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Unemployment and the credibility of exchange rate pegs: evidence from the Brazilian currency crisis of January 1999

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Abstract

The paper examines the vicious circle into which Brazilian authorities found themselves after the outbreak of the Asian crisis as a result of the excessive rigidity of the nominal exchange rate. The vicious circle we focus on implies that worsening exchange rate expectations lead to higher nominal and real interest rates and therefore to higher unemployment. Higher unemployment, in turn, affects expectations negatively. We estimate a three equation model explaining exchange rate expectations (the credibility of the peg), the rate of unemployment and the short term interest rate. The latter equation can be interpreted as a reaction function of the Brazilian monetary authorities.

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Introduction

From the monetary reform of July 1994 to January 1999 Brazil followed the policy of pegging the new currency (the real) to the US dollar. In January 1999 the real came under intense pressure after a relatively small depreciation of the central rate (in the order of 7%) was interpreted by markets as a first step towards further exchange rate adjustments. As a result the policy of pegging the exchange rate had to be abandoned and the real became a floating currency. Between January and February 1999 the currency collapsed by about 80% (from US$ 1.21 to US$ 2.2). It then recovered somewhat and stood at about US$ 1.85 at the time of writing (October 2000).

When the January 1999 crisis occurred the exchange rate policy pursued by the Brazilian authorities and supported by the IMF had evidently lost all the remaining credibility. The real exchange rate was clearly overvalued and the defence of the currency peg had led to high nominal and real interest rates, increasing unemployment and a halt in economic growth. In the eyes of financial markets the political cost of the defence of the currency had become too high and no longer sustainable and this was undermining the credibility of the peg itself.

This paper examines by means of econometric analysis the vicious circle into which Brazilian authorities found themselves after the outbreak of the Asian crisis as a result of the excessive rigidity of the nominal exchange rate. We estimate a three equation model explaining *exchange rate expectations* (the credibility of the peg), the *rate of unemployment* and the *short term interest rate*. The latter equation can be considered a reaction function of Brazilian monetary authorities. Exchange rate expectations are measured by the spread (agio) of the black market exchange rate over the official exchange rate for commercial transactions. Both exchange rates are measured with respect to the US dollar. We show that unemployment lagged by about two months is a very significant variable influencing the agio, that the agio in turn significantly affects the nominal short term interest rate controlled by monetary authorities (the Selic rate) and that unemployment is significantly influenced by the real interest rate lagged by about six months. Thus by estimating these three equations we capture the essence of the vicious circle into which Brazilian authorities found themselves as the result of their own inconsistent choices.

Our model belongs to the class of so-called second generation models of currency crises in which authorities are assumed to minimize a loss function (a function of the square of unemployment from target and of percentage changes of the nominal exchange rate) and to trade off between higher unemployment and exchange rate stability. For models of this type see Obstfeld (1986, 1994, 1996), Masson (1995) and Eichengreen and Jeanne (1998). However, a too expansionary fiscal policy, especially in 1998, also contributed to explain the Brazilian crisis as suggested by first generation models of currency crises (Krugman, 1979). For this reason we have incorporated fiscal variables as much as possible into the estimated equations.

The paper is structured as follows. In Section 1 we present the model consisting of four equations (a loss function of the government, an unemployment equation, an equation determining devaluation expectations and a reaction function of monetary authorities explaining the short term interest rate). Section 2-4 contain the estimates of the model for the period March 1995-

August 1999 performed with monthly data.[1] Section 2 presents estimates of the equation explaining expectations of exchange rate changes (the agio), Section 3 presents estimates of the equation explaining unemployment and Section 4 explains the short term interest rate. Section 5 concludes.

1 A model of unemployment and exchange rate expectations under pegged exchange rates.

Consider a loss function L of the government with unemployment and exchange rate changes as arguments:

$$L_t = \alpha_1 U_t^2 + \alpha_2 (S_t - S_{t-1}) \qquad (1)$$

where U are deviations of unemployment from target, S is the nominal exchange rate and α_1 and α_2 are the weights of unemployment and changes in the exchange rate in the preference function of the government.

Equation (1) says that the higher the deviation of unemployment from target and the larger the devaluation of the nominal exchange rate, the worse off is the governmemt.

It is assumed that the unemployment rate is a function of the domestic interest rate i:

$$U_t = \beta i_t \qquad (2)$$

where i is the Brazilian short term rate controlled by the monetary authority (the SELIC rate).

Equation (2) can be derived from an IS equation, relating the deviation of GDP from its trend to the real interest rate (Taylor, 1999), *plus* Okun's law. It says that an increase in the real interest rate leads to an increase in unemployment. Here we are

[1] The sample period changes slightly depending on the equation.

assuming expected inflation to be zero and therefore the nominal interest rate to be equal to the real interest rate.

The domestic interest rate i is determined by:

$$i_t = \delta_1 i^{US} + \delta_2 \varepsilon^e_t \qquad (3)$$

where i^{US} is the US nominal interest rate (the Federal Funds rate) and ε^e is the expected change in the exchange rate.

Equation (3) may be interpreted as the Central Bank's reaction function. It says that the Banco Central do Brasil reacts defensively to an increase in short term rates in the US and also reacts to a worsening of devaluation expectations by increasing the short term interest rate. An appreciation of the domestic currency will adversely affect unemployment via this interest rate channel.

Finally, devaluation expectations ε^e are modeled as a function of the deviation of the current exchange rate from the equilibrium exchange rate S*:

$$\varepsilon^e_t = \gamma (S^* - S_t) \qquad (4)$$

Substituting (4) into (3), (3) into (2) and (2) into (1), we get the following expression for the government's loss function:

$$L_t = \alpha_1 \{\beta [\delta_1 i^{US} + \delta_2 \gamma (S^* - S_t)]\}^2 + \alpha_2 (S_t - S_{t-1})$$

The government's problem is to choose the value of S_t that minimizes L. The first order condition for a minimum is:

$$d L_t / d S_t = -2 \alpha_1 \beta \delta_2 \gamma \{\beta [\delta_1 i^{US} + \delta_2 \gamma (S^* - S_t)]\} + \alpha_2 = 0$$

Note that the first term in the derivative above is the *marginal benefit* of a devaluation. A devaluation reduces the difference between S* and S_t and thus leads to a fall in the interest rate and in the rate of unemployment, reducing the government loss. The second term in the derivative represents the *marginal cost* for the government of a devaluation. The government minimizes its loss choosing that value of S_t for which the marginal benefit and

marginal cost of a devaluation are equal.

From the FOC, we get the value of the exchange rate chosen by the government as:

$$S_t = S^* - (\alpha_2 / 2 \alpha_1 \beta^2 \delta_2{}^2 \gamma^2) + (\delta_1 / \delta_2 \gamma)\, i^{US} \qquad (5)$$

Equation 5 says that the current exchange rate increases with the long run exchange rate and the US interest rate.

According to the first two terms in the LHS of this equation, an appreciation of the domestic currency ($S_t < S^*$) will be more likely:

(i) the lower α_1, the weight attached by the government to unemployment,
(ii) the higher α_2, the importance attached by the government to a devaluation of the exchange rate,
(iii) the lower β, the effect of the domestic interest rate on unemployment,
(iv) the lower $\delta_2 \gamma$, the effect of deviations of the exchange rate from its long run equilibrium value on the domestic interest rate.

Note also that, according to the third term in the LHS, the impact of an increase in the US interest rate on the exchange rate is greater the more responsive to changes in the US rate is the domestic interest rate (the larger δ_1). If the domestic and foreign interest rates are tightly connected, the government will try to compensate the adverse effect of an increase in i^{US} on i and therefore on unemployment, by reducing the expectations of a devaluation through an increase in S_t. The required increase in S_t will be higher the less sensitive the domestic interest rate is to changes in the deviation of S_t from S*, i.e., the lower $\delta_2 \gamma$.

Substituting (5) into (3), using (4), we derive the following expression for the domestic interest rate:

$$i_t = \alpha_2 / 2 \alpha_1 \beta^2 \delta_2 \gamma \qquad (6)$$

According to (6), quite intuitively, the domestic interest rate will be lower the higher the *relative* importance attached by the government to unemployment (the higher α_1 relative to α_2) and the higher the effect of the interest rate on unemployment (measured by β).

The fact that the US interest rate does not appear in equation (6), as would seem logical, can be explained as follows. An increase in i^{US}, according to equation (5), leads to a devaluation. The devaluation, in turn, according to equation (4), generates an expectation of an appreciation (or of a reduced depreciation). Hence, $\varepsilon^e{}_t$ goes down. The decrease in $\varepsilon^e{}_t$ fully compensates the increase in i^{US}, in equation (3), and, therefore, i remains unchanged.

Finally, substituting (6) into (2), gives

$$U_t = \alpha_2 / 2\, \alpha_1\, \beta\, \delta_2 \gamma \qquad (7)$$

Equation (7) suggests that the higher the weight the government places on the stability of the exchange rate vis-à-vis unemployment (the higher α_2/α_1), the higher the unemployment rate will be.

Another interesting possibility is to make ε^e depend also on U itself, as in equation (8):

$$\varepsilon^e{}_t = (S^* - S_t) + \lambda U_t \qquad (8)$$

where, for simplicity, we have assumed $\gamma = 1$.

The idea here is that as long as Brazilian unemployment was low or declining (1995-first half of 1997), the large real appreciation of the currency was in itself not sufficient to make the currency very vulnerable to a speculative attack, but when in late 1997 and 1998 unemployment increased substantially without a significant correction in the real exchange rate, the currency be-

came more and more vulnerable.

The government's loss function now is:

$$L_t = \alpha_1 \{ [\beta / (1 - \beta \lambda)] [i^{US} + (S^* - S_t)] \}^2 + \alpha_2 (S_t - S_{t-1})$$

where, again for simplicity, we have also assumed $\delta_1 = \delta_2 = 1$.

The government will now set the value of the exchange rate as:

$$S_t = S^* - (\alpha_2 / 2\, \alpha_1)[(1 - \beta \lambda) / \beta]^2 + i^{US} \qquad (9)$$

The interest rate, in turn, will be:

$$i_t = (\alpha_2 / 2\, \alpha_1)\, [(1 - \beta \lambda) / \beta^2] \qquad (10)$$

Finally, the unemployment rate now is:

$$U_t = (\alpha_2 / 2\, \alpha_1)\, [(1 - \beta \lambda) / \beta] \qquad (11)$$

Since, by definition, $U > 0$, $\beta \lambda$ is necessarily less than 1. The unemployment rate will be lower the higher λ, i.e., the higher the effect of U on exchange rate expectations. This channel between unemployment and expectations calls, therefore, for a lower level of optimal unemployment. The existence of this channel makes the policy of pegging the exchange rate more vulnerable to foreign shocks. In case of negative shocks to U the government's fixed exchange rate policy is less optimal than in the absence of the channels analysed in this model unless the government is willing to put $\alpha_1 = 0$ roughly like the Argentinian government under the currency board policy.

The group of links isolated in the model presented above and going from U to ε^e, to i and back to U can be summarized graphically as follows:

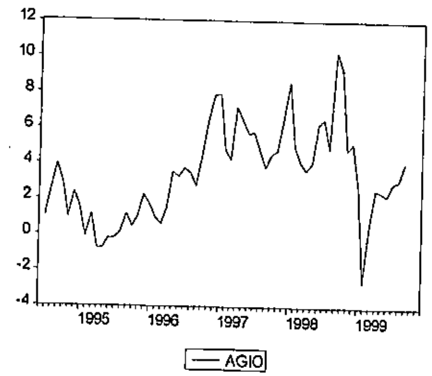
Eq. (8)		Eq. (3)		Eq. (2)		
U	→	ε^e	→	i	→	U

The model presented above does not exhaust the channels through which an international shock could set in motion destabilizing forces and eventually lead to a self-fulfilling currency crisis. There are additional ones which have been neglected here: (i) as a result of an increase in domestic interest rates, if public debt is large, the government deficit can worsen to such an extent that the dynamics of the public debt becomes unsustainable, (ii) the same can happen for foreign debt when international interest rates go up or the country risk increases sharply, (iii) in the presence of currency substitution and negative expectations about the future stability of the currency the real money demand could fall and, if the Central Bank does not realize this, monetary policy can become excessively expansionary and contribute to a currency crisis which could otherwise have been avoided. It has been shown that this latter kind of destabilizing force was at work in Italy in 1994-95 when nominal money was not growing, the Banca d'Italia was convinced that monetary policy was restrictive and the lira was depreciating sharply (Nielsen, Tullio and Wolters, 2000).

2 *The determinants of exchange rate expectations in Brazil.*

In this section we present OLS estimates of equation (8). As a proxy for exchange rate expectations we use the percentage deviation of the black market exchange rate of the Brazilian real with the US dollar from the official exchange rate for commercial transactions (S). We call this percentage deviation the AGIO. The AGIO is shown in Figure 1.

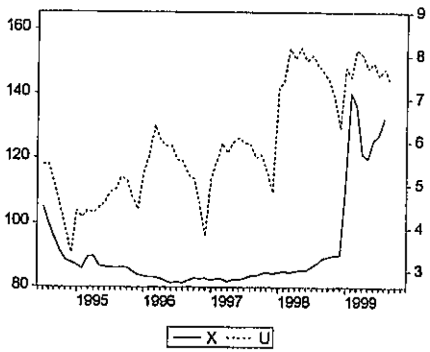
FIGURE 1



The agio underwent large fluctuations during the sample period. In particular we observe a significant increase in the last quarter of 1996, well before the outbreak of the Asian crisis, a high agio (from 4 to 7%) in the course of 1997 and a significant decline in the first four months of 1998 (from 8.5% in January to 3. 6% in April) when confidence returned to Brazil. The highest levels were reached in September and October of 1998 (9-10%) just after the outbreak of the Russian crisis. Finally one observes that after the large devaluation of the official exchange rate in January and February 1999 the agio falls significantly to less than 1% on average in the first four months of 1999. Thus the agio seems to be a good measure of exchange rate expectations in Brazil.

Figure 2 shows the two main independent variables of equation (8): U and X (the real effective exchange rate, a proxy for the deviations of the nominal exchange rate from its equilibrium value). During the sample period they tended to move in opposite directions, with U low at first but increasing sharply as time went by, while X which was already appreciated by about 20% at the beginning of the sample period (with respect to August 1994), depreciated slightly after mid 1997 but not by enough to compensate for the effect of the increase in unemployment on the agio.

FIGURE 2



While at the beginning of this research we had planned to experiment with other proxies of exchange rate expectations like the forward discount in the foreign exchange market, the interest rate differential between the Selic rate and the US Federal Funds rate and measures of exchange market pressure (a weighted average of changes in the exchange rate and changes in international reserves), both the analysis of Fig. 1 and the satisfactory results of the regressions using the agio as dependent variable convinced us not to try with other measures.

Table 1 contains the tests of equation (8). The sample period is April 1995-August 1999. The data are monthly and not seasonally adjusted. A number of independent variables have been added to the regression. All independent variables are defined as 3-months moving averages with two exceptions: X is not a moving average and PRIV is a 6-months moving average. The real effective exchange rate (X) is deflated using consumer price indeces in Brazil and abroad. Besides U and X, also the following variables influence significantly the agio: the Brazilian trade balance measured in US dollars (TR), the ratio of Brazilian M2 to international reserves (M2RES), a variable frequently used in the recent literature on financial crises to measure "international illiquidity" of a country, the proceeds of privatizations (PRIV), and the primary deficit of the government as a share of GDP (DEFPRIM). All variables except PRIV have the expected sign and their coefficients are highly significantly different from zero with t-statistics ranging from about 2.5 to about 7.5.

The significance of the coefficients is in general rather insensitive to the inclusion of dummies and changes in the specification. One exception arises from changes in the definition of PRIV and from its elimination from the equation. In Table 1 PRIV excludes the proceeds from the privatization of Telebras, the Brazilian telecommunication giant. This privatization took place on July 29 1998 and the proceeds were 19.2 billion reais, higher than the total receipts of all other privatizations that occurred between October 1991 and June 1999 (18.6 billion). If one includes in PRIV the proceeds from the sale of Telebras, its coefficient becomes statistically insignificant. If as a result one suppresses PRIV from the regression the coefficient of U becomes insignificant. However, the inclusion of the proceeds from the privatization of Telebras into PRIV virtually transforms the latter into a (0,1) dummy variable and for this reason we tend to trust more the narrower definition of PRIV actually used in the table.

The lags of the independent variables (other than X) are 2 months for U, TR and DEFPRIM, 2 or 3 months for PRIV, depending on the equation, and 7 months for M2RES.[2] However, recalling that these independent variables are defined as 3 or 6-months moving averages, the true lags are at least 1.5 months longer. The 8.5 month lag with which the illiquidity ratio influences the agio suggests that what we are measuring here may be more the effect of domestic monetary policy on exchange rate expectations than changes in the perception of international financial markets about the international illiquidity position of the country. Similarly long lags of monetary policy on the agio de-

[2] Considering that these data are published with at least a one month lag, the lags of the agio with respect to their announcement date is much shorter.

fined in exactly the same way were found in a study on the Italian lira (Tullio,1979).

Regression 1.1 contains no dummy variables. The coefficient of U(-2) which has a t-statistics of about 4.5 implies that a 1 percentage point increase in U (say from 5% to 6%) leads to an increase in the agio of 1.2 percentage points. Eichengreen and Jeanne (1998) found a similar strong and significant effect of U on devaluation probability in Great Britain from May 1925 to December 1936. A 1 percentage point appreciation of the real effective exchange rate X (with the index moving from, say, 100 to 99) leads roughly to a 0.15 percentage points increase in the agio. The t-statistics of the coefficient of X is about 7.5. This confirms the validity of the assumptions made in specifiying the model of the previous section and in particular in specifying equations (4) and (8). As to the other variables a one billion dollar improvement in the trade balance leads to a 2.4 percentage point reduction in the agio and a one point increase in the illiquidity ratio (say from 2.5 to 3.5) leads to an increase in the agio of about 1.8 percentage points. Privatization proceeds have the "wrong" sign: their increase leads to an increase in the agio (a worsening of exchange rate expectations). This implies that privatization proceeds strengthen the official exchange rate more than the parallel one. In the study on the lira by Tullio (1979) foreign exchange market intervention by the Banca d'Italia also had the "wrong" sign for the same reason. The adjusted R2 of regression 1.1 is 0.65. The residuals of the regression are not well behaved: the LM and Ljung-Box tests show that they are autocorrelated and the Ramsey F-Reset test indicates that there may be a functional form mispecfication. The other tests, however, show that the residuals are normally distributed (Jarque-Bera) and not heteroskedastic (White).

In order to try to overcome these problems we have studied the residuals of the regression and analysed the stability of the coefficients of the independent variables through time. Regression 1.2 differs from regression 1.1 in two respects: (a) we have added a dummy variable which is equal to 1 in September and October 1998, two very bad months for financial markets worldwide because of the crash of stock markets in the aftermath of the August 1998 Russian crisis, and zero otherwise. The dummy, not shown in Table 1, has a coefficient of 5.1 which is highly significantly different from zero; (b) we have defined 3 dummy variables which are respectively equal to one from the beginning of the sample period to July 1997 and zero otherwise (called DBEF), equal to one from August 1997 to December 1998 and zero otherwise (called DASIA) and equal to one from January 1999 to the end of the sample period and zero otherwise (called DAFTER). July 1997 marks the beginning of the Asian currency and financial crisis and January 1999 the beginning of floating for the Brazilian real. We have then multiplied the variable X by each of these three newly defined dummies and introduced the three new variables thus obtained into the regression (regression 1.2). The purpose is to test whether during the Asian crisis the agio was more sensitive to the degree of overvaluation of the Brazilian real. The answer to this question is clearly yes. A Wald F-test performed on regression 1.2 shows that the hypothesis that the coefficients of DBEF*X and DASIA*X are equal can be rejected at the 0.3% confidence level. Hence we conclude that the sensitivity of the agio with respect to X was significanly higher during the Asian crisis than before. Similarly the hypothesis that the coefficients of DASIA*X and DAFTER*X are equal can be rejected at the 6.5% confidence level. On the contrary the hypothesis that the coefficients of DBEF*X and DAFTER*X are equal cannot be rejected. These results are very plausible. Thanks to these two changes we obtain a sharp improvement in the adjusted R2 (from 0.65 to 0.82) and in the significance of the coefficients of all independent variables (with the exception of X) and the elimination of the functional form misspecification. However, the autocorrelation of the residuals remains.

Regression 1.3 differs from regression 1.2 in two respects: (a) additional monthly dummy variables were included to account for shocks which occurred in some months,[3] (b) the variable DEFPRIM, the primary deficit of the government as a ratio to GDP, defined as a 3-term moving average, was added to the regression. The coefficient of this latter variable is significantly different from zero (at the 2% confidence level) and positive implying that an increase in the deficit by 1 percentage point of GDP leads to an increase in the agio of about 0.6 percentage points. The coefficient of the operational deficit, a measure of the deficit frequently used in Brazil is not as significantly different from zero as the coefficient of DEFPRIM. The adjusted R2 of regression 1.3 is 0.88 and the residuals of the regression are now very well behaved.

Overall the model proposed to explain devaluation expectations in Brazil performs quite well. In particular the empirical tests confirm the importance of unemployment and of the real effective exchange rate in the explanation of devaluation expectations, as suggested in equations (4) and (8). However, the trade balance, the illiquidity ratio, the primary government budget deficit and privatization proceeds are also very significant determinants of the agio. We turn now to equation (2) of the model explaining unemployment.

3 *High real interest rates and unemployment in Brazil.*

Table 2 contains the regression explaining Brazilian unemployment as a function of the real interest rate and the world industrial production gap. In this section the variables are not transformed into moving averages as in Section 2. The real interest rate is defined as:

[3] A description of the dummies added to this and to the other regressions reported in this paper can be obtained from the authors upon request.

$$R = [(1+i) / (1+\pi)] - 1$$

where i= the short term interest rate (Selic) and π is Brazilian consumer price inflation. The world industrial production gap (WIPG) is defined as the percentage deviation of world industrial production from trend calculated using the Hodrick-Prescott filter.

Seasonality in Brazilian unemployment data is very high. The seasonal scaling factors range from 1.07 in May to 0.78 in December (1994-1999). Since in the regression of Table 2 U is not seasonally adjusted we have added seasonal dummy variables among the regressors. An increase in the real interest rate lagged 6 months leads to an increase in U and its coefficient is highly significant with a t-statistics of 5.5. The length of the lag seems very plausible. The estimated coefficient of R(-6) implies that one would need an increase of 17 percentage points of R in order to increase unemployment by 1 percentage point. This may seem rather small at first sight. However, first, real interest rates were high and variable in Brazil and this reduces the size of the estimated coefficient; second, bank lending to enterprises is still not very developed in Brazil compared to industrial countries because of its prohibitive cost and third due to the simple specification of the equation our estimates measure more temporary than permanent effects, the former being notoriously smaller.

For the world industrial production gap the most significant lag is substantially shorter (2 months). The coefficient of WIPG is also highly significant (t-statistics 4.6) and with the right sign. It implies that an increase of 1 percentage point in world industrial production above trend leads to a reduction of Brazilian unemployment of about 0.6 percentage points within two months. This equation also has some dummy variables among the regressors. One is DASIA, already defined in Section 2. Its coefficient is significant and positive suggesting an increase in Brazilian unemployment after the outbreak of the Asian crisis not explained by the other right handside variables. We shall try to explain the causes of this increase below. The adjusted R2 is 0.77. The residuals of the regressions are well behaved. However, the regression does not pass the functional form mispecification Reset test.

In order to double-check the validity of the results of Table 2 we have tested a set of equations with the same explanatory variables but with a different dependent variable: the percentage deviation of Brazilian industrial production from trend (BIPG) where the trend is obtained by computing the Hodrick-Prescott filter. Thus this alternative variable is constructed in exactly the same way as WIPG. According to Okun's law BIPG is inversely related to U. The results are presented in Table 3. The sample period is September 1995 to June 1999. As before the real interest rate R and WIPG have coefficients which are very significantly different from zero. Their signs are as expected. However, the lag of R is now much shorter and WIPG is always contemporaneous. This faster reaction is plausible since it is known that output reacts faster than employment to changes in demand.

Table 3 includes also an explanatory variable which was not significant in Table 2: DlnX, the rate of change of the real effective exchange rate (deflated with the consumer price index) with respect to the same month of the previous year. The sign of the coefficient of DlnX is as expected: a real depreciation of the effective exchange rate leads to an increase in industrial production with a two month lag. Regression 3.1 also contains one monthly dummy variable. The adjusted R2 is 0.53. The residuals are not well behaved. They are autocorrelated and heteroskedastik, suggesting instability of the coefficients and/or misspecification.

In regression 3.2 of Table 3 we test whether the coefficient of WIPG changes significantly through time. As in the previous tables we identify 3 subperiods: the period before the Asian crisis, the period characterized by the Asian and Russian crises and the period starting in January 1999. We therefore multiply WIPG by DBEF, DASIA and DAFTER introducing the 3 newly generated variables among the regressors. It turns out that the sensitivity of the Brazilian industrial cycle to the world cycle increases sharply through time, reflecting the increased openness of the economy on the one hand and the disappearance of domestic sources of growth on the other. With this modification and the inclusion of one additional monthly dummy variable, the adjusted R2 increases to 0.64 and the heteroskedasticity of the residuals disappears. However, the problems of autocorrelation of the residuals remain.

In regression 3.3 we add the primary deficit of the government among the explanatory variables and one seasonal dummy variable (for March). The deficit lagged four months is highly significant (the t-statistics is 5.1) with a positive sign suggesting that fiscal policy has Keynesian effects on the business cycle. This last regression is the most satisfactory in terms of the adjusted R2 (which increases to 0.74) and in terms of the significance the coefficients of R(-1), WIPG and DlnX(-2), although some of the autocorrelation tests suggest that autocorrelation of the residuals remains.

The implications of the estimates presented in Tables 2 and 3 for the model of Section 1 are first that real interest rates are a key determinant of Brazilian unemployment and of the business cycle and second that the real effective exchange rate of the Brazilian real has significant direct and indirect effects on the business cycle and unemployment. As to the direct effects we have found that the coefficient of DlnX(-2) is significantly different from zero and has the expected sign in the regressions explaining BIPG (Table 3). As to the indirect effects we found in Section 2 that X is one of the main determinants of the agio and we shall see in Section 4 that the agio is in turn a key determinant of the nominal interest rate: therefore X influences U and BIPG also indirectly via the agio and the real interest rate. Finally the tests presented in this section suggest a high and increasing dependence of Brazilian unemployment to the foreign business cycle and hence an increasing vulnerability of Brazil to real economic developments abroad.

We turn now to the determinants of the nominal Selic rate (equation (3)).

4 Devaluation expectations and the reaction function of the Banco Central do Brasil.

In this section we analyse the determinants of the key Brazilian short term interest rate, the Selic rate, which is under the direct control of the Banco Central do Brasil and is equivalent to the Federal Funds rate in the United States. For estimation we have modified equation (3) by taking first differences and by including a few additional explanatory variables. The resulting specification is more consistent with the empirical literature on reaction functions. The equation is:

$$\Delta i = \delta_0 + \delta_1 \Delta i^{US} + \delta_2 \varepsilon^e - \delta_3 \Delta IR - \delta_4 U + \delta_5 S\% \qquad (3a)$$

where Δ stands for the absolute change with respect to the previous month, i^{US} is the Federal Funds rate in the US, ε^e is the AGIO, IR is international reserves, U is the 3-months moving average of unemployment and S% is the percentage change of the Brazilian real-US dollar nominal exchange rate with respect to the previous month. The agio does not enter as a first difference because the coefficient of ε^e turned out to be more significantly different from zero than the one of $\Delta\varepsilon^e$.

The three independent variables which have been added [cfr. equation (3) with equation (3a)] are: ΔIR, the rate of unemployment reflecting the concern of monetary authorities with unemployment (the negative sign in front of δ_4 implies that if U increases i is reduced) and the percentage change of S with respect to the month before reflecting the concern of monetary

authorities with a depreciating exchange rate. The inclusion of S% only makes sense under flexible exchange rates when S stops being a target of policy. As we shall see below δ_5 is significantly different from zero only after January 1999. The OLS estimates of equation (3a) are presented in Table 4. The sample period is March 1995-June 1999.

The coefficients of all explanatory variables have the expected sign. Except for the coefficient of Δi^{US} they are all significantly different from zero at the 1% confidence level. The most significant lag of Δi^{US} is two months. A 1 percentage point increase in the agio leads to an increase in the nominal Selic rate of over 300 basis points in the same month. When international reserves increase the Banco Central do Brasil feels more relaxed and reduces interest rates significantly within the same month. The reaction of the Central Bank to U is very slow. Considering that U is defined as a three months moving average the lag is about 7.5 months. Some monthly dummy variables are also included among the regressors. The adjusted R2 is 0.91 and the residuals pass all the standard tests except the one for normality (Jarque-Bera).

In regression 4.2 we check whether the coefficients of the explanatory variables are stable over time. In order to do this we use the dummy variables DBEF, DASIA and DAFTER already defined above. It turns out that the coefficient of Δ IR is significantly different from zero only in the period August 1997-December 1998 (during which DASIA is equal to 1) and that the coefficient of S% is significantly different from zero only during the flexible exchange rate period (during which DAFTER is equal to 1).[4] This implies that the Central Bank reacted to changes in international reserves in the expected direction only during the Asian/Russian crisis. In regression 4.2 the coefficient of the AGIO is substantially higher: a change of 1 percentage

[4] The regression which includes the insignificant variables is not shown to save space. It is available from the autors upon request.

points implies an increase in i of about 400 basis points. The adjusted R2 is 0.92 and the problem of non-normality of the residuals persists.

5 *Conclusions*

In this paper we have analysed the vicious circle into which a country can end up if it insists in defending an excessively overvalued exchange rate for too long. High interest rates are needed to defend the currency peg, unemployment goes up and this influences the credibility of the peg and devaluation expectations in a negative way. Increased devaluation expectations in turn are incorporated into interest rates, a fact which eventually leads to even higher unemployment until the defence of the currency becomes politically unsustainable. We analyze these channels both theoretically and empirically.

In the theoretical model of Section 1 we start from a loss function of the government in which the latter is assumed to pursue two objectives: keep deviations of unemployment from target low and avoid devaluations. We show that the higher the weight attached by the government to exchange rate stability and the lower the weight attached to increases in unemployment, the more it will persist in the defence of the currency. We also show that the defence will be more stubborn and persistent, the lower the effect of an increase in interest rates on unemployment and the lower the effect of the overvaluation of the currency and of devaluation expectations on the domestic interest rate.

In the empirical part of the paper we estimate a 3 equation monthly model for Brazil from March 1995 to August 1999. The estimated equations are an equation explaining devaluation expectations, another one explaining unemployment and, finally, the reaction function of monetary authorities explaining the Selic interest rate. We show that all the channels mentioned above

played an important role in Brazil. In particular we show that (i) the rate of unemployment and the overvaluation of the currency are significant determinants of devaluation expectations measured by the spread (agio) of the black market R$-US$ exchange rate over the official market rate for commercial transactions, (ii) devaluation expectations influence significantly the Selic rate and (iii) the real interest rate is a significant determinant of the rate of unemployment.

We show in addition that fiscal policy, which was very expansionary in Brazil especially in the election year 1998, influenced significantly the agio in the direction one would expect. This fiscal indiscipline prepared the ground for the currency crisis of the second half of the year which led to the abandonment of the peg in January 1999. It is worth noting that Brazil did not buy any economic growth with these policies, as real GDP was virtually flat in 1998.

References

Calvo G. and Mendoza E.G., "Mexico's balance-of-payments crisis: a chronicle of a death foretold", Journal of International Economics, vol. 41, 1996, pp. 235-264.

Cardoso E. and Goldfajn I., "Capital flows to Brazil: the endogeneity of capital controls", IMF Staff Papers, vol. 45, March 1998, pp. 161-202.

Carvalho J. C. and Gianbiagi F., "Cambio real: onde ficamos e para onde vamos", Conjuntura Economica, June 1999, pp.16-20.

Corsetti G., Pesenti P. and Roubini N., "What caused the Asian Currency and Financial Crisis?", Temi di Discussione, Servizio Studi Banca d'Italia, no. 343, December 1998.

Dornbusch R., Goldfajn I. and Valdes R., "Currency crises and collapses", Brooking Papers on Economic Activity, no. 2, 1995, pp. 219-293.

Eichengreen B. and Jeanne O., "Currency crisis and unemployment: sterling in 1931" NBER Working Paper no. 6535, (http://www.nber.org/papers/w6563), Cambridge USA, May 1998.

Eichengreen B. and Masson P., "Exit strategies: policy options for countries seeking greater exchange rate flexibility", IMF Occasional Paper no. 168, Washington D.C., September 1998.

Ferreira A. and Tullio G., "The Brazilian exchange rate crisis of January 1999: errors in economic policy or contagion from Asia and Russia.", unpublished paper, Universidade Federal

de Minas Gerais, Belo Horizonte, March 2000.

Goldfajn I. and Gupta P., "Does monetary policy stabilize the exchange rate following a currency crisis?", Texto para Discussao no. 396, Departamento de Economia PUC-Rio, Rio de Janeiro, February 1999.

Goldfajn I. and Valdes R.O., "Are currency crisis predictable?", European Economic Review, vol. 42, 1998, pp. 873-885.

Krugman P., "A model of balance of payments crises", Journal of Money, Credit and Banking, vol 11, 1979, pp. 311-25.

Masson P., "Gaining and losing credibility: the case of the United Kingdom", The Economic Journal, vol. 105, May 1995, pp.571-582.

Micossi S. and Padoan P.C., "Italy in the EMS: after crisis, salvation?" in "The Monetary Economics of Europe: Causes of the EMS Crisis", Christofer Johnson and Stefan Collingnon (eds.), Rutherford, N.J., Fairly Dickinson University Press, 1995, pp. 61-83.

Nielsen, H. Tullio, G. and Wolters, J. "Currency substitution and the stability of the Italian demand for money before the entry into the European Monetary Union – 1972-98", Humboldt University of Berlin, Discussion Paper no. 66, July 2000 and OCSM-Luiss University Working Paper, November 2000.

Nogueira Batista Jr. P., "O Brasil depois do Plano Real" , Economia Aplicada, vol. 3, March 1999, pp. 95-107.

Obstfeld M., "Rational and self-fulfilling balance-of-payments crises", American Economic Review, vol. 76, 1986, pp. 72-81.

Obstfeld M., "The logic of currency crises", NBER Working Paper no. 4640, Cambridge USA, 1994.

Obstfeld M., "Models of currency crises with self-fulfilling features", European Economic Review, vol. 40, April 1996, pp. 1037-47.

Radlet S. and Sachs J., "The East Asian financial crisis: diagnosis, remedies, prospects." Brooking Papers on Economic Activity 1:1998, pp. 1-90.

Sachs J., Tornell A. and Velasco A., "Financial crises in emerging markets: the lessons of 1995", Brooking Papers on Economic Activity, no. 1, 1996a, pp.147-217.

Sachs J., Tornell A. and Velasco A., "The collapse of the Mexican peso: what have we learned?", Economic Policy, 1996b, pp.13-63.

Schwartsman A., "A crise cambial e o ajuste fiscal", Revista de Economia Politica, vol.19, no.1, January-February 1999, pp.5-29.

Taylor, J. The robustness and efficiency of monetary policy rules as guidelines for interest rate setting by the European Central Bank, Journal of Monetary Economics 43, 1999, pp. 655-679.

Tullio G., "An empirical note on monetary expansion and depreciation: the case of the lira-swiss franc exchange rate, February 1973-December 1976", European Economic Review, vol. 12, 1979, pp. 91-100.

Tullio G., "Exchange rate policy and monetary integration in Europe and Mercosur", Nova Economia, vol 8, no. 1, July

1998, pp.9-34.

Tullio G. and Ronci M., "Brazilian inflation from 1980 to 1993: causes, consequences and dynamics", Journal of Latin American Studies, vol. 28, no. 3, October 1996.

Table 1Brazil – Determinants of the black market exchange rate premiumDependent variable: agio – OLS estimates

Independent variables	Regression 1.1	Regression 1.2	Regression 1.3
C	3.0342 (1.9332)	5.9464 (1.0147)	2.2533 (0.4545)
U (-2)	1.2283 (4.3865)	1.5202 (5.6366)	1.1021 (3.0406)
X	-0.1473 (-7.6776)	— —	— —
DBEF*X	— —	-0.2162 (-3.5171)	-0.1497 (-2.8841)
DASIA*X	— —	-0.2430 (-4.1475)	-0.1828 (-3.6936)
DAFTER*X	— —	-0.2047 (-5.2032)	-0.1612 (-4.8069)
TR (-2)	-2.4110 (-4.0586)	-2.8710 (-5.9395)	-2.4400 (-5.8260)
M2RES (-7)	1.7903 (3.0935)	2.2975 (4.8525)	2.7096 (6.5571)
PRIV (-2)	0.0031 (2.7932)	— —	— —
PRIV (-3)	— —	0.0046 (5.1339)	0.0046 (4.7988)
DEFPRIM (-2)	— —	— —	0.5888 (2.5928)
Adjusted R2	0.6525	0.8186	0.8831
LM1	13.7370 (0.0006)	6.6232 (0.0136)	0.1479 (0.7027)
LM4	— —	— —	1.0928 (0.3757)
LM12	— —	— —	0.6409 (0.7886)
Ljung-Box	23.484 (0.024)	21.733 (0.041)	10.131 (0.604)
Jarque-Bera	3.8411 (0.1465)	0.8441 (0.6557)	1.2727 (0.5292)
White	1.2721 (0.2768)	1.0337 (0.4453)	0.7762 (0.7238)
RESET (2)	3.1390 (0.0529)	0.5603 (0.5752)	1.3220 (0.2792)
RESET (3)	2.1972 (0.1018)	0.3729 (0.7730)	1.0902 (0.3661)

Notes: (1) Period of estimation: Regressions 1.1 and 1.2 – April 1995/August 1999; Regression 1.3 – May 1995/August1999; (2) Figures below the regression coefficients are t-statistics; figures below the diagnostic tests are p-values; (3) Regressions 1.2 and 1.3 included dummy variables, which are not show to save space.

Table 2
Brazil – Real interest rate and unemploymentDependent variable: U – Period of estimation:May 1995/August 1999 – OLS estimates

Independent variables	Coeficients
C	3.2839 (12.0223)
R (-6)	0.0592 (5.5134)
WIPG (-2)	-0.5925 (-4.5962)
DASIA	2.3830 (8.8483)
Adjusted R2	0.7707
LM1	1.6857 (0.2020)
LM4	0.5742 (0.6831)
LM12	0.7423 (0.6997)
Ljung-Box	9.8304 (0.631)
Jarque-Bera	2.9299 (0.2311)
White	0.8654 (0.5993)
RESET (2)	9.3887 (0.005)
RESET (3)	6.0900 (0.0018)

Notes:

(1) Figures below the regression coefficients are t-statistics; figures below the diagnostic tests are p-values;

(2) (2) The regression included dummy variables, which are not shown to save space.

Table 3

Brazil – Real interest rate and the output gapDependent variable: BIPG – Period of estimation:September 1995/June 1999 – OLS estimates

Independent variables	Regression 3.1	Regression 3.2	Regression 3.3
C	3.6969 (3.9937)	3.1539 (3.6535)	3.4733 (4.7289)
D lnX (-2)	0.0431 (2.0158)	0.0567 (2.3887)	0.0610 (3.0451)
R (-1)	-0.1842 (-4.4892)	-0.1498 (-4.0508)	-0.1666 (-5.3961)
WIPG	2.1617 (5.9089)	— —	— —
DBEF*WIPG	— —	1.4476 (3.1796)	1.2087 (3.1021)
DASIA*WIPG	— —	2.3019 (3.4719)	2.7024 (4.7997)
DAFTER*WIPG	— —	4.8516 (3.3997)	6.0696 (4.9833)
DEFPRIM (-4)	— —	— —	1.3373 (5.0866)
Adjusted R2	0.5272	0.6381	0.7419
LM1	2.7511 (0.1050)	0.6427 (0.4278)	1.5115 (0.2269)
LM4	1.5388 (0.2111)	1.7064 (0.1713)	1.2997 (0.2904)
LM12	1.7240 (0.1128)	1.8459 (0.0927)	2.7921 (0.0146)
Ljung-Box	25.164 (0.014)	25.403 (0.013)	41.831 (0.000)
Jarque-Bera	1.1464 (0.5637)	0.3491 (0.8398)	0.1113 (0.9459)
White	3.0274 (0.0125)	1.3027 (0.2633)	0.7306 (0.7288)
RESET (2)	2.3474 (0.1090)	0.9051 (0.4135)	0.3943 (0.6771)
RESET (3)	1.8943 (0.1470)	0.5886 (0.6266)	0.3881 (0.7623)

Notes: (1) Figures below the regression coefficients are t-statistics; figures below the diagnostic tests are p-values; (2) All regressions included dummy variables, which are not shown to save space.

Table 4

Brazil – Determinants of the short term interest rate (SELIC)Dependent variable: Δi – Period of estimation:**March 1995/June 1999 – OLS estimates**

Independent variables	Regression 4.1	Regression 4.2
C	4.0830 (2.9632)	3.3762 (2.5784)
AGIO	0.3119 (2.7715)	0.3938 (3.7556)
Δ IR	-0.2689 (-4.0880)	— —
DASIA* Δ IR	— —	-0.3567 (-4.6979)
Δ i^{us} (-2)	2.3440 (1.1650)	2.4299 (1.2641)
U (-6)	-1.2869 (-4.9087)	-1.2298 (-4.8881)
S%	0.1330 (2.3458)	— —
DAFTER*S%	— —	0.2127 (4.2195)
Adjusted R2	0.9136	0.9214
LM1	0.1834 (0.6708)	0.4695 (0.4972)
LM4	1.2480 (0.3077)	0.5873 (0.6739)
LM12	1.1504 (0.3612)	1.4261 (0.2102)
Ljung-Box	11.807 (0.461)	10.707 (0.554)
Jarque-Bera	6.4599 (0.0396)	7.8100 (0.0201)
White	1.5517 (0.1384)	1.1262 (0.3696)
RESET (2)	0.7575 (0.4756)	0.9453 (0.3973)
RESET (3)	0.7112 (0.5514)	0.6295 (0.6005)

Notes: (1) Figures below the regression coefficients are t-statistics; figures below the diagnostic tests are p-values; (2) All regressions included dummy variables, which are not shown to save space.

APPENDIX – DATA DEFINITIONS AND SOURCES

AGIO – black market exchange rate premium – source: FGV/Conjuntura Economica.

BIPG – index of Brazilian industrial production (deviation from trend – HP filter) – source: FGV/Conjuntura Economica.

DEFPRIM – primary fiscal deficit – % of GDP – source: FGV/Conjuntura Economica.

i – nominal interest rate SELIC – source: FGV/Conjuntura Economica.

i^{us} – US federal funds rate – source: IFS-International Monetary Fund.

IR – international reserves – US$ million – source: Macro-metrica.

M2RES – M2/IR – source: Boletim do Banco Central do Brasil.

PRIV – privatization receipts – R$ million – source: Boletim do Banco Central do Brasil.

R – real interest rate SELIC (deflator: consumer price index) – source: FGV/Conjuntura Economica.

S – nominal exchange rate R$/US$ – source: FGVConjuntura Economica.

TR – trade balance – US$ billion – source: FGV/Conjuntura Economica.

U – unemployment rate – source: FIBGE.

X – index of the real effective exchange rate (deflator: consumer price index) – source: Macrometrica.

WIPG – index of OECD industrial production – (deviation from trend - HP filter) – source: OECD Main Economic Indicators.

QUADERNI C.E.I.S. PUBBLICATI

Atella V.
Drug Cost Containment Policies in Italy: Are They Really Effective in the Long-Run? The Case of Minimum Reference Price, prossima pubblicazione in "Health Policy".

Atella V., Caiumi A., Perali F.
Una scala di equivalenza non vale l'altra, prossima pubblicazione in "Economia e Lavoro".

Atella V.,. Rosati F. C
Uncertainty About Children' s Survival and Fertility: A Test Using Indian Microdata, prossima pubblicazione in "Journal of Population Economics".

Atella V., Caiumi A., Perali Fe.,
Quanto efficace è il "Riccomentro" nell'individuare le famiglie più bisognose?, in " La Famiglia", Anno 32, Nov/Dic. 1998, n. 192.

Atella V. e Quintieri B., *Productivity Growth and the Effects of Recessions,* in " Giornale degli Economisti" e 2Annali di Economia", vol. 57, n.3-4, dicembre 1998, 359-386

Bagella M., Castellucci L.
Financial Integration and Capital Taxation in Italy: Issues and Evidence (1982-91)", in "Rivista di Politica Economica", Marzo 1994.

Bagella M., Becchetti L.,Sacchi S.
The Positive Link between Geographical Agglomeration and Export Intensity: The Engine of Italian Endogenous Growth?, in "Economic Notes", n. 1, pp.1-34, 1998

Becchetti L., Rossi S.
The Positive Effect of Industrial District on the Export Performance of Italian Firms, in "The Review of Industrial Organisation", 16.1, pp.53-68

Bagella M., Becchetti L., Carpentieri A.
"The First ShallBe Last" Size and value Strategy Premia at the London Stock Exchange, in "Journal of Banking and Finance" di prossima pubblicazione

Becchetti L., Paganetto L.,
The Determinants of Suboptimal Technological Development in the System Company-Component Producers Relationship, in "International Journal of Industrial Organisation" di prossima pubblicazione

Bagella M., Becchetti L.
The Optimal Financing Strategy of a High -Tech Firm: the Role of Warrants, in "Journal of Economic, Behaviour and Organization,Vol. 1026, pag. 1-22, 1997.

Bagella M., Becchetti L.
Inflation, Central Bank Independence, Labour and Financial Governance: Some Evidence from OECD Countries, in "Rivista di Politica Economica".

Bagella M., Becchetti L. Caggese A.
La struttura del capitale in un'economia con piccole e medie imprese: modello teorico ed evidenza , in "Economia, Società e Istituzioni".

Bagella M.,Becchetti L.,Sacchi S.
The Positive Link between Geographical Agglomeration and Export Intensity: The Engine of Italian Endogenous Growth?, in "Economic Notes", n. 11998, pp.1-34,

Bagella M., Becchetti L.,
The Determinants of Motion Picture Box Offece Performance: Evidence from Movies Produced in Italy, in "Journal of Cultural Economics", 1999.

Becchetti L., Gaggese A.,
Effects of Index Option Introduction on Stock Index Volatility: A Procedure for Empirical Testing Based on SSC-GARCH Models, in "Applied Financial Economics", 1999.

Becchetti L.
Finance, Investment and Innovation: a Theoretical and Empirical Comparative Analysis, in "Empirica", n. 22, 1995.

Becchetti L.
Real Effectiveness of National System of Finance, Investmjent and Innovation: a Review of the Literature and a Proposal for a Comparative Approach, in M. Bagella, *Finance, Investment and Innovation: Theory and Empirical Analyses,* Ashgate, 1997.

Boltho A., Carlin W., Scaramozzino P.
Will East Germany become a New Mezzogiorno?, in "Journal of Comparative Economics", Vol. 24, n. 3, June 1997, pp. 241-264.

Brandolini A., Rossi N.
Growth, Inequality and Social Institutions, in *Income Distriibution and High Quality Growth,* Cambridge: MIT Press, 1997, 69-105.

Carbonaro I.
Aspettative sui tassi di interesse e composizione del portafoglio, in "Rivista di Politica Economica", Fascicolo X, Ottobre 1993.

Castellucci L.
La tassazione dei Capital Gains: confronti internazionali ed effetti sul valore e volume delle azioni quotate in borsa, in "Sviluppo Economico", n.2, 1993.

Cigno A., Rosati F.C.
Nuove prospettive teoriche ed empiriche sul risparmio delle famiglie e sicurezza sociale, in "Economia Politica", Vol. 1, 1996.

Cigno A., Rosati F.C.
Jointly Determined Saving and Fertility Behaviour: Theory and Estimates for Germany, Italy, UK and USA, in " European Economic Review", 1996.

Cucculelli M., Scandizzo P.L.
Risk and the Financial Structure of the Firm, in R.B.M. Huirne, J.B. Hardaker, A.A. Dijkhuizen, *Risk Management Strategies in Agriculture*, Mansholt Institute, Wageningen, The Netherlands, 1997.

Felli E. e Tria G.
Externalities, Cross-Sectoral Spillovers and Productivity Growth, in "The Open Economies Review", 1997, pp. 171-188.

Fiorito R.
Disoccupazione in Europa: fatti e proposte, in "Moneta e Credito", 1998.

Haskel J., Scaramozzino P.
Do Other Firms Matter in Oligopolies?, in " The Journal of Industrial Economics", Vol. 45, n.1, March 1997, pp. 27-45.

Knudsen O., Scandizzo P.L.
Social Supply and the Evaluation of Food Policies, in "American Journal of Agricultural Economics", 78, Febbraio, 1996.

Marini G.
Monetary Shocks and the Nominal Interest Rate, in "Economica", Vol. 59, August 1992, pp. 365-371.

Marini G., Scaramozzino P.
Monopolistic Competition, Expected Inflation and Contract Lenght, in "Labour", Vol. 6, n. 2, Autumn 1992, pp. 85-103.

Marini G., Scaramozzino P.
Expected Inflation and Output Variability in Flexible Price and Contracting Models, Oxford Economic Papers, Vol. 44, n. 2, April 1992, pp. 232-241.

Marini G., Scaramozzino P.
Inflation Expectation, Price Flexibility and Output Variability in Macro Models, in *Structural Change and Economic Dynamics*, Vol. 4, n. 2, December 1993, pp. 367-383.

Marini G., Scaramozzino P.
Overlapping Generations and Environmental Control, in "Journal of Environmental Economics and Management 29", n.. 1, July 1995, pp. 64-77.

Marini G., Scaramozzino P.
Public Debt and Redistribution, in "The Manchester School of Economic and Social Studies",Vol. LXIV, n. 3, September 1996, pp. 269-280.

Marini G., Scaramozzino P.
Intergenerational Equity, Fiscal Policy and Environmental Sustainability, in Sylvie Faucheux, David Pearce and John Proops, *Models of Sustainable Development*, Cheltenham andBrookfield, Edward Elgar, 1996, pp. 58-72

Paganetto L., Scandizzo P.L.
Il ruolo dell'educazione e della conoscenza nella crescita, in N. Rossi, *L'istruzione in Italia: solo un pezzo di carta?*, Il Mulino, Bologna, 1997.

Peracchi F., Rossi N.
Nonostante tutto e' una riforma, in *Le nuove frontiere della politica economica: 1996*, Milano, Il Sole 24 Ore, 1996, 63-155.

Pietrobelli C.
National Technological Capabilities and Manufactured Exports Performance: a Comparative Approach in "Development Policy Review", ODI, B. Blackwell, London Vol. 12, n. 2, June 1994 .

Pietrobelli C.
Developing Countries and Dynamic Comparative Advantage in Manufactures. Econometric Evidence from Chile, Monograph n. 18, The University of Liverpool, Institute of Latin American Studies.

Pietrobelli C.
Trade Liberalization and Industrial Response: the Case of Chile 1974/87, in Banca Nazionale del Lavoro "Quarterly Review", n. 191, December 1994 e in "Moneta e Credito" n. 189, Marzo 1995.

Pietrobelli C., Rossi S.
Investments, Saving and Capital Mobility: an Analysis of the ASEAN Experience, in "Estudios de Economìa", Vol. 21, n. 1, Junio de 1994.

Pietrobelli C.
A Note on the Theory of Technological Capabilities and Developing Countries' Dynamic Comparative Advantage in Manufactures, in "International Review of Economics and Business", Vol. XLIV, n. 2, June '97.

Pietrobelli C.
"The Multiple Linkages between Technology and the Economy", in "Labour", Vol. XIII, n. 2, 1998.

Rosati F.C.
Supply and Demand Policies in an Economy with Centralized Wage Setting, in "Jahrbucher fur Nationalokonomie und Statistik", 210/5-6.

Rosati F.C.
Intergenerational Transfers and Public Pensions in a non Altruistic Setting: A Public Choise Model, in "Journal of Population Economics".

Rosati F.C.
Social Security in a non Altruistic Model with Uncertaintyand Endogenous Fertility, in "Journal of Public Economics, Maggio 1996.

Rossi N., Visco I.
National Saving and Social Security in Italy, in "Ricerche Economiche", 49, 4, 1995, 329-356.

Scandizzo P.L.
The Structure of Financing and Intellectual Property Rights, in *Finance, Investment and Innovation: Theory and Empirical Analyses*, Ashgate 1997.

Scaramozzino P.
Investment Irreversibility and Finance Constraints, in "Oxford Bulletin of Economics and Statistics", Vol. 59, n. 1, February 1997, pp. 89-108.

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