Inflationary Stabilization and External Vulnerability of the Brazilian Economy in the Second Half of 1990´s: a Systemic Approach.

Newton Paulo Bueno*
Silvia Harumi Toyoshima*
Alan Figueiredo Arêdes**
Fabricio Marques dos Santos**

1 - Introduction

The current boom of economic studies using the systemic approach has not yet produced effects in Brazil. For instance, there are no macroeconomics studies published in the principal Brazilian economic journals which use this approach. The present study seeks to begin to fill this gap, building and simulating a very preliminary systemic model for the Brazilian economy. The purpose of the paper is to try to understand why the stabilization plan launched in 1994 – The Real Plan – endogenously generated unexpected effects that ended for threatening to reverse the victory in the battle for economic stabilization reached in the first years. It will be argued that one of the reasons the plan was not as successful as it could have been was the disregard for the systemic effects of the adoption of an appreciated exchange rate as an anchor for the new currency. The most important of those effects was the Brazilian economy´s progressive vulnerability to external shocks, which culminated by bringing the country to the edge of insolvency in the beginning of 1999.

1.1 - A brief review of the stabilization period and organization of the study

In June of 1994, Brazil adopted a plan of stabilization – the Real Plan – that made possible to reduce the annual rate of inflation of approximately 3000% for less than 10% in

*Professors and **students of Department of Economics at Federal University of Viçosa, Minas Gerais, Brazil. E.mail: npbueno@mail.ufv.br

the four following years.. The plan was based on the inertial inflation diagnosis[1]. In accord with this diagnosis, supply shocks – as oil price increases, in 1973 and 1979 – or demand shocks - as those derived from the II Development National Plan´s implementation – contributed to raise the existenting inflation level, which reproduced itself over time, due to the indexation mechanisms that had being created since the sixties[2]. The indexation, in correcting prices of the economy automatically – for example, wages, rents, deposits in saving, among others – on the basis of prior inflation. resulted in accumulation of demand and supply shocks in an inflationary tendency .

In the first half of the eighties, it was already clear to the majority of the economists that, in the case of Brazil, orthodox stabilization programs, based only on aggregated demand restrictions, were inadequate to reduce the inflation rate. They realized that it would be necessary the adoption of a plan of heterodox nature to eliminate inflationary inertia. After several unsuccessful attempts of heterodox plans implementations by former governments, based mainly on prices and wage freezes, President Itamar Franco decided to implement a second policy option, which had been suggested by the original texts about inertial inflation, but still had not been tried: the creation of an indexed currency.

The basic idea was to create a fictitious currency, in the sense that it would not be a real circulation currency, but just a reference for the other prices. For a certain period of time, there would be two currencies in the economy – one as a reference of value and the other as a means of circulation. That was expected to eliminate the "inflationary memory" of the economy, as economic agents started to quote their prices in that currency.

In February of 1994 the new currency was created, with the name Value Reference Unit (URV), that would have its value readjusted on a daily basis in terms of Cruzeiro (CR$) – the money in effective circulation – in accord with the observed inflation rate. Private agents were not forced to convert their prices to URV´s, but motivated to do it[3]. The incentive for the economic agents to start to quote their prices in the new currency was,

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[1] In 1993, one year before the Real Plan implementation, the general price index, calculated by the Getulio Vargas Foundation (Fundação Getúlio Vargas, 2003) was 2851%; in 1996, the same index was 9,22%.

[2] Initially, the automatic readjustment was created for savings accounts in order to make them more attractive and for federal government's notes, with the objective to reduce of reducing inflationary financing of its expenses. As inflation increased, however, that indexation mechanism was extended for wages, rents and other contracts in order to protect from inflation (Baer, 1995). The irony is that the initial idea, that it was to avoid the inflation through money emission, became the principal source of inflation.

[3] All the public prices - contracts and taxes - were converted to URV.

obviously, preserving the real value of their revenues in the uncertain state of the economic affairs at time. When a significant number of agents had converted their prices to URVs, a new currency would be created, but this time of real circulation, and strictly controlled, in that the prices in URVs would be eventually converted The Real was created in 07/01/1994, being with the following conversion rates: 1 URV = R$ 1 = US$ 1 = CR$ 2750,00.

In addiction to creation of the new currency, the stabilization plan included the adoption of a mildly restrictive monetary policy with high interest rates, which stimulated a great influx of foreign capital. This, combined with trade surplus brought an appreciation of the exchange rate; in September of 1994, the Real was quoted in US$ 0,86 (Baer, 1995). Such quotation, besides giving credibility to the new currency, favored the imports of necessary goods for the control of the inflation.

Differently from the stabilization plan adopted by Argentina in the same period, the Real was not strictly linked to the dollar, due to the fear that a great valorization of the exchange could bring an exchange crisis, as had happened with Mexico (Krugman, 1999). In September of 1994, when it was realized that the exchange was sharply appreciated, the Central Bank began to intervene in the market by buying dollars, informally establishing a regime of exchange bands. This regime was institutionalized in the beginning of 1995, establishing upper and lower limits for the exchange rate, which allowed the government the implement exchange rate minidevaluations (Falcão Silva, 2002).

The regime of exchange bands, however, did not allow large variation of the limits of those bands, since the success of the plan depended on exchange rate anchor. The necessity of keeping increasing imports in order to avoid possible demand excesses influenced the government to avoid depreciating exchange rate at the same pace as inflation. The result of that policy was the exchange rate overvaluation and rising trade deficits, which were produced in 1995 for the first time in several years. In order to equilibrate the balance of payments - worsened by the deficit in the Services accounts -, the success of the plan had to count on the entrance of foreign capitals , including short term loans, what required the maintenance of high level of interest rates, during the entire period.

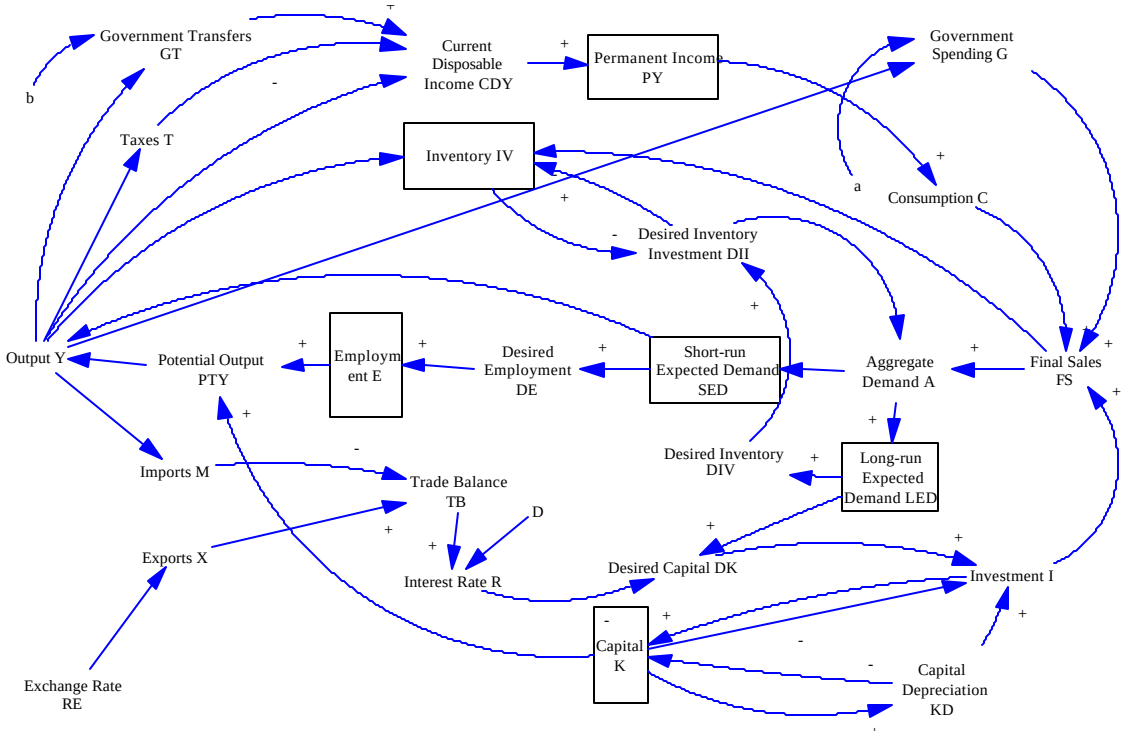
The Real Plan, therefore, was successful in terms of preventing a hyper-inflation, but it caused an undesirable side effect that damaged economic growth in the following years: external vulnerability increasing, which led to the maintenance of high real domestic interest rates during practically the entire first term of President Fernando Henrique Cardoso´s administration.

This text seeks to reproduce, in a simulation model, the dynamics of the Brazilian economy described above, characterizing mainly the increasing vulnerabilility to external shocks, caused by the overvalued exchange rate regime. It will be shown, specifically, that, in this kind of regime, the domestic interest rate must be consistently high in order to attract external capitals, which equilibrate the corresponding trade balance deficit. The model described in the next section then adopts the Mundell - Fleming´s hypothesis, in making the interest rate dependent on the exchange rate;it will also be argued that the exchange rate is more important for the dynamics of short and long periods the more dependent the economy is on foreign capital, as is the case of developing economies, In section 3, the key results of the simulation are discussed and, in section 4, the expected dynamics of some variables not included in the model, as the public debt and the inflation rate, is suggested. Section 5 concludes the paper.

2 - The simulation model

2.1 - The model

The simulation model below, built with VENSIM software, adapts to Brazil the model proposed by FORRESTER (1982) for the American economy.



The main characteristics of the model, emphasizing the differences in relation to the Forrester´s model, are:

i) the interest rate is determined, as in the Mundell -Fleming model under conditions of small economy and fixed exchange rate, on the real side of the economy, by the need for foreign financing The larger the trade deficit, the larger the spread to be maintained among the domestic and the external interest rate in order to produce a balance of payments equilibrium. As imports depend on the level of economic activity and exports depend on the exchange rate, the model operates with external restriction to growth, because the acceleration of growth gives rise to an increase of the imports but not of exports;

ii) there are two fundamental loops in the model, the first, positive and the second, negative. In the first one, in the superior part of the diagram, the increase of final sales induces increase of the consumption expenses, through increase of the permanent income, and increase of the investment expenses, through elevation of the desired stock of capital. In the second loop, the increase of income, induced by the growth of final sales, activates

the external restriction to growth , pressuring imports, which, given a certain exchange rate, increase trade deficit (or reduce trade surplus) inducing interest rate increases and reduction of private investment; that, as will be shown, is the key relationship in the model;

iii) the model presents automatic stabilizers due the existence of the negative loop. For instance, an increase in the interest rate reduces investment and product levels. But the decrease of the product reduces imports, reducing the need for external financing and, therefore, the interest rate. The increase of the public expense in proportion to the product, on the other hand, induces private investment increases by improving long term demand expectations, but this increasingly pressures the balance of payments inducing interest rate increases and reduction of the private investment.

2.2 - Hypotheses, calibration and data sources

The model was initialized with the observed values for the Brazilian economy in 1983 at 1998 prices, when data are available, and with the values of Forrester´s thesis for American economy when Brazilian data are not available. The key values adopted as initial conditions and parameters were:1) value of the initial product equal to 500 billion dollars; this is the first value of the series used for the calculation of the regressions among: i) imports and Gross Domestic Product (GDP); ii) real interest rate and trade balance figures and iii) exports and the real exchange rate. 2) stocks were set at the following values: i) final products stocks : 150 billion dollars, defined as a proportion of 0,3 of GDP ; and ii) capital stock : 1230 billion dollars; and 3) The marginal propensity to consume, finally, was set in a constant level of 0,76.

The calibration sought to make the model compatible with the Keynesian theory. In order to do that , the value of the aggregated initial demand was set in 500 billion dollars, equilibrating the product at this level in the first year of the simulation, while the initial value of the investment equals to 77 billion dollars, satisfying the general Keynesian equilibrium equation for a closed economy: $Y = C + I + G$. The model was complemented by adding taxes (0,3 of GDP) and public expenses (0,3 of GDP). These values, as well as

exports and imports, were calculated in 1998 dollars. The basic interest rate of the economy was the SELIC, discounted by general consumer price index. The relationship between interest rate and trade balance figures was estimated with base on a simple linear regression model, including a dummy variable equal to 1 in years of high political instability, as in 1989 and 1992.

The main data sources were the journal Conjuntura Econômica, The Central Bank Bulletin, and the site of the Institute of Applied Economic Research (www.ipeadata.gov.br).

2.3 - Observations on the model validation

The question of whether a simulation model is valid does not, as we know, have a simple answer[4]. A model does not seek to totally reproduce the reality, but to capture the fundamental mechanics of certain processes, increasing our understanding about this reality. However, once the model presupposes values for parameters and is simulated starting from initial conditions that refer to a specific reality, an obvious criterion of the quality of the model is the larger or smaller convergence of results between the simulations and the real data. In this sense, in spite of the difficulties in comparing the results of the simulations with Brazilian data in the last few years, due mainly to large variations in the exchange rate (in which data are valuated in this work)[5] , the model seems to generate a reasonable approach to the dynamics of the Brazilian economy in recent years. The principal results which support this inference are the following[6]:

[4] For a interesting discussion on that point see, for instance, Ford (1999: cap. 22).

[5] Just to have an insight on this difficulty, observe that the value of Brazilian GDP was reduced from US$ 708 Billion to US$531 between 1998 and 1999, without that an economic recession had happened on this last year, but rather a slight growth of 0.8% of real GDP. The explanation for that fact is the major depreciation of the Real in this last year.

[6] The simulations was based on the following scenario: exchange rate appreciated at the parity level with the dollar, between 1995 and 1998, and exchange rate at R$ 3 / US$ 1, which is close to the present observed average level, , in the remainder of the simulation period:

i) the estimated values of GDP, in US$ billion of 2001, for 1983 and 2000 are very close to the values indeed observed; in this last year, for instance, the estimated value was of US$ 577 billions and the observed one was of US$ 594 billions;

ii) the external shock was simulated as having happened only in 1995, due to the Mexican crisis; the other shocks, such as those which occurred in 1997 and 1998, were not considered; it is in 1995, however, that the basic interest rate of the economy (SELIC) in fact reached its higher level, about 45% annually in real terms, what justifies the temporary location of the shock in this year;

iii) the simulations approximately reproduce the reduction of the rate of economic growth between 1995 and 1998;

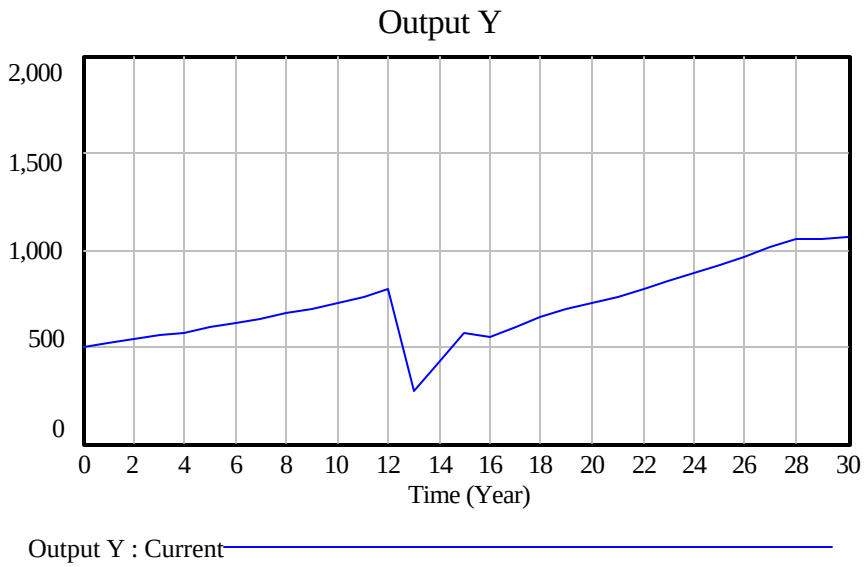
iv) the simulations reproduce finally, although only crudely, the inversion of the sign of the trade balance that becomes negative starting from 1995; in the simulations, however, a real deficit occurs only in 1995.

3 - Simulations

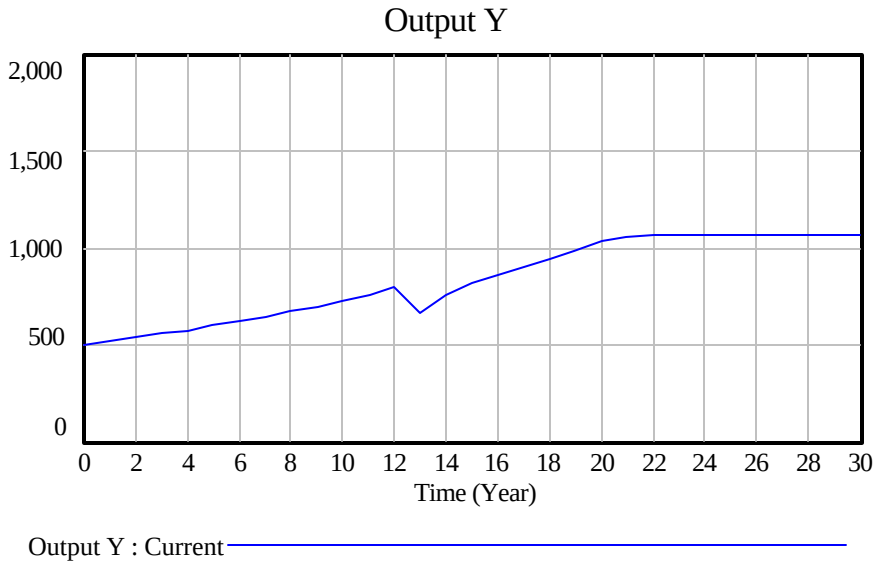
Figure 1 presents the simulation for the growth of the output (GDP) over 30 years, beginning in 1983, in two scenarios. In the first, the occurrence of a large increase in interest rate is supposed in the twelfth year of the simulation (as it happened in 1995 in reason of the Mexican crisis), simultaneously to the exchange rate appreciation promoted by the Real Plan. In the second scenario, the simulation is what would have happened with GDP if exchange rate valorization had not occurred when the shock of interest rate occurred. The simulation is made on the hypothesis that the equilibrium exchange rate during the whole simulation period is the triple of the rate observed in the beginning of the stabilization plan (as it seems to be happening now).

Figure 1- Interest rate shock effect over economic growth in two different scenarios for the exchange rate

scenario 1: appreciated exchange rate



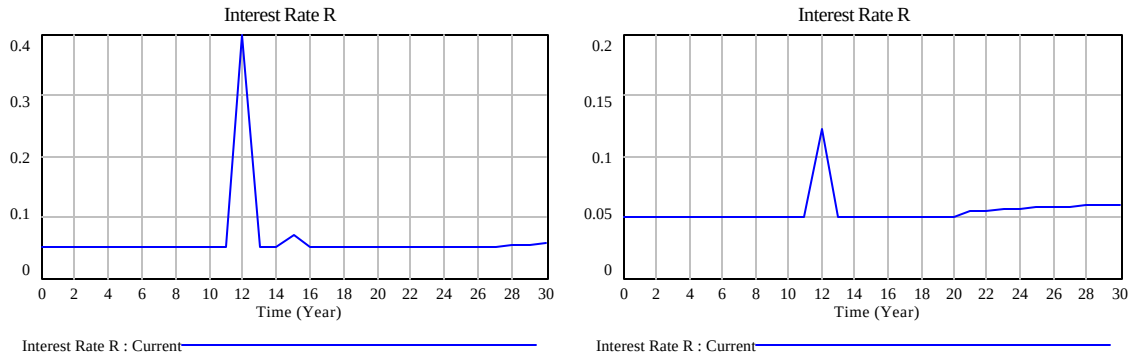
scenario 2: equilibrium exchange rate



The simulation suggests that the stronger the appreciation of the exchange rate, the greater the effect of the shock of the interest rate on GDP In the second scenario, corresponding to the exchange rate of R$ 3 / US$ 1, the growth tendency is not even interrupted. In the first scenario, in which it is supposed that, in the period 1995-1998, the exchange rate is appreciated from the equilibrium level above to the level of R$ 1 / US$ 1 (as indeed happened in the first phase of the Real Plan), an expressive reduction of economic activity occurs. The recession will produce long term effects. The GDP in the thirtieth period of the simulation - that is, in 2015 (of course it is just an exercise without any pretension of perfect forecasting) – is about 30% smaller (US$ 690 billion) in the first scenario compared to the third scenario in that the exchange rate is not appreciated during the period of stabilization

The reason why exchange rate appreciation makes the shock of the interest rate more aggressive for the economy in the short period is explained by the formulation of the relationship among those two variables inspired in the Mundell-Fleming model. In an economy with appreciated currency, the trade balance is in general in deficit, what means that, besides the need of attracting foreign capital to balance the services account, the spread among the domestic and the external interest rate has to be large enough in order to equilibrate the trade deficit. Figure 2 compares the impact of a same increase of the international interest rate on the basic interest rate of the Brazilian economy in the two scenarios described in the previous paragraph.

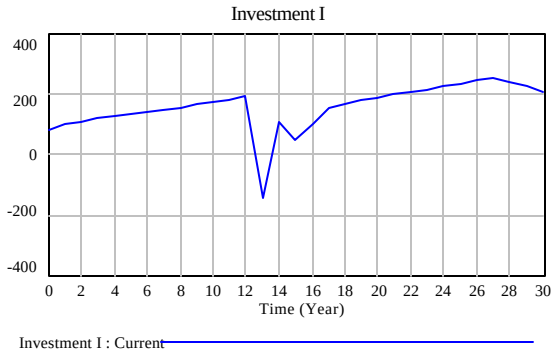
Figure 2 - Impact of external interest rate shock over the domestic interest rate in two scenarios for the exchange rate



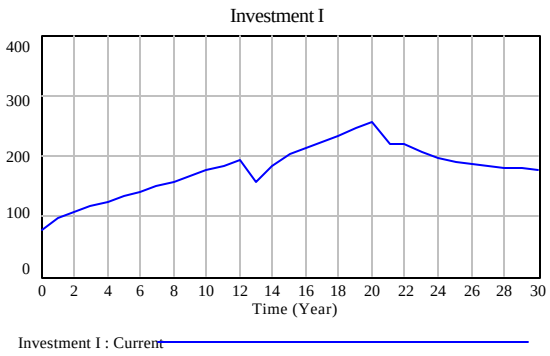
scenario 1: appreciated exchange rate **scenario 2: equilibrium exchange rate**

The domestic interest rate increase to the level of 40% a year, in the scenario of appreciated exchange rate, generates an immediate reduction of investment in 1995, explaining the recession that takes place in the short term. But in addiction, in reducing the aggregate demand of the economy, it will reduce the consumption in the following periods, depressing the expectations, and reducing the investments for several years ahead. Figure 3 compares the evolution of the investment and consumption, respectively, in the scenarios of appreciated and equilibrium exchange rate.

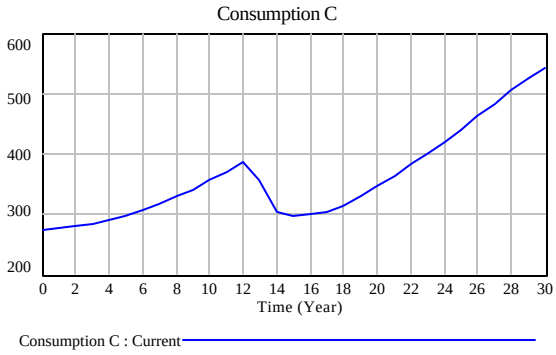
Figure 3 - Evolution of Investment and Consumption in two scenarios for the exchange rate



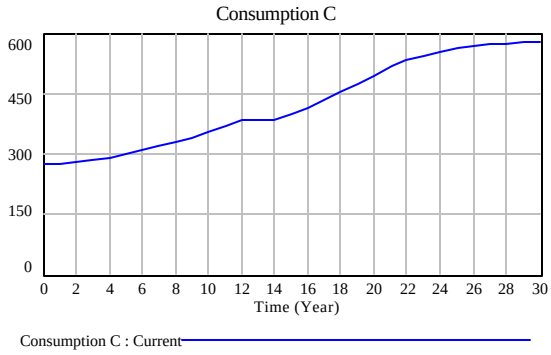
scenario 1: appreciated exchange rate



scenario 2 : equilibrium exchange rate



scenario 1: appreciated exchange rate

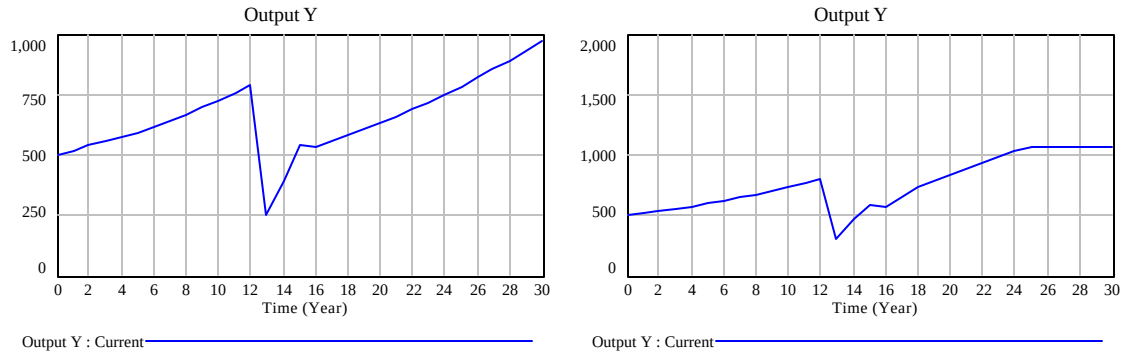


scenario 2: equilibrium exchange rate

Note that, when interest rate shock and currency appreciation coincide, the investment and the consumption recover their levels pre-shock only after 10 years, that is, in 2005. In the equilibrium exchange rate scenario, however, after a slight fall, both, consumption and investment resume their growth paths already in 1997.

The impact of the interest rate shock combined with appreciated exchange rate can be even larger if, simultaneously, a restrictive fiscal policy is adopted, in order to weaken inflationary effects of the external shock. Figure 4 compares two situations: one in that the government reacts to the shock adopting a fiscal restrictive policy (keeping a primary surplus of 4% of annual GDP during the period of stabilization, as it is happening now in Brazil) and the other in that, to compensate the reduction of the private investment provoked by the interest rate increase, the primary public deficit is kept on 4% of GDP.

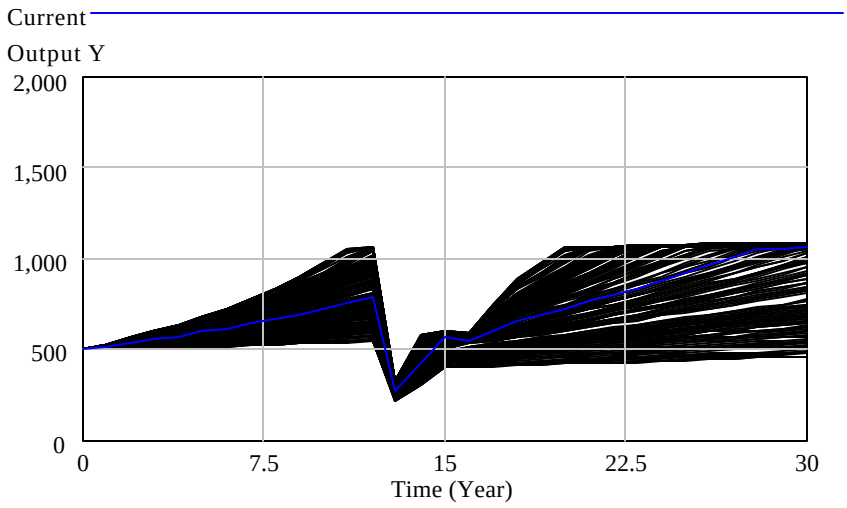
Figure 4 - Evolution of the GDP in two scenarios of fiscal policy



scenario 1: restrictive fiscal policy **scenario 2: expansionist fiscal policy**

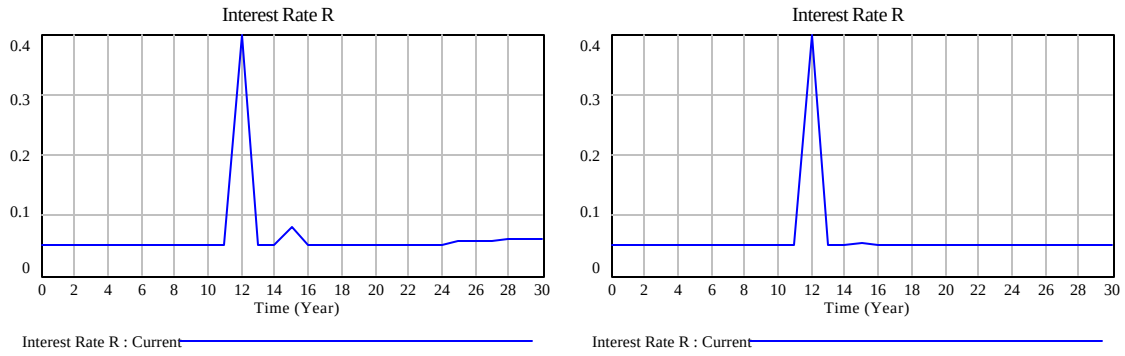
It can be seen that, after the shock that reduces the activity level, GDP falls less and grows more quickly when government increases its expenses to compensate for the reduction of the private investment; the simulation indicates that, in that case, the economy resumes its pre-shock activity level six years earlier than in the other scenario in which government works with primary fiscal surplus. The sensibility analysis below shows more clearly this result: long term GDP and the time for resuming economic growth vary substantially when public deficit is allowed to vary in the specified interval.

Figure 5 - Sensivity analysis for GDP for different primary superavit levels



Note additionally that the maintenance of the public deficit doesn't produce significant impacts on the interest rate. The only difference is that, when government works with a deficit, there is a second domestic interest rate increase in the period 15, due to the fact that the fastest growth resuming leads to a larger growth of imports on that year (1997) and then to the necessity for more external financing.

Figure 6 - Impact of public deficit on domestic interest rate in two scenarios



scenario 1: government fiscal deficit **scenario 2: government fiscal superavit**

4 - Variables not included in the simulation model

As the objective of the study was to capture the essential aspects of the Brazilian economy´s dynamics, variables that, although important, seem do not play a independent role in that dynamics were not simulated. The two more important variables not included were:

i) the inflation rate: it seems reasonable to suppose that the main influence on the price level under conditions of low inflation regime, as it seems to be the case of Brazil after 1995, is the exchange rate. This does not mean, of course, that we are not taking in account the influence of eventual demand and supply shocks at all, but instead that, on conditions of almost totally open small economy, as it was observed since the Real Plan implementation, the exchange rate determines the essential imports prices which have a utmost importance in the general price index. It seems plausible, therefore, that the inflation rate follows the exchange rate dynamics;

ii) the public debt: the domestic public debt dynamics in Brazil tends to follow the foreign debt one, because the monetary supply control requests the foreign loans sterilization ; in periods of appreciated exchange, therefore, both debts tend to grow above their historical rates. Then, although it is obviously an important indicator of the government's financial solidity, the dynamics of the debt is largely dependent on the exchange rate evolution, as is the inflation rate.

5 – Conclusion

Brazil is a country of great economic potential, but the use of this potential is still far from satisfactory. Several causes have been pointed for that, but it was not the purpose of this work to contribute to that discussion. What we tried to show was that attempts to solving structural problems, such inflation, only through stabilization programs, are not enough to place the country in a sustainable development path.

It was shown, specifically, that the adoption of stabilization programs anchored in appreciated exchange rates – as it was Real Plan – besides not being a definitive solution

for the inflation problem, makes economy more vulnerable to external shocks, in two key senses. First, it makes the impact of those shocks more severe in the short term, generating more serious and more durable economic recessions than if the exchange rate was closer to its equilibrium level. The exchange rate anchor, in the second place, due to endogenous mechanisms related to the process of expectations formation, affects the long term economy´s performance, reducing its growth rate.

The model utilized in the paper is quite simplified; several important variables as the inflation rate and the public debt were not included in the present version. The probable effects of the external shocks on those variables, however, were appraised. The conclusion was that those variables behaviour is probably endogenous to the dynamics modeled.

It is not totally clear yet if the Real Plan has completely failed. But the available empirical evidence indicates that, although it has been fundamental in erasing the Brazilian inflation´s inertia, the Plan still has to be complemented by structural reforms. If those reforms are not made, as the social security and the tributary systems, a great chance to erradicate inflation in Brazil will be lost. This, after the society has already paid almost all the costs in terms of economic growth that a successful stabilization would have demanded.

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Appendix 1: equations of the model

a = 0,3 + primary surplus

b = 0

Desired Capital DK = 0.3*(Long-run Expected Demand LED)/(1/14+Interest Rate R)

Capital K = INTEG (Investment I - Capital Depreciation KD, 1230)

Consumption C = 0.78*Permanent Income PY

D = PULSE TRAIN(6, 1, 3, 10)

Aggregate Demand A = DELAY FIXED (Final Sales FS + Desired Inventory Investment DII, 0, 500)

Capital Depreciation KD = Capital K/14

Desired Inventory Investment DII = (Desired Inventory DIV - Inventory IV)/0.4 Desejado

Desired Employment DE = (1-0.25)*Short-run Expected Demand SED/(0.75*500/25)

Employment E = INTEG ((Desired Employment DE - Employment E)/0.5, 25)

Desired Inventory DIV = 0.3* Long- run Expected Demand LED

Inventory IV = INTEG (Output Y – Final Sales FS + Desired Inventory Investment DII, 150)

Short-run Expected Demand SED = SMOOTH(Aggregate Demand A,0.5)

Long- Run Expected Demand LED = SMOOTH(Aggregate Demand A,3)

Exports X = 44.67*Exchange Rate ER+14

Government Spending G = a* Output Y

Imports M = 0.173*Output Y-58

Investment I = DELAY FIXED (Capital Depreciation KD+(Capital Depreciation DK - Capital K)/2, 0, 77)

Potential Output PTY = 500*((Employment E/25)^0.75)*((Capital K/1230)^0.25)

Output Y = Potential Output PTY*(1-0.2) + Short-run Expected Demand SED*0.2

Current Disposable Income CDY = Output Y-(Taxes T – Government Transfers GT)

Permanent Income PY = SMOOTH (Current Disposable Income CDY, 3)

Trade Balance TB = Exports X - Imports M

Exchange Rate ER = 1

Interest Rate R = IF THEN ELSE(-0.0031*Trade Balance TB+0.2113*D+0.1266>0.05, -0.0031*Trade Balance TB+0.2113*D+0.1266 , 0.05)

Taxes T = 0.3*Output Y

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