 1994 and of Brasil, Argentina and Uruguay in the early 1980s proves that the running out of reserves is a serious problem.

The experience of Argentina with its stabilization plan of 1991 matches with the above described characteristics of ERBS programs. Since Argentine data will be used in the following econometric analysis, the Argentine stabilization plan shall be described now in more detail to provide the background for the interpretation of the empirical results.

[1] This implies the underlying assumption of ERBS as such being a risky policy.

III. The Convertibility Plan and the Economic Development in Argentina from 1991-95

After several stabilization attempts in the 1980s, neo-liberal policies began under the Alfonsín-government and were continued and reinforced after the political change in 1989, when Carlos Menem was elected president. The liberalisation of foreign trade and the privatisation of state-owned companies were two of the main characteristics of the new policies. Among others, these measures were designed to strengthen the role of market forces. But at the same time, inflation rates increased further and culminated in a hyperinflation with rates of over 100% per month in 1989/90. The hyperinflation was one of the key events before the introduction of the Convertibility Plan in April 1991: Fighting inflation had become the top priority.

In April 1991 the *Convertibility Plan*, designed by the former minister for economic affairs Domingo Cavallo, was introduced: The Argentine Peso[1] was tied to the US dollar at a parity of 1:1 and full convertibility was established. At the same time, the monetary base had to be backed up 100% by foreign-currency-denominated assets of the Central Bank.[2] In fact, a modified Currency Board-system had been introduced. Moreover, indexation of contracts was prohibited and a bimonetary system was implemented: The use of US dollars as accounting and transaction currency was authorized.

Additional reforms to sustain the Currency Board-system were under way: The independence of the Central Bank was guaranteed by a new Central Bank's charta, trade liberalisation and the privatisations continued and the payment of the external debt was renegotiated in the Brady Plan. Moreover, structural reforms in the form of deregulations in many markets and a reform of the tax system were undertaken to promote the adjustment process. The constitution of the Mercosur, which started to operate properly in 1995, also played an important role in the promotion of foreign trade.

The *economic development from 1991-95* can be divided into two phases: first an expansionary phase from 1991 to the end of 1994 and second a recessionary phase in 1995. The first four years of the Convertibility Plan were characterised by high growth rates and an import boom which led to a trade deficit, for the first time since over 20 years. Exports stagnated or could not keep up with the high growth rates of

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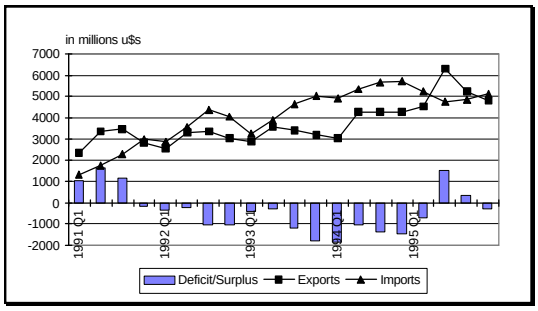
[1] In April 1991 the Argentinian currency was still the Austral. The exchange rate was fixed at 10,000 Austral : 1 US Dollar. At the beginning of 1992 the Austral was substituted by the Peso at 10,000:1, so that since then 1 Peso equals 1 US Dollar.

[2] The strength of this rule was alleviated by the fact that 10% of the international reserves could be held in Bonex (dollar-denominated bonds of the Argentinian state). This percentage was later raised up to 20 and 30%.

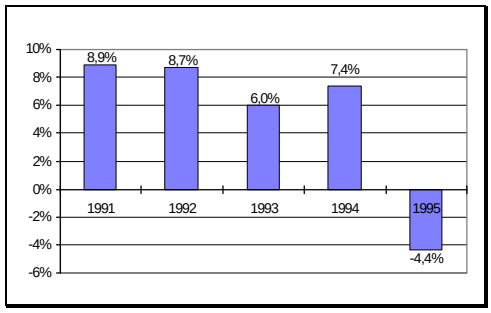
imports. The trade deficit could be balanced by high capital inflows in the form of capital repatriations and foreign investment due to the good economic prospects of the Argentine economy (see figures 1-3).

Figure 1: The Trade Balance 1991-95



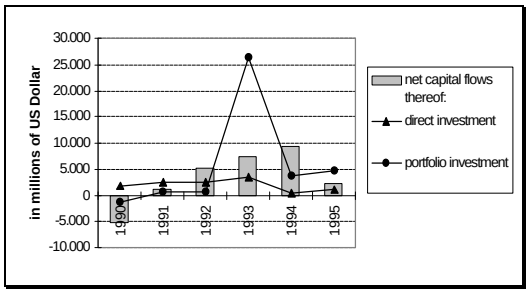
Source: INDEC.

Figure 2: Growth Rates of Real GDP 1991-95



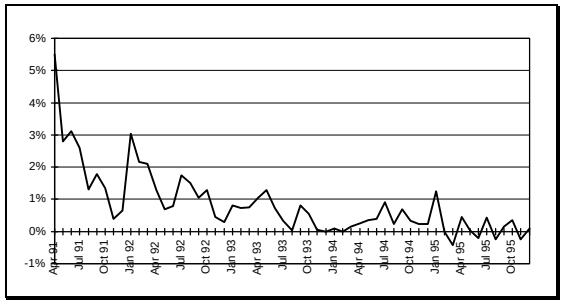
Source: EIU Country Report Argentina, 3rd Quarter 1996, p.3.

Figure 3: Capital Flows 1990-95 1991-95



Source: IMF, Balance of Payments Statistics Yearbook 1996, p.28ff.

Figure 4: Monthly Inflation Rates



Source: INDEC.

The Mexican crisis in December 1994 marked the end of the expansionary phase. Liquidity problems provoked bankruptcies and the Argentinian economy fell into a deep recession. Although the exchange rate parity could be maintained, GDP growth in 1995 was negative. Import demand fell, while exports grew further, so that a surplus of the trade balance was temporarily restored.

Despite the economic recession, the main objective - fighting inflation - was reached. The yearly inflation rate was brought down to one-digit levels, and in 1995 some monthly inflation rates were even negative (see figure 4).

IV. Empirical Analysis

The development in Argentina matches with the stylized facts of the other exchange rate-based stabilization programs: the slow convergence of the inflation rate and the devaluation rate (in this case a zero-devaluation as the nominal exchange rate is fixed) led to a real appreciation of the currency. The trade balance fell into a deficit, the first since over 10 years. And the economic boom of the first years was followed by a recession in 1995. Therefore, the following hypothesis can be formulated.

Hypothesis to be tested

If the nominal exchange rate of a country with high inflation rates is pegged to the exchange rate of a country with low inflation rates, a real appreciation of the local currency results. This real appreciation leads to a trade deficit if relative prices play the role asigned by economic theory. Therefore, the policy of a fixed nominal exchange rate to calm down inflation can be classified as an inherently risky policy as it provokes a (temporary) external disequilibrium. This hypothesis is to be tested.

When evaluating the result of the hypothesis test, one has to keep in mind, though, that the period under scrutiny marks a new beginning in Argentine economic policy and that influences from the past might still have an impact on the period 1991-95. Furthermore, it should be clear that conclusions can only for be drawn for short-term and not for long-term policy making due to the limited sample period.

To answer the question, whether the real appreciation leads to a trade deficit in the short to medium run (within 5 years), the price elasticites of ex- and imports will be estimated. If the coefficient of the price elasticity is significant, then a link between the evolution of the real exchange rate and the development of the trade flows exists. Furthermore, the magnitude of the price elasiticity and its sign give evidence of the strength and direction of the influence of movements of the real exchange rate on trade flows. To make the interpretation of the estimated coefficients easier, exports and imports will be further divided into smaller, more homogenous groups. Imports are divided into capital goods, consumer goods and intermediate goods; exports are classified into primary products, agricultural manufactures, industrial manufactures and fuel.

Short Description of the Underlying Theory: the Dependent Economy Model

The underlying economic model is the Dependent Economy Model from Wilson, Swan and Salter.[1] It is a model for a small open economy that produces two types of goods: tradables and nontradables. The prices for tradable goods (p^T) are solely determined on world markets, as a small country cannot influence international prices. Tradable goods comprise exportables, importables and import substitutes. The price for nontradable goods (p^N) is determined by supply and demand on the domestic market. The real exchange rate (e^r) is defined as the relative price between tradables and non-tradables and is one of the determinants of demand and supply for tradables and non-tradables. Demand is, furthermore, depending positively on the level of real absorption (A^r).

The model can be described by the following equations.

Real exchange rate:	$e^r = p^T/p^N$	(1)
Demand for nontradables:	$D^N = D^N(e^r, A^r)$ with $\delta D^N/\delta e^r>0$ and $\delta D^N/\delta A^r>0$	(2)
Supply of nontradables:	$S^N = S^N(e^r)$ with $\delta S^N/\delta e^r<0$	(3)
Internal equilibrium:	$D^N(e^r, A^r) = S^N(e^r)$	(4)
Demand for tradables:	$D^T = D^T(e^r, A^r)$ with $\delta D^T/\delta e^r<0$ and $\delta D^T/\delta A^r>0$	(5)
Supply of tradables:	$S^T = S^T(e^r)$ with $\delta S^T/\delta e^r>0$	(6)
External equilibrium:	$TB = S^T(e^r) - D^T(e^r, A^r)$	(7)

The market of nontradables has to be in equilibrium otherwise an adjustment process is induced, which will lead to a new equlibrium. *Internal balance* exists, if demand and supply of non-tradables balance. The trade balance (TB), in contrast, can be in deficit or surplus, as long as capital flows can compensate for it. The model is short-term, as a trade deficit or surplus can exist. *External equilibrium* is given, if exports and imports balance.

According to this model, the following *adjustment process* is triggered, if the nominal exchange rate in a country with high inflation rates is pegged to a currency of a country with lower inflation rates:

[1] Salter (1959), Swan (1960 and 1963) and Wilson (1931). A summarizing presentation of the model can be found in Dornbusch (1980), p.97 ff.

The positive inflation differential leads to a real appreciation of the currency. The real appreciation increases the demand for tradables as they have become relatively cheaper and it decreases the demand for nontradables. Consequently, the current account deteriorates. The excess demand for tradables is linked to an excess demand for foreign exchange, which puts pressure on the nominal exchange rate. The central bank has to intervene and sell foreign exchange to sustain the exchange rate parity. By this way, the money supply is reduced, if the effects on the money supply are not neutralised. The contraction of the money supply induces a reduction of real absorption. In consequence, demand for tradables as well as for nontradables diminishes as demand depends positively on the level of absorption. On the tradables' market the excess demand is reduced and the current account improves. But on the nontradables' market the excess supply is reinforced by the further decrease of demand. This puts downward pressure on prices. If the monetary contraction is perceived as permanent, the suppliers of *nontradables* will lower their prices. The reduction of nontradables' prices provokes a real depreciation of the currency and an increase in real absorption. Finally, the point of departure, the equilibrium with internal and external balance, is reached again - but at a lower inflation rate.[1]

Econometric Analysis

The equations to be estimated are derived as follows:

Dependent variables:

The dependent variables are the demand and supply for tradables and nontradables. The sector of tradables can be further distinguished into exportables, importables and import substitutes. For the analysis of the trade deficit it is sufficient to concentrate on the ex- and import functions only. And as already mentioned above, they will be divided into smaller, more homogenous groups of products.

Independent variables

According to the economic model, the independent variables of the econometric model are the real exchange rate and the real absorption in the demand functions and only the real exchange rate in the supply functions.
As the elasticity of the *real absorption* is difficult to interpret, real absorption can be approximated by real GDP and the trade deficit/surplus (in real terms) in relation to

[1] See Corden (1991), p.233, Schweickert et al. (1992), pp.5 and Svensson (1994), p.448.

real GDP, as the following transformation shows.[1] The advantage of this transformation is that the income elasticity can now be estimated directly.

$$
\begin{aligned}
Y-A &= X-M \\
A &= Y-(X-M) \\
&= Y[\,1-(X-M)/Y\,] \\
\log A &= \log Y + \log[1-(X-M)/Y\,]
\end{aligned}
$$

The *real exchange rate* can be calculated in different ways: as import-weighted (me^r), export-weighted (xe^r) or im- and export-weighted real exchange rate (mxe^r). Furthermore, the average ex- and import tariff (Z^X resp. Z^M) can be included in its calculation. This is advisable as tariffs exert a direct influence on the price level of tradables. For the estimation of the export function the export-weighted real exchange rate including export tariffs is most appropriate as it reflects the relative price changes between Argentina and its export trading partners only. Accordingly, for the import function the import-weighted real exchange rate including the average import tariff is used in the regressions.

The *export-weighted real exchange rate* (incl. the average export tariff) is calculated as

$$xe_t^r = \prod_{i=1}^{I} \left(\frac{e_{it} * WPI_{it}}{CPI_{At}}\right)^{x_{it}} * (1 - Z_t^X)$$

and the *import-weighted real exchange rate* (incl. the average import tariff) as

$$me_t^r = \prod_{i=1}^{I} \left(\frac{e_{it} * WPI_{it}}{CPI_{At}}\right)^{m_{it}} * (1 + Z_t^M)$$

The number of trading partners (I) included in the calculations was determined so that 85% of the exports or imports were represented.[2] In addition, the weight of the trading partners was calculated separately for each period according to their share in exports or imports in the respective period. By this way, the changing importance of the trading partners, especially the growing importance of Brazil since the Mercosur-agreements came into effect, was taken into consideration.

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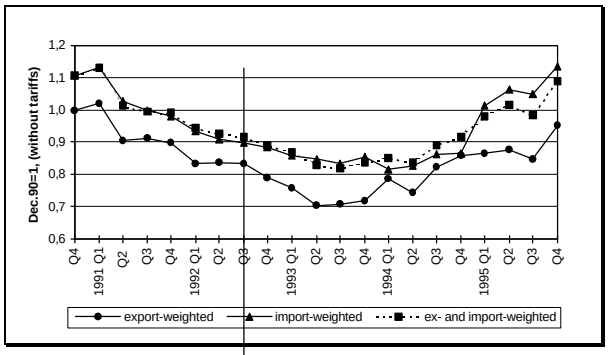
[1] See Sjaastad (1981), p.267. All variables are measured in real terms.

[2] In addition, in the calculation of the export-weighted exchange rate only trading partners, whose share exceeded 1% of total exports, were included.

Figure 5: The Real Exchange Rate 1991-95



Source: Own calculations.

The Argentine currency experienced a strong real appreciation since 1991, when the exchange rate parity was fixed. This real appreciation lasted until the end of 1993, when, there was a turning point and the real exchange rate began to rise again - that means the currency was depreciating in real terms. The real depreciation since 1994 compensated for the real appreciation at the beginning of the stabilisation plan, so that the level of departure from April 1991 was almost recovered. The ex- and import-weighted real exchange rate follow roughly the same line, although the export-weighted real exchange rate appreciated slightly more than the import-weighted one.

Real GDP or *real production* is added as explanatory variable to the export supply functions as well. It is used as an indicator for productive capacity, as the country's capacity to supply exports cannot be fully captured in the relative price. Changes in real production can be an indicator for advances in factor supplies, infrastructure or total factor productivity, which can lead to production increases at a given level of prices.[1] On the other hand, real income could also be an indicator for demand pressures. When domestic demand pressures increase, selling in the home market can be more profitable than selling abroad.[2] But in the case of the export supply function, this would suggest a negative dependence of exports from real GDP, so I assume here that the capacity effect prevails.

The *real GDP of the export trading partners* (Y^{r}*) was added to the export function as explanatory variable to account for movements in expected demand.

To evaluate the real effects of the exchange rate policy, the following demand and supply functions will be estimated. The signs above the independent variables indicate whether a positive or negative dependence is expected:[3]

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[1] See Goldstein/Khan (1978), p.276 and Goldstein/Khan (1985), p.1060.

[2] See Goldstein/Khan (1985), p.1061.

[3] The expected sign of the regression coefficient is pointed out above the corresponding explanatory variable.

$$\text{Export supply:} \qquad X = f(\underset{+}{e^r}, \underset{+}{Y^r}, \underset{+}{Y^{r*}})$$

$$\text{Import demand:} \qquad M = f(\underset{-}{e^r}, \underset{+}{Y^r}, \underset{-}{(X-M)/Y})$$

The import functions are estimated for capital goods' imports, consumer goods' imports and intermediate goods' imports and the supply function for primary products, agricultural manufactures, industrial manufactures and fuel.

Econometric proceeding

First, the time-series properties of the variables had to be examined: a *unit root test* (here the Phillips-Perron-Test), was applied to check for stationarity of the time-series. All variables were integrated variables of first order. As the time series were relatively short, no cointegration techniques were applied and only short-run elasticities were estimated using the time series in first differences.

Next, the regression equations were formulated. First, the relationship between dependent and independent variables had to be tested for possible *lags*. The length of the lag was determined by calculating cross correlations between the dependent and the independent variables, this method relies on Jenkins (1979). Before calculating the cross correlations the time series had to be transformed into stationary, white noise series by applying a univariate (i.e. a moving-average or an autoregressive) model.[1] Then the cross correlations between the white noise series were calculated. High correlation coefficients are an indicaton for possible lags. Then, the lags with the highest correlation coefficients were introduced in the regression equations.

The *regression equations* were formulated *in logs* except for the variable (X-M)/Y, which can take on negative values. After that, the regression equations were estimated by *Ordinary Least Squares*. The regression equation with endogenous variables (i.e. (X-M)/Y) was estimated by *Two-Stage-Least-Squares*. The OLS- and the 2SLS-results were later compared testing for significant differences of the residuals with an *F-Test*. If the differences were not significant, the OLS-method was applied, because it meant that the variables were only weakly endogenous.

Finally, the results were tested for *serial correlation* of first and fourth order as quarterly data had been used. The Breusch-Godfrey LM-Test was used to test for serial correlation.

In the next chapter, the results of the estimations will be presented.

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[1] See Jenkins (1979), pp. 16-19 and 38ff.

V. Estimation Results

Import demand

Imports were divided into imports of capital goods, consumer goods and intermediate goods. The regression analysis led to the following results:[1]

Table 1: Summary of the Elasticities for the Import Groups

Independent variables	Period	Capital goods imports	Consumer goods imports	Intermediate goods imports
real exchange rate	**t**	*0.28*		-0.08
(import weighted)	**t-1**			
	t-2		-0.26	
GDP	**t**	2.30 **	3.32 **	
	t-1			
	t-2			*-0.57* *
	t-3	0.74 **		0.69 *
	t-4			1.40 **
[(X-M)/Y]	**t**	-6.85 **	-7.29 **	-4.66 **
	t-1			
R-squared		0.76	0.68	0.63
Adjusted R-squared		0.72	0.64	0.53
F-statistic		16.3	17.3	6.0

* significant at 10%.
** significant at 5%
Source: Own calculations.

Import demand for capital goods

The price elasticity for imports of capital goods is not significant, but the income elasticity is highly significant and positive. For the interpretation of these results it is useful to provide a short background of the evolution of investment in Argentina in recent years. Since the early 1980s the investment ratio had declined from 26% to 13% in 1990. Not only the modernization of the capital stock had been postponed, but also the necessary replacement of machinery and equipment had been neglected, so that at the end of the 80s the capital stock had, in fact, diminished.[2] With the

[1] The variables and the econometric proceeding are described in the appendix.

[2] See Messner (1996), p.164.

beginning of the Convertibility Plan in 1991 tariffs for capital goods were abolished to stimulate the modernization of the capital stock and facilitate imports of new technologies. Actually, investment in imported capital goods rose much more than investment in national capital goods. This tendency was reinforced by the fact that a high quantity of the necessary machinery and equipment for the production process is not produced at all in Argentina, so that the import dependency is very high here. Another explanation for the high proportion of imported capital goods is the high inflow of direct investment from abroad, which is partly linked to the privatization process. It is common among foreign investors to import also their own production technology.

The fact that the *price elasticity* for the imports of capital goods is not significant, which means that the real exchange does not exert any influence on the imports of capital goods, might be due to the high need for modernization of the capital stock, which is so important that price movements are neglected. As already mentioned, a lot of capital goods are not at all produced in Argentina. On the one hand, the real exchange rate is not relevant for these goods as a relative price does not exist. On the other hand, import dependency is so high here that these goods are imported even if their price increases, as there are no possibilities for substitution (apart from the fact that capital could be substituted by labor).

The *income elasticity* of capital goods is very high. If income increases, higher demand is expected and producers expand their production capacities. The height of the income elasticity underlines the fact that the need for modernization of the capital stock in Argentina is very strong. The income elasticity of capital goods is also significant with a lag of three periods (that is nine months). The lagged influence of income on capital goods' imports is due to the fact that investment decisions are planned for the long term and that capital goods have a longer delivery period, as they are often produced on demand.

In summary, capital goods imports are very much dependent on the general economic trend whereas the real exchange rate does not exert a great influence on them. It has to be recognized, though, that high capital imports do not only have a negative effect on the current account. On the one hand, they increase the deficit of the trade balance, but on the other hand they also help to raise productivity which makes domestic goods more competitive and in the long run improves the trade balance.

Import demand for consumer goods

An important determinant of the demand for consumer goods is the income of private households. Since the beginning of the Convertibility Plan in 1991, real income declined until mid 1993, than it rose again and stabilized since 1994.[1] There is no data available about disposable real income, but with the monetary stabilization inflation tax almost disappeared. Together with the tax reform, which aimed at reducing the tax burden of the lower income classes, this probably led to an increase of disposable real income, especially for the lower income classes which have a higher consumption ratio. The distribution of income (Gini coefficient) did almost not change between 1991 and 1995. A characteristic of the consumption boom is the high proportion of consumption of durable goods. There was a high need for durable goods as purchases of durables had been postponed in times of economic recession and moreover, the availability of consumer loanst has increased since the introduction of the convertibility law. Therefore, it became easier to finance costly purchases.

It is quite surprising that the *price elasticity* of the import demand for consumer goods is not significant. Normally, a fairly high price elasticity is assumed for consumer goods. It is probably due to the specific situation in Argentina in the years under examination that the price elasticity is not significant: The consumption boom was probably motivated by the recuperation of living standards, which had declined in the 1980s, and led to the result that - in combination with increasing disposable income - consumer goods were imported disregarding the movements of prices. That means, goods were consumed even if their prices had increased. When the consumption needs are satisfied and living standards have recuperated, then the sensibility for price changes should increase again. So in the middle to the long run, the significance of the price elasticity should rise again.

The *income elasticity* of import demand for consumer goods is the highest among the groups under examination and shows a direct impact without any lag. Consumer goods are very income elastic as some of them are luxury goods, their consumption can easily be reduced when income falls.

In summary, the import demand for consumer goods is, similar to the demand for capital goods, very much dependent on the evolution of income. This link is even stronger for consumer goods than for capital goods. Nevertheless, one can assume that the price elasticity of consumer goods will increase in the long run.

[1] See EIU (1996), p.55 and FIEL (1997), p.20.

Import demand for intermediate goods

The need for imported inputs is mainly determined by the evolution of the market of the respective finished products. As the production in the industrial sector has increased significantly since 1991, it can be assumed that also the need for imported inputs has increased. And in line with globalisation, inputs are increasingly imported from abroad rather than produced in Argentina.

The *price elasticity* of intermediate goods is not significant. This could point to the fact that some inputs are not produced in Argentina and need to be imported. Import dependence is strong for intermediate goods that cannot be produced in Argentina, and consequently price elasticities are low or insignificant. Moreover, the imports of intermediate goods depend very much on the evolution of the market of the respective finished goods, which probably dominates the influence of prices on these imports. If finished goods become more profitable or if productivity gains can be realised in the production process, then this could compensate for a rise in prices of intermediate goods. Moreover, a high proportion of intermediate goods' imports forms part of intra-industry trade, where some price setting is possible due to product differentiation.

The *income elasticity* does not show a systematic link between the demand for imported inputs and the evolution of income. This is probably due to accidental influences in the sample or to special features in the market of finished goods, which due to a lack of information cannot be explained here.

In summary, a striking fact is that none of the import functions show a significant price elasticity in the period 1991-95. This points to the fact that in the rather short post-inflation period 1991-95 import demand was dominated by other influences than relative prices.

It should be stressed, however, that this result contradicts long-run studies[1] in which the real exchange rate clearly exerts a significant influence on import demand as far as total imports, consumer goods and intermediate goods are concerned. As far as food imports and capital goods imports are considered the real exchange rate proved to be insignificant. This result is in line with the observed price inelasticity of the demand for food and the price inelasticity of the demand for capital goods which cannot be substituted in an easy fashion.

[1] See Nowak (1989, 228-248)

Exports

Exports were divided into four groups: exports of primary products, agricultural manufactures, industrial manufactures and fuel. The following regression results were obtained.

Table 2: Summary of the Elasticities for the Export Groups

Independent variables	Period	Primary goods exports	Exports of agricultural manufactures	Exports of industrial manufactures	Exports of fuel and energy
real exchange rate	**t**				
(export-weighted)	**t-1**	1.92			
	t-2	4.02 **			
	t-3			*-0.33*	
	t-4	*-3.31* **	0.23		
	t-5				
	t-6				*-1.00* *
sectoral production	**t**				
	t-1				
	t-2				
	t-3	*-1.46* **		*-0.98* **	*-2.75* **
	t-4		0.96 **		
	t-5				
	t-6				
	t-7				*-1.87* *
foreign GDP	**t**		6.09 **	4.79 **	
	t-1				
	t-2		*-1.34*		
	t-3	8.73			0.68
	t-4		*-2.75* **	2.20	
	t-5	*-6.68*			
R-squared		0.65	0.78	0.67	0.56
Adjusted R-squared		0.51	0.72	0.60	0.45
F-statistic		4.5	11.7	9.4	5.1

* significant at 10%.
** significant at 5%
Source: Own calculations.

Export supply of primary products

The main primary products, which are exported, are grains and oilseeds. In comparison with other agricultural products the amount of production can be varied fairly quickly as a reaction to price changes as grain and oilseed have to be sowed every year. Although Argentina is among the ten biggest producers of grains and oilseeds,

it has no influence on international prices. The agricultural sector had been under very strict regulation until the 1990s. The lobby of the agricultural sector is very strong, as for a long time their exports had been the main source of foreign exchange. They used to push through devaluations of the currency to make their exports more competitive. In return, they neglected possible improvements in the production process to raise productivity, so that there was still a high potential for productivity increases when the ERBS program started in 1991. The main destination of primary products' exports are the EU and the Mercosur, especially Brazil. Since 1991, the agricultural sector underwent significant changes: export tariffs were abolished, new production technologies introduced and structural changes took place.

The *price elasticity* of exports is significant with a lag of two and four periods. The lag of two periods indicates that the relative price at the time of the dissemination period determines the production and consequently the amount that can be exported. The positive sign of the elasticity confirms the assumption that supply is increased when prices rise. The price elasticity is very high, because agricultural products are very homogenous, so that Argentine products can easily be substituted by products from other countries. Competition on the world markets is tense. The link between export supply and the relative price was intensified by the abolition of export tariffs, which removed price distortions.

Production varies with price increases or decreases, but the domestic demand for primary products remains stable as primary products are basic supply of food. The *elasticity of foreign income* is not significant, as the demand for basic food is not income elastic.

In 1991/92 exports of the primary sector weakened. This could be assigned to the fact that the real appreciation made the primary products less competitive on world markets. In consequence, the agricultural sector was forced to raise productivity. In this respect, the need for structural changes had been increased by the real appreciation. All in all, the real exchange rate proves to be one of the major determinants of the export supply of primary products.

Export supply of agricultural manufactures

The production of agricultural manufactures forms part of the industrial sector, but agricultural manufactures- in contrast to industrial manufactures - are based on a natural resource. Oil and fat, meat and the residuals of the food industries, which are used as animals' food, are the main export products. Agricultural manufactures make up for 45% of total exports of the industrial sector, although they stand for only 22.5%

of the total production of the industrial sector. The main part of the production of agricultural manufactures is bound for the domestic market, but export orientation is increasing. The main destinations of exports are the EU with 30% of exports and the Mercosur with 15%.

The *price elasticity* of exports is not significant. A fact that could be explained by the high inward orientation of production: The main part of production is sold on the domestic market and only the excess supply is exported. Intra-firm trade is gaining importance and for this kind of trade the real exchange rate is, in general, irrelevant (internal prices which determine trade flows are set). The *production elasticity*[1] is also positive and significant, which confirms the assumption that production is an indicator for capacity and when capacity is increased also exports rise. The fact that a high proportion of direct investment went into the production of agricultural manufactures confirms this argument. The lag of four periods indicates that there is a reaction lag to price changes: First, the supply of the natural resource has to be increased, then the elaboration of the product takes place, until finally an increase in exports can be noticed.

The *elasticity of foreign income* shows no systematic influence. The high positive influence without a lag could be due to the influence of Brazil: In recent years, Brazil has experienced an economic boom which led to higher demand for Argentinian exports. Another explanation could be the fact that agricultural manufactures do not satisfy any basic needs, so they react more elastic to changes in income.

In summary, the influence of the real exchange rate on exports of agricultural manufactures is negligable. It could increase in importance, when the export orientation of production increases.

Export supply of industrial manufactures

The sector of industrial manufactures in Argentina has two main pillars: the automobile production and the basic industries. The basic industries (iron and steel, paper, cement, petrochemicals etc.) had been promoted by industrial policies in former times. They have excellent production capacities and production is highly competitive. Nevertheless, the domestic market is more profitable than exports, so that only the excess supply is exported. Production capacity can only be increased in the middle to the long run. The second most important branch of the industrial sector is the automobile industry. The automobile industries are promoted by a special tariff regime. The main part of production is destinated for the domestic market, although

[1] The term “production elasticity” is used here to denominate the elasticity between exports and the real production, which serves as an index of productive capacity in the export supply functions.

intra-industry trade with Brazil plays an important role. Since the end of the 80s, the industrial sector has been opened up for foreign competition. Therefore productivity had to be increased by new technologies and a more capital intensive production. With the internationalisation of the companies export orientation increased, too.[1]

The insignificance of the *price elasticity* can be explained by the special characteristics of the Argentine industrial sector: For the two main branches, basic industries and the automobile production, it is more profitable to sell to the domestic market than to export. Therefore, only the exceeding production, which is not absorbed by the domestic market, is exported. Consequently, the real exchnage rate does not have a big influence on the amount that is exported. Another explanation for the lack of influence of the real exchange rate on exports consists in the fact that intra-industry trade plays an important role and here trade flows are not very price elastic as due to product diversification each producer can set prices inside a certain range. As a main part of the exports goes to Brazil, the real exchange rate with Brazil, which is only partly reflected in the export-weighted real exchange rate, is of outstanding importance.

The *production elasticity* is negative. Also this can be explained by the special characteristics of the Argentine industrial sector: Industrial exports react anticyclically. When domestic absorption increases, exports diminish and vice versa as production capacities are fixed in the short run and production is primarily sold on the domestic market.

Exports of industrial manufactures show a very high *elasticity of foreign income*. On the one hand, industrial manufactures are fairly income elastic products, on the other hand some of them are inputs for the production process. Demand for the inputs varies with the level of economic activity abroad. Competition on world markets is also high for industrial inputs and they can easily be substituted. The high number of the income elasticity can also be explained by the influence of Brazil: Brazil absorbs a high proportion of Argentine industrial exports and its share is still growing. Therefore, the economic development in Brazil is of special importance. With the economic boom in Brazil since 1994 the demand for Argentinian exports increased above average. The immediate reaction of export supply to changes in foreign income suggests that capacities are still underutilized. In fact, capacity utilization has increased markedly since the beginning of the Convertibility Plan.

In summary, for the exports of industrial manufactures movements of the real exchange rate play only a minor role as trade is dominated by intra-industry trade.

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[1] See Cline (1995), p.30 and Bisang et.al. (1996), pp.204-208.

Export supply of fuel

The energy sector and the exploration of crude oil had been highly regulated. Deregulation started under the Alfonsín government, but was mainly carried out since 1990.[1] A main part of production is destinated for exports.

The R-squared of the equation with 0.56 is very low and the results do not confirm any of the assumptions made. The influence of the real exchange rate and domestic and foreign income is either not significant or carries the wrong sign. This is probably due to the fact that privatizations and deregulating measures had more important effects on exports of fuel than the assumed export determinants, so that the export function is misspecified. Anyway, the price of crude oil should be more important for the exports of fuel than the real exchange rate. Also intra-industry trade with fixed contracts and agreed prices plays a major role and makes movements of the real exchange rate irrelevant.

Long-run empirical studies[2] confirm those results in that the real exchange rate proves to be irrelevant for products traded on stock exchanges (primary goods) pointing to the fact that the real exchange rate is a very rough price indicator for those goods. However, the above results do contradict the empirical findings of long-run analyses in which industrial exports clearly proved to be price elastic and therefore reacted positively to real depreciations and negatively to real appreciations. The impact of the real exchange rate on agricultural exports was not significant, but carried the expected positive sign.

VI. Conclusions

The Real Exchange Rate and External Equilibrium

The hypothesis under examination in the empirical part was that the real appreciation of the currency tended to cause a trade deficit and was therefore risky in the short run (type 1 riskiness). However, the link between the real exchange rate and the evolution of exports and imports, which has been explained theoretically by the Dependent Economy Model, could not be confirmed empirically. Concerning the import side, the results of the analysis demonstrated that the evolution of the real exchange rate did not have any impact on the evolution of imports (imports of capital goods, consumer goods or intermediate products). It should be stressed that the income ela-

[1] See Gerchunoff (1994), pp.8-11.

[2] See Nowak (1989, 138-188).

sticity has

been much more important. Its values were not only significant but also assumed high values for capital and consumer goods. Therefore, the import boom which Argentina experienced in the early 1990s - according to these results - cannot be attributed to the movements of the real exchange rate (i.e. the real appreciation of the currency). There are strong hints that other causal factors for the tremendous increase in imports, such as the need for modernization of the capital stock, the recuperation of living standards etc., must have overcompensated the influence of relative price changes on imports.

Concerning the export side of the trade balance, the real exchange rate had a significant influence on primary goods' exports, whereas industrial goods' exports (agricultural and industrial manufactures) were not dependent on price changes. The high proportion of intra-industry and intra-firm trade in industrial exports was made responsible for the lack of influence of the real exchange rate. Moreover, exports of agricultural and industrial manufactures were identified as residual production (i.e. the production not absorbed by the domestic market). Therefore, the real exchange rate did not exert an influence on the amount of exports supplied. In contrast, the price elasticity of exports of primary products was quite high. In summary, the evolution of exports was at least partly influenced by the movements of the real exchange rate - especially as primary products make up for a high proportion of exports (20-30%) - whereas the enormous increase in imports is probably due to other factors, such as modernization, higher living standards etc.

According to these results, there is no strong link between the evolution of the trade balance and the real exchange rate in between 1991 and 1995. That means, riskiness (type1 riskiness) can be ruled out. This would imply that real appreciations are not harmful in the short (or medium) term. Therefore, the increasing trade deficit cannot be attributed to the real appreciation of the Argentine currency . Rather; changes in the trade balance have to be assigned to the absorption and income swings in the period under consideration. It is known from long-term studies, however, that real appreciations do have a negative impact on the trade balance suggesting that relative prices do matter - according to economic theory - when considering a longer time span.

This conclusion, that there is no strong link between movements of the real exchange rate and the evolution of the trade balance, is based on the specific case of Argentina and on a determined period of years. There are some hints that the importance of real exchange rate movements might increase in the future and in the long run, when the major wave of the modernization of the capital stock and the recuperation of li-

ving standards have come to an end and the economy has returned or at least has come closer to her long-run economic trend line. However, this would imply that one will have to worry about a type 2 risk which is likely to occur in the medium to long run. The type 2 risk is more dangerous than the type 1 risk because it is not so visible and appears only after a few years (mostly boom years) in which the economy has developed so nicely.

Policy Implications

The real exchange rate did not show the expected strong influence on the evolution of trade flows as far as the period of 1991-95 is concerned. A possible explanation for this quite surprising result could be the fact, that the Argentine economy was experiencing a major restructuring in the early 1990s. The transition from an economy with a big public sector to an economy where private initiative and market mechanisms prevail may be the reason for the fact that price changes were not the major determinant of trade flows. As a similar transformation of the economy was or is also under way in Central and Eastern European countries, the conclusions which were drawn for Argentina might also apply to these countries: In countries in transition the influence of relative price changes on trade flows seems to be overcompensated by other factors (restructuring on the supply side and a bigger variety of goods on the demand side), i.e. the real exchange rate does not play the major role for the direction of trade flows which theory attributes to it under normal conditions. In the medium and long run, however, price movements will regain importance, when economic conditions have normalized. Therefore, according to long term studies ERBS will always be risky in the medium to long term, even though it seems to be risk-free in the short run, taking Argentina as an example.

Concluding, the short term exchange rate-based stabilization did not prove to be an inherently risky (i.e. no type 1 riskiness could be detected) policy which generates external disequilibria via movements of the real exchange rate. However, supplementary structural policies are necessary to promote price flexiblity so as to yield a competitive exchange rate, otherwise the costs of an ERBS program (recession, high unemployment) are very high. If monetary stability is secured and the ERBS program has reached its objective of reducing the inflation rate, viable alternatives should then be more flexible exchange rate systems, such as a crawling peg system or the fixing of the exchange rate to a basket of currencies and allowing the exchange rate to fluctuate within a band of a few percentage points. The exchange rate system should thus be used to achieve a competitive real exchange rate in order to alleviate trade balance problems in the medium to long term and to limit the type 2 riskiness of

EBRS which arises after economic conditions have normalized and relative prices have restarted to play their long term role.

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Appendix: Data sources

All data was measured in quarterly terms from the 2nd quarter 1991 - 4th quarter 1995.

Imports, exports:

Imports and exports in real terms; import and export data in US-dollars from the Balance of Payments' statistics was converted into pesos and then deflated by an appropriate deflator.
(Source of the data: INDEC).

Real exchange rate:

Ex- or import-weighted real exchange rate. the import-weighted real exchange rate includes the average tariff of the respective group.
(Sources: IFS, INDEC, and minor sources).

GDP:

Index for Argentinian real GDP. (Source: MEySOP).

Equivalent for the real production of...

... primary products:

Index for the real GDP of the agricultural sector (Source: MEyOSP).

... agricultural manufactures:

Real production of the food, beverages and tobacco industry (Source: MEyOSP).

... industrial manufactures:

Real production of the industrial sector excluding food, beverages and tobacco (Source: MEyOSP).

... fuel:

Industrial production index of the fuel's sector (Source: FIEL).

Foreign GDP:

Export-weighted index of the real GDP of Argentina's export trading partners (Source: IFS, INDEC, and minor sources).

[(X-M)/Y]:

Difference in exports and imports in real terms. divided by Argentinian real GDP (Sources: INDEC and MEySOP).