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ENDOGENOUS FOREIGN CAPITAL FLOW IN A CGE MODEL FOR BRAZIL: THE ROLE OF INTERNATIONAL RESERVES[1]

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SUMMARY

SINOPSE

Neste artigo admitimos que o fluxo de capital externo para o Brasil subordina-se a uma decisão de investimento cujo nível de risco depende da taxa esperada de perda de reservas internacionais. Isso foi motivado pela estimação que fazemos de uma relação empírica entre essas duas variáveis que é válida para períodos em que não há crise de balanço de pagamentos. Essa relação foi então introduzida em um modelo estático de equilíbrio geral aplicado, um CGE, que havia sido anteriormente desenvolvido no IPEA para o Brasil, para produzir uma versão com fluxo de capital externo endógeno. Depois de ajustar a calibragem do ano-base do modelo (1998) para levar em conta a inclusão dessa equação nele, o artigo compara a resposta das duas versões do modelo à simulação da implementação de dois acordos de livre-comércio: o Alca e o acordo com a União Européia. A principal conclusão é que a endogeneização do fluxo de capital externo amplia o efeito simulado sobre a economia real desses acordos de livre-comércio.

ABSTRACT

In this paper we model foreign capital flow to Brazil as stemming from an investment decision that whose risk depends on the expected rate of loss of foreign reserves. This motivates the estimation of an empirical relationship between these two variables that is valid for "normal" periods (when there is no foreign exchange crisis) which is used to calculate the capital flow associated with a given expected rate of foreign reserves loss. This empirical relationship is then introduced in a static General Equilibrium Model for Brazil which has exogenous foreign capital flow and follows a relatively standard specification, to produce a version of it with endogenous capital flow. After employing the inverse of the estimated relationship to calculate the difference between the expected and the realized values of the reserve loss in 1998, and using it to adjust the base year data, we recalibrate the model and compare the response of the two versions of the model to a simulation of the implementation of two free trade agreements: with the Americas (ALCA) and with the European Union. The main conclusion is that the inclusion of endogenous foreign capital flow in the model significantly amplifies, and in some cases changes, the real effects of these free trade agreements.

1 INTRODUCTION

International trade agreements have important trade effects, through their effects on tariffs, and, consequently, in the relative competitiveness of production in the countries involved. The reallocation of production to the most efficient producers entails efficiency gains, and potential welfare gains, but these are often regarded as only part of the benefit of those agreements. Other effects, usually referred to as the dynamic gains from trade, are sometimes regarded as more important in the long term, but modeling them has been an elusive goal for researchers in this area. Many different phenomena are included in that broad category, which can best be described as encompassing all the mechanisms that extrapolate the (static) trade gains. This paper is an effort to incorporate one specific dynamic gain, the impact in the foreign capital flow, in the static general equilibrium framework (CGE) for the evaluation of trade agreements.

The foreign capital flow $(FCAP)$, composed of real and portfolio investments, as well as net lending, affects the exchange rate and the capital accumulation in productive sectors. In a highly integrated international financial system, where there are few barriers to the foreign capital flow and the transaction costs are low, $FCAP$ may trigger a growth cycle of a country, or hinder it. It is therefore important to try to incorporate some of the determinants of the foreign capital flow in the CGE framework, when it is used to assess the tradeoffs involved in signing international trade agreements, because its impact on this flow may ultimately determine whether signing it will have a long-term positive impact on the country.

There are many parameters and variables than can affect each component of $FCAP$ as, for example, the (average) borrowing rate of interest, the rate of return to capital, and the indicators of the solvency of the country. Some of these parameters and variables are known, while others are only revealed at the end of the period of analysis. We assume that investors formulate expectations of the future value of the unknown variables and parameters, to be able to make decisions before the uncertainty is resolved.

In this paper we propose that the foreign capital flow depends on the expected value of the rate of the loss of foreign reserves. The motivation and intuition for this hypothesis is that the foreign reserves are viewed as collateral by foreign investors, and its level at the end of the period is the relevant variable to characterize the country risk for the investment decision of international financial agents.

One can find alternatives for the determinants of the supply of foreign capital in the literature. Khan and Zahler (1989) propose that the capital inflow depends on the spread of between the domestic and international interest rate, the country risk, and the devaluation of the currency in the relevant period. Azis (2000) also uses the CGE framework to address these issues for Indonesia, considers that the inflow and the outflow of foreign capital have distinct determinants, and assumes that the latter depends on the expected exchange rate, not its rate of change.

To support our formulation, we first describe the empirical relation between $FCAP$ and the relative decrease in the foreign reserves $(RLSFRES)$ for Brazil, in the period that followed the monetary stabilization of the Real Plan. We then show

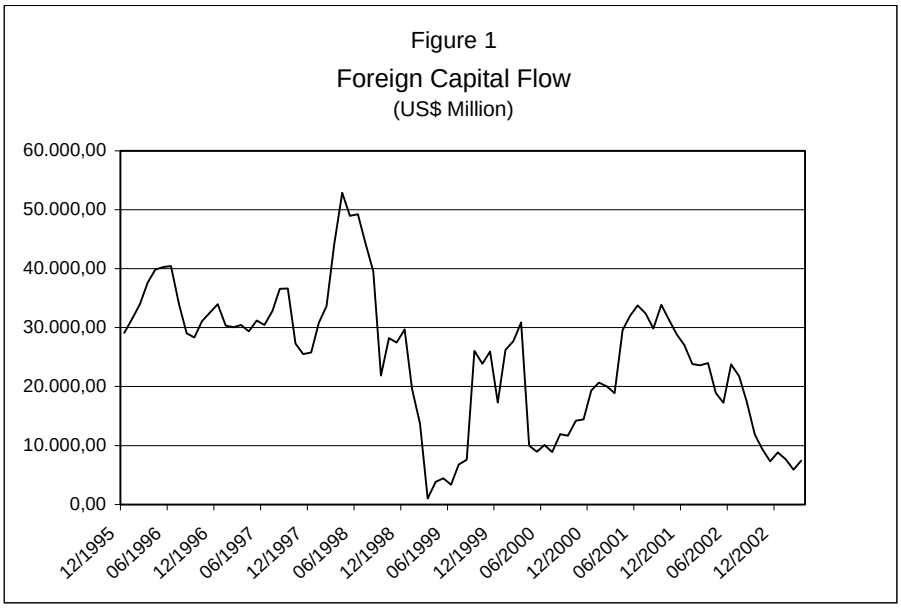
that there is a stable relation between them in periods which can be classified as non-crisis periods, that we call "normal" periods, and propose a functional form for it. We then explore the implications of the existence of this regularity in a standard static CGE model that had previously been implemented for Brazil to study the effects of international trade agreements [see Tourinho and Kume (2002)]. Lastly, we use this extended model to evaluate the aggregate and sector effects of the proposed initiatives currently under consideration by Brazil: the Alca and European Union agreements.

The paper is divided in four sections. Section 2 describes the relationship between the time series for *FCAP* and *RLSFRES* , and summarizes the results of Appendix A, which develops its specification and calibration. Section 3 has two parts. The first one discusses the corrections of the calibration of the CGE steady-state model that are required to take into account, in the calibration of the reference scenario, the effects international financial crisis precipitated by the Russian default in 1998, and the ensuing devaluation of the real. Appendix B reports the effects of the trade agreements in the CGE model whose base case has not been adjusted to correct for the transitory effects observed in 1998. The second part of Section 3 analyses the impacts on the Brazilian economy of signing international trade agreements with the European Union, and with the Americas (Alca), using as a tool the extended CGE model, which includes the foreign capital supply equation discussed in Section 2. Section 4 summarizes the main conclusions.

2 THE DETERMINANTS OF THE FOREIGN CAPITAL FLOW

Figure 1 displays the foreign capital flow to Brazil from December 1995 to March 2003, and shows that it fluctuated significantly, even in periods of relative stability of the international capital markets and of the domestic monetary policy. We have not been successful in tracking these changes by correlating them with other macro variables, like the domestic and foreign interest rates, the exchange rate, and indicators of country risk.

Figure 1
Foreign Capital Flow
(US$ Million)



In this section we show that, for Brazil, a stable relationship existed between $FCAP$ and $RLSFRES$ in the normal (non-crisis) years after 1995. However, in the years when a foreign exchange crisis occurred that relationship did not hold.[1] This empirical regularity is described here by assuming that $FCAP$ always depends on the *expected* relative foreign reserves loss $(RLSFRES^{e})$, and that in normal years that rate coincides with the observed rate, i.e., expectations are self-fulfilling, but in crisis years they do not coincide.

In normal years, a foreign investor will increase his investment in the country if he expects that an increase in foreign reserves holdings will occur. This would be his rational response if the addition to reserves reduces the risk of a foreign exchange shortage and, therefore, of devaluation that would depreciate the value of his investment in terms of the foreign currency.

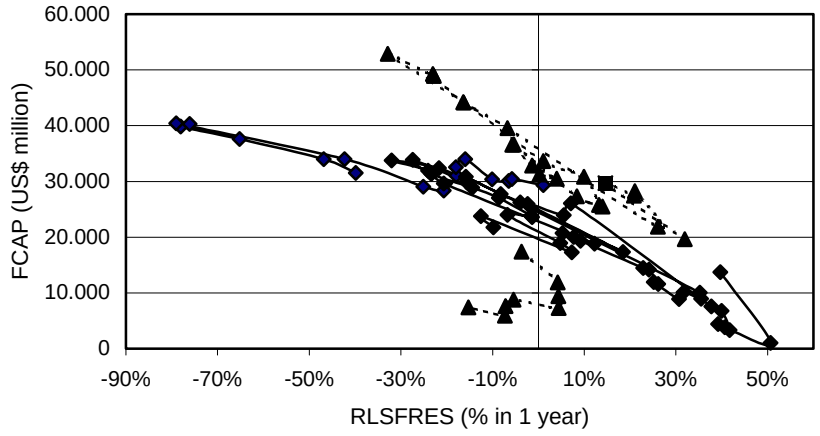
Alternatively, in a crisis the level of reserves is expected to decrease and the risk of a negative return on the investment increases. The ensuing decreased expected return could then lead to a reduction in the foreign investment flow, or even to a net foreign capital outflow or a foreign exchange crisis. An eventual increase in reserves in this case may not lead to an increase in the foreign capital flow, because it is not seen as structural. This behaviour can also be rationalized by assuming foreign investors think of the expected level of foreign reserves as the collateral of their investments in the country, and react accordingly.

One can be interpret the response of $FCAP$ to $RLSFRES^{e}$ in a narrow or broad sense, depending on whether it reflects the reaction of risk-adverse foreign investors to the expectation of the deterioration of the foreign reserves position of the country itself, or if $RLSFRES^{e}$ actually summarizes the effects of the several variables that are deemed important for the investment decision by a foreign investor, such as the ones considered by Aziz (2000).[2]

The empirical motivation for the hypothesized stable relation between $FCAP$ and $RLSFRES^{e}$ is discussed below with reference to Figure 2, where each observation displays these two variables in a month of our period of analysis. They are measured as the accumulated flow in the previous 12 months of $FCAP$ (vertical axis, in US$ Millions) and $RLSFRES$ (horizontal axis, in percentages). The points in the graph are joined by lines which indicate their chronology. The normal periods (January 1996 to April 1997, and February 1999 to July 2002) are marked with a "♦" and joined by a continuous line. The crisis periods are marked with "▲" and are jointed with a dotted line. The basis year for our simulations (1998) is marked with a "■".

1. These periods may or may not coincide, or be triggered, by broader movements in the international financial markets.
2. Azis (2000), in a model that tries explain the transmission of the financial crises in Asia to Indonesia, assumed that some of the variables that foreign investors consider in deciding to invest in a country are the interest rates spreads, the foreign exchange devaluation, the political and country risk, etc.

Figure 2
Rate of Decrease of Foreign Reserves (RLSFRES)
and Foreign Capital Flow (FCAP)



2.1 THE BALANCE OF PAYMENTS EQUILIBRIUM

In the normal periods, $RLSFRES^e = RLSFRES$ and the graph of the relationship between $FCAP$ and $RLSFRES^e$ approaches a curve *f*, represented this by equation (1), which describes approximately the continuous line in Figure 2. In the crisis periods the observations are either above or below that curve.

$$FCAP_t = f(RLSFRES_t^e) \text{ where } RLSFRES_t^e = 1 - (FRES_{t+1}^e / FRES_t) \qquad (1)$$

where $FRES_t$ and $FRES_t^e$ are, respectively, the actual and the expected level of foreign reserves at the beginning of the period *t*. Note also that $f' < 0$, because an increase in the rate of foreign reserve losses decreases the flow of foreign capital to the country, as could be expected.

To analyse the implications of (1) in a partial equilibrium setting, we must also take into consideration the current account balance equation (2):

$$FSAV_t = FCAP_t + LSFRES_t \qquad (2)$$

where $FSAV_t$ is the flow of foreign savings in period *t*, and $LSFRES_t = -(FRES_{t+1} - FRES_t)$ is the (actual) decrease of foreign reserves in period *t*.

To insure that supply equals demand of foreign capital, substitute (2) in (1) to get (3):

$$FSAV_t - LSFRES_t = f(LSFRES_t^e / FRES_t) \qquad (3)$$

This equation shows that the actual decrease of international reserves $(LSFRES_t)$ depends on its expected value $(LSFRES_t^e)$. If they turn out to be equal, the balance of payments is self-fulfilled expectations equilibrium, and if they are different a *temporary* equilibrium occurs. This can be formalized by requiring that the

self-fulfilled expectations equilibrium satisfies equation (3'), which is obtained by making $LSFRES_t^e = LSFRES_t$ in (3):

$$FSAV_t = LSFRES_t + f\left(LSFRES_t / FRES_t\right) \qquad (3')$$

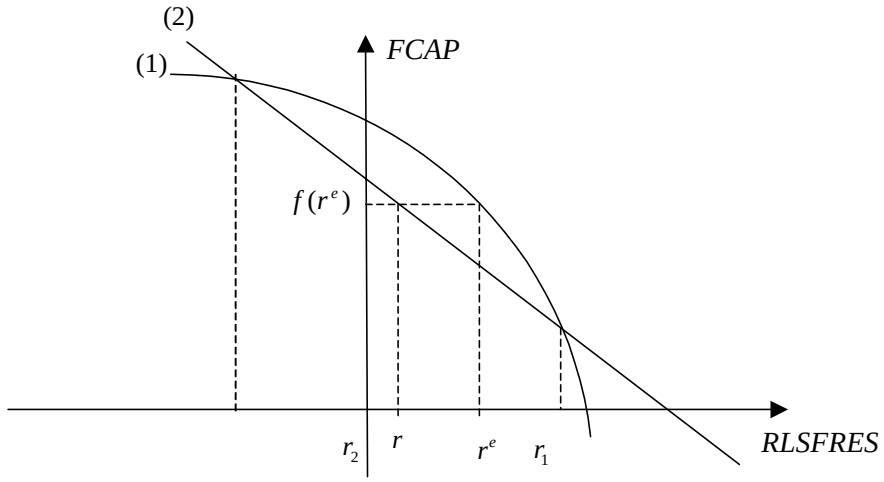
Recalling that $FRES_t$ is pre-determined, and assuming that $FSAV_t$ is given by the domestic savings shortage, equation (3') can be used to determine the self fulfilling expectations equilibrium level of $LSFRES_t$ and, therefore, of $RLSFRES_t$.

2.2 THE NATURE OF EQUILIBRIUM

In this section we illustrate these equilibrium concepts[3] with the help of Figure 3 which displays: *a*) a hypothetical reserves supply function *f* (equation (1)), assuming that $(f'' < 0)$, which means that increases in the rate of foreign reserves accumulation have decreasing returns in terms of attracting foreign capital, and *b*) the current account balance line (equation (2)), that has an inclination equal to $-FRES$, which is given.

FIGURE 3

SELF-FULFILLED AND TEMPORARY EQUILIBRIUMS IN THE BALANCE OF PAYMENTS



Note that r_1 and r_2, which are the values of $RLSFRES^e$ that solve equation (3'), produce self-fulfilled expectations equilibriums $(r_1, f(r_1))$ and $(r_2, f(r_2))$ where the demand and supply of foreign capital are equal, and expectations are self-fulfilled. For other values of $RLSFRES^e$, denoted by r^e, expectations will not be confirmed, because the supply foreign capital will be $FCAP = f(r^e)$ and that will imply that the actual rate of decrease of international reserves will be r, determined by equation (2), and a temporary equilibrium $(r, f(r^e))$ will obtained.

3. To simplify the notation, in this section we omit the time index of all the variables.

Further, r_1 is unstable while r_2 is stable, in the expectations sense, as defined by Evans and Honkapohja (1999).[4] Starting at r_1, if the expected rate deviates from it, the actual rate in the next period will move away from it, while if the deviation is around r_2, the actual rate will converge back to it. This can be verified by noting that $|f'(r_2)| < FRES$ and $|f'(r_1)| > FRES$.

2.3 THE BALANCE OF PAYMENTS OF BRAZIL 1995-2002

The calibration of equation (1) for the Brazilian balance of payments data shown in Figure 2 is discussed in Appendix A, which also addresses the choice of the hyperbolic functional form for *f*, the elimination of the crisis years from the sample, and the estimation of the parameters using non-linear regression techniques. The empirical relation thus obtained yields Table 1, that shows the supply of foreign capital that would be forthcoming in each year of the sample if it had been a normal year, since it displays the value of $FCAP$ given by (1) if $RLSFRES^e$ is equal to the observed $RLSFRES$.

TABLE 1
EQUILIBRIUM RATE OF DECREASE OF FOREIGN RESERVES (*RLFRES*^{e}) AND OBSERVED FLOW OF FOREIGN CAPITAL (*FCAP*)

	1995	1996	1997	1998	1999	2000	2001	2002
FRESo	38.806	51.840	60.110	52.173	44.556	36.342	33.011	35.866
RLSFRES (% in 1 year)	–33,59	–15,95	13,20	14,60	18,44	9,17	–8,65	–5,46
RLSFRESe (% in 1 year)	–15,4	–39,02	–4,74	–21,91	15,83	11,38	–8,46	33,60
FCAP (US$ million)	29.095	33.968	25.800	30.723	17.319	19.325	27.052	8.810

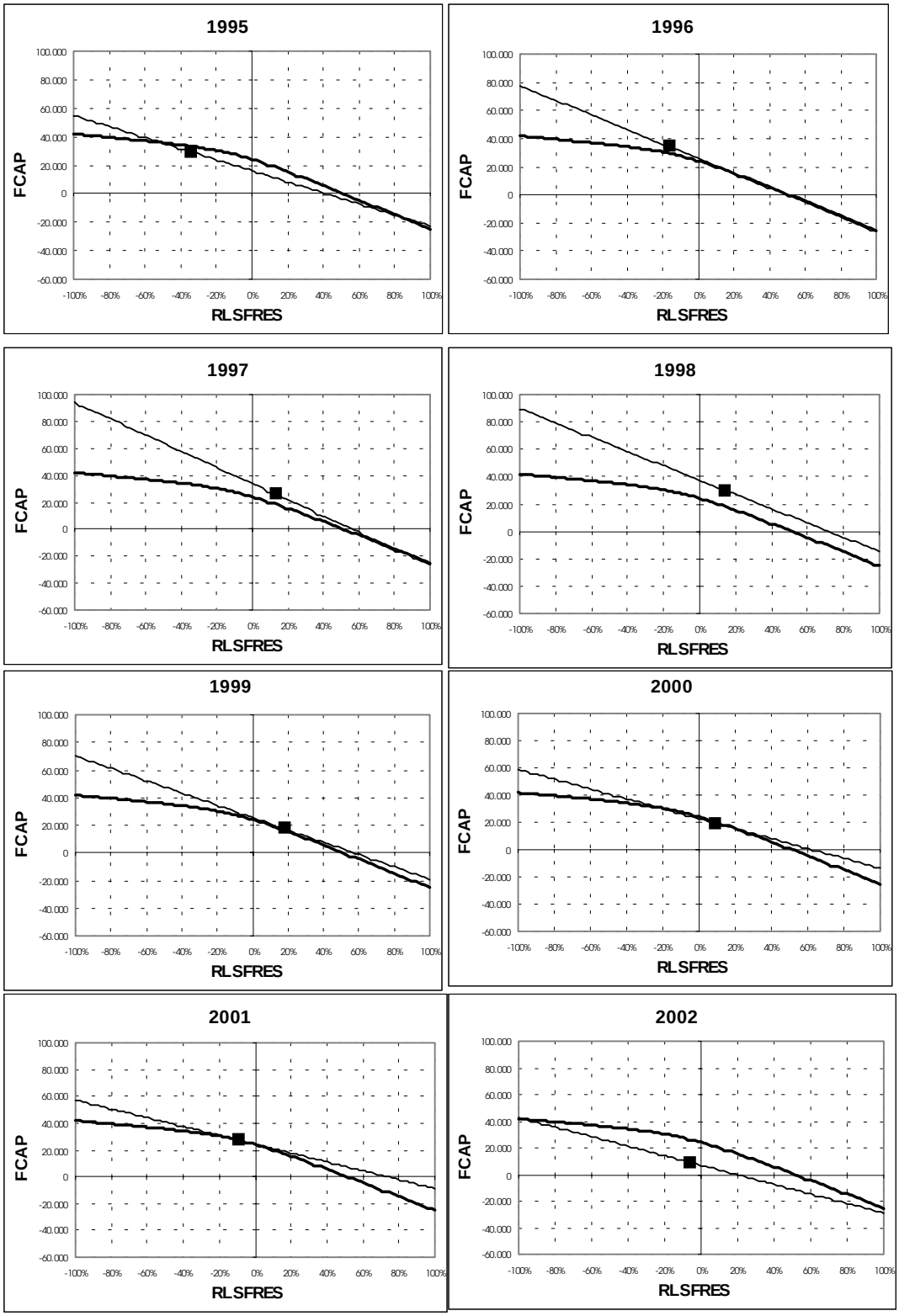
Figure 4 displays the demand schedule and the ex-ante (expected) supply for foreign capital in each year of the sample. The latter is fixed, given the calibration in Appendix A, while the former shifts every year, and has a vertical offset which is equal to the actual $FSAV$ for that year (see equation (2)). In each panel of Figure 4 the temporary equilibrium, characterized by the observed values of (*RLSFRES*, *FCAP*) in the corresponding year, is displayed with the symbol ■.

For 1995 and 1996 the temporary equilibrium was close to the self-fulfilling expectations equilibrium, since they are close to the function *f*. In 1995 the foreign reserves accumulation was slightly larger than expected, while in 1996 it was slightly smaller. In either case, if we take into account the existence of errors in the estimation of *f*, we can say that in those years expectations were fulfilled. Using the same argument, we can also say that in 1997, 1999, 2000 and 2001 expectations were fulfilled.

In the remaining years expectations are not fulfilled. To interpret the graphs for these years, it is important to note that each time the temporary equilibrium is above the foreign capital supply equation, the economy is in worse shape than that expected ex-ante, because that situation implies a larger rate of decrease of foreign reserves, for a given *FCAP*. The opposite occurs if the observation is below the curve *f*.

4. Note that the stability properties of the system depend crucially on concavity assumption of *f*.

FIGURE 4
EQUILIBRIUM SCHEDULES (*FCAP, RLFRES*) OF FOREIGN CAPITAL SUPPLY AND DEMAND



In our base year (1998), the temporary equilibrium is significantly above the curve, characterizing a foreign exchange crisis situation. Further, in that year there is no self-fulfilled expectations equilibrium possible, because there is no intersection between the supply and demand schedules for foreign capital. Due to the international capital markets crisis, the loss of foreign reserves was so significant that it shifted the vertical intercept of the demand schedule above that of the supply schedule.

In 2002, the opposite situation occurred: the realized scenario was more favourable than the expected one. There was a confidence crisis associated with the newly elected president, and a demand for foreign capital smaller than the supply, and the rate of loss of foreign reserves turned out to be smaller than the one expected.

3 THE IMPACT OF TRADE AGREEMENTS

In this section we describe the use of a fairly standard CGE model that is expanded to include de foreign capital flows as modeled in the previous section, to analyze the impact in the domestic economy of the international trade agreements currently under consideration by Brazil. Invoking the small country assumption, we use a static single-country model, and perform a comparative static exercise. Starting from a base year, the policy change is implemented, and the new equilibrium is compared with the initial situation to assess the effect of the policy. As is well known, however, it is necessary that the economy be in equilibrium in the base year for this methodology to be valid.

We used a pre-existing CGE model, that is described in Tourinho and Kume (2002) and is similar to the one described in Robinson, *et al.* (1999), which was calibrated for 1998, and made some adjustments to the base year data to take into account that in that year the foreign sector of the Brazilian economy was not in self-fulfilled expectations equilibrium. We then constructed a hypothetical steady-state scenario for that base year where the foreign capital flow is in self-fulfilling expectations equilibrium, by requiring that it satisfies equation (3').

More specifically, we used the function equation (1) to obtain the expected rate of foreign reserves loss $(RLSFRES^e)$ which is consistent with the flow of foreign capital flow $(FCAP)$ that was actually observed in that year. Recalling that under self-fulfilling expectations equilibrium $RLSFRES = RLSFRES^e$, we use (3′) to calculate the equilibrium level of foreign savings $(FSAV)$ and solve the model with this new value of that variable. The comparison of this hypothetical situation with the actual economy in that year allows us to evaluate the impact of the foreign exchange crisis of 1998 in all the variables of the model.

Using as benchmark this hypothetical economy, we then use the extended model (which includes equation (3)) to evaluate the impact of the international trade agreements that are currently under consideration in Brazil. We do this in the conventional way, by altering the tariffs on imports and the exports subsidies to reflect the impact of the agreements, and examining the new equilibrium.

3.1 THE EQUILIBRIUM IN THE BASE YEAR

In this section we first show that in 1998 the Brazilian economy was not in self-fulfilling expectations equilibrium. We then construct a hypothetical equilibrium for that year which has that property, and is an adequate starting point for the comparative static analysis in the presence of endogenous foreign capital flows.

To check if the Brazilian economy was in a self-fulfilling expectation stable equilibrium in base year we verify if the expected foreign reserve reduction of that year, produced by equation (2), is equal to the actual reduction. Using the adjusted functional form of f given in Appendix A, and substituting the actual values of the foreign savings flow ($FSAV = \text{US\$ } 38,340$ million), of the foreign reserves loss ($LSFRES = \text{US\$ } 7,617$ million) and of reserves in the beginning of 1998 ($FRES = \text{US\$ } 52,173$ million) in equation (3), and solving, we obtain $LSFRES^e = -\text{US\$ } 11,430$ million.[5] We conclude that that the 1998 data has to be adjusted to build a reference self-fulfilling equilibrium scenario.

Using a "prime" to denote the new values of the variables, we note that if expectations had been fulfilled, we would have had $LSFRES' = -\text{US\$ } 11,430$ million, and equation (3') would yield $FSAV' = \text{US\$ } 20,773$ million. Note that, since in this scenario the *expected* loss of foreign reserves is the same as before, the foreign capital flow does not change ($FCAP' = \text{US\$ } 30,723$ million). Graphically, the adjustment to the base year data consists of shifting the current account balance (equation (2)) in Figure 2 down by $FSAV - FSAV' = \text{US\$ } 17,567$ million. The equilibrium scenario can be completed by solving the CGE model for 1998 with $FSAV'$ and $LSFRES'$, and thus obtaining all other variables that characterize the economy.

Table 2 shows the main macroeconomic data for the equilibrium scenario and for the base year. In the first part of the table the data for 1998 are presented as relative deviations from the equilibrium scenario, and in the second as actual values. Observe that in equilibrium there is an accumulation of US$ 11,430 million of reserves, while in 1998 we had a foreign reserves loss of US$ 7,617 million, as discussed before. In 1998, total exports were 12.3% smaller and imports were 13.2% larger than the respective values in the equilibrium scenario.

This would have been possible because the exchange rate in equilibrium would be 1,294 R$/US$, which is 10.7% larger (i.e. more devalued) than the value of 1,163 R$/US$ observed in 1998. The equilibrium deficit in trade of goods and services would have been only US$ 2,124, while the actual deficit was US$ 20,624. As a consequence, in 1998 current account deficit is larger, and the required flow of foreign savings is 98.7% larger than that which would have been observed in equilibrium.

5. A negative value for the foreign reserves loss corresponds to an accumulation. That value indicates that foreign reserves would have been expected to increase in that year, but since they in fact decreased, this means that the Russian crisis and the currency devaluation associated to it produced an unexpected loss of US$ 17,567 million.

TABLE 2
MACROECONOMIC IMPACTS OF THE 1998 CRISIS

	Units (million)	Equilibrium	1998
		Value	(Δ%)
GDP	R$	891,189	1.0
Government deficit	R$	70,904	–5.7
Entrepreneurs saving	R$	59,505	2.8
Households saving	R$	41,843	0.8
Foreign saving (*FSAV*)	US$	19,293	98.7
Total exports	US$	66,255	–12.3
Total imports	US$	68,378	13.2
		Value	Value
Deficit in trade of services	US$	7,647	9,872
Deficit in trade of goods	US$	–5,523	10,747
Deficit in trade of goods and services	US$	2,124	20,619
Foreign reserves loss (*LSFRES*)	US$	–11,430	7,617

Table 3 shows, at the sector level, the deviation of 1998 production, exports and imports from their respective values in the equilibrium scenario The largest negative effects in output appear in "Cars trucks and buses" (–7.2%), "Other vehicles and parts" (–9.2%), "Footwear, leather products" (–24.3%), and "Sugar" (–11.9%), and the largest positive effects are in "Non-Metallic minerals" (8.2%) and Construction (15.0%).

The level of exports in 1998 is smaller than the equilibrium level in all sectors, but the largest reductions are in the same industries for which we observed the largest deviation in output: "Cars trucks and buses" (–19.4%), "Other vehicles and parts" (–21.3%), "Footwear, leather products" (–33.8%), "Sugar" (–23.4%). This suggests that the smaller exports would have been the driving force behind the smaller than equilibrium output in those sectors. However, several other industries with small output deviation have export reductions larger than 10%.

Imports in 1998 were larger than what they would have been in equilibrium. The largest deviations occur in the following sectors: "Agriculture" (22.8%), "Machineries and tractors" (24,6%), "Cars, trucks and buses" (83,5%), "Wood and furniture" (41.3%), "Meat products" (32.6%), "Vegetable oils and fats" (32.4%) and "Other industries" (30.5%).

TABLE 3
SECTOR IMPACTS OF THE 1998 CRISIS

Sectors	Gross output		Imports		Exports	
	Equilibrium (R$ million)	1998 Δ%	Equilibrium (US$ million)	1998 Δ%	Equilibrium (US$ million)	1998 Δ%
Agriculture	113,851	–1.6	2,101	22.8	3,687	–6.7
Minerals	7,827	–4.4	0,323	4.3	4,069	–6.6
Petroleum, natural gas,coal and other fuels	6,081	–4.6	2,666	4.1	0,012	–8.3
Non-metallic minerals	18,943	8.2	0,506	19.0	0,894	–6.6
Iron and steel industry	25,575	–4.4	0,897	1.1	3,973	–14.1
Non-ferrous metals	11,423	–4.8	0,953	18.0	1,879	–10.4
Other metallic products	23,155	0.5	1,372	16.7	1,214	–13.8
Machineries and tractors	27,079	–3.4	6,337	24.6	3,839	–16.3
Electrical machinery and parts	14,779	4.0	3,316	8.0	1,540	–9.6
Electronic equipment	11,633	5.3	7,467	9.5	1,204	–6.9
Cars, trucks and buses	22,130	–7.2	2,182	83.5	4,080	–19.4
Other vehicles and parts	21,560	–9.2	5,351	1.0	6,053	–21.3
Wood and furniture	14,053	0.2	0,269	41.3	1,610	–11.0
Paper products, publishing	24,371	–2.2	1,260	5.2	1,999	–11.2
Rubber industry	7,608	–6.7	0,766	8.7	0,825	–18.4
Chemical elements	15,896	–4.2	1,890	12.3	1,052	–17.1
Refined petroleum and petrochemical industry	56,274	–1.2	5,325	1.7	1,786	–12.9
Other chemical products	21,098	–1.9	2,344	4.9	0,984	–14.3
Pharmacy and perfume products	15,683	0.3	2,496	6.8	0,532	–12.8
Plastic products	10,250	0.2	0,686	13.0	0,288	–12.2
Textiles	18,181	–4.7	1,449	17.1	1,160	–16.6
Wearing apparel	9,486	0.6	0,252	20.2	0,118	–11.9
Footwear, leather products	6,991	–24.3	0,303	-0.3	3,139	–33.8
Coffee	10,592	–6.3	0,002	50.0	2,559	–10.6
Tobacco	24,750	–2.1	0,895	11.5	3,267	–8.3
Meat products	21,679	–1.2	0,215	31.6	1,520	–4.3
Dairy products	9,836	0.1	0,401	21.7	0,022	–13.6
Sugar	8,315	–11.9	0,003	0.0	2,462	–23.4
Vegetable oils and fats	15,333	–4.2	0,340	32.4	2,848	–7.4
Other food products and beverages	32,027	–0.8	1,257	11.3	1,197	–10.4
Other industries	8,546	–4.3	1,444	30.5	0,779	–17.2
Public utilities	39,663	–0.1	0,941	2.0		
Construction	120,203	15.0	0,000	21.4		
Trade	113,675	–0.3	0,839	16.9	0,649	–2.8
Transportation	54,688	–0.3	1,896	16.4	0,445	–2.7
Communication	26,081	0.1	0,161	17.4	0,202	–7.9
Renting services	127,742	0.7	0,005	20.0		
Public administration, defense, education, health	173,006	0.0	1,037	2.1	0,674	–5.3
Other services	232,007	0.0	8,433	18.0	3,695	–2.7
Total	1,522,069	0.2	68,378	14.3	66,255	–13.2

3.2 EFFECTS OF FREE TRADE AGREEMENTS

This subsection analyzes the macroeconomic and sector effects of the international trade agreements which are currently under discussion in Brazil: FTAA, EU and a bilateral agreement ALCA&EU. We use the methodology described in Tourinho and Kume (2002), and perform comparative static exercises where the import tariffs and export prices are changed in order to simulate the effects of the agreements, as summarized in Appendix B.

However, we extend that model to capture the dynamic effects associated with the long-run impact of the agreements on foreign capital flows by introducing two new equations in the model. The first is (3'), discussed in Section 2. The other is a Solow-type steady-state condition, requiring that the aggregate ratio of investment to the capital stock remain constant. This allows us to more properly simulate in a static model the long-run impact of the increase in investment afforded by the agreements.[6]

The implicit assumption is that the economy is in steady-state in the base year, and that the impact of the agreement in investment would induce a proportional change in the aggregate stock of capital. The larger availability of capital would then support a larger level of aggregate production which would, in part, supply the larger investment. Further, capital is allowed to migrate between sectors (i.e. it is assumed to be *putty-putty*), but with the condition that the *relative* marginal return to capital in each sector is maintained equal to that of the base case.

Table 4 describes the effects of the agreements on the main macroeconomic variables, assuming that the country had entered them several years earlier, in such a way that would allow enough time for the Brazilian economy to adjust to the structural changes implied by the agreements,[7] and reach 1998 in self-fulfilling expectations equilibrium regarding the foreign capital flow. The column labelled "Self-fulfilled base equilibrium" shows the variables for scenario described in Subsection 3.1 and each of the other columns shows either the deviation from it, or the actual value, that is expected to occur if the country joins the corresponding agreement.

First we analyse the impact of the agreements on the flow of foreign capital, whose endogenous determination is the main interest in this paper. But before proceeding it is important to recall that the results of the simulations are equilibrium solutions, and as such, those flows are affected by the supply equation (1), but also by the current account balance equation (2). Therefore, it is necessary to resist the temptation to interpret the variations as due to any of these forces in isolation.

6. Rutherford and Tarr (2002) validated the use of a Solow type condition to approximate in a static model the results of the equivalent dynamic equilibrium model. The form of the condition they introduce is, however, different from the one we used. In their model the capital stock adjusts so that the ratio of the rental rate on capital to the cost of producing a unit of the capital good is constant.

7. The number of years necessary for the steady-state equilibrium to consolidate is not determined here. We just assume that sufficient time is allowed for stabilization to occur.

TABLE 4
MACROECONOMIC IMPACTS OF THE FREE TRADE AGREEMENTS

	Units (million)	Self-fulfilled expectations equilibrium	FTAA	EU	FTAA&EU
		Value	Δ	Δ	Δ
GDP	R$	891,189	0.1	0.2	0.2
Exchange rate	R$/US$	1,294	–3.1	–1.6	–4.3
Composite price index		1,068	–0.2	–0.1	–0.3
Government deficit	R$	70,904	4.5	4.9	8.4
Entrepreneur saving	R$	59,505	0.4	0.7	1.1
Household saving	R$	41,843	0.5	0.6	1.0
Foreign saving *(FSAV)*	US$	19,293	17.4	16.8	31.8
Exports of goods and services	US$	66,255	0.1	–0.5	0.1
Imports of goods and services	US$	68,378	4.8	4.2	8.8
		Value	Value	Value	Value
Deficit in trade of services	US$	7,647	8.407	8.119	8.747
Deficit in trade of goods	US$	–5,523	–3.064	–2.828	–0.683
Deficit in trade of goods and services	US$	2,124	5.343	5.291	8.064
Foreign capital flow *(FCAP)*	US$	30,723	27.030	27.215	18.288
Foreign reserves loss *(LSFRES)*	US$	–11,430	-4.376	-4.678	7.148

The last line of Table 4 shows that under FTAA or EU the foreign reserves accumulation (negative loss) and the flow of foreign capital are smaller than in the base case, but the net effect in the flow of foreign savings is positive by 17.4% and 16.8%, respectively. If the country had decided to join both agreements (the FTAA&EU column), the changes indicated by the model for the economy in 1998 are: a decrease in foreign reserves of US$ 7,148 million, an inflow of foreign capital of US$ 18,288 million, and a 31.8% increase of in the flow of foreign savings relative to the base case. The model therefore indicates that FTAA&EU option is the one that has the largest impact in the supply of foreign savings, and therefore on total savings. The larger investment sustains a larger capital stock in the steady-state, and this affords a larger output, and GDP, as can be seen in the first row.

The second line of Table 4 shows that the agreements produce an appreciation of the exchange rate (increase in value of R$ in terms of the US$), and this is responsible, given the Armington specification of the trade-off between domestic production and imports, for an average increase in imports of 4.5% if only one agreement is signed, and 8.8%, if both are signed. Exports, however, are virtually constant, or decrease slightly in all cases. This could be surprising, if one did not recall that capital flows are endogenous, and the exchange rate is flexible. The dominant effect here is the smaller required reserves accumulation (actually, a reduction in the FTAA&EU case) which frees hard currency reserves which can be used to increase imports (and therefore of consumption), without requiring increases of exports. This larger trade deficit is the product-side effect which corresponds to the increase of the availability of foreign savings. This appreciation is, therefore, intimately dependent on our endogenous specification of the capital flows.

The *relative* loss of foreign reserves can be obtained from the last line of Table 4 by dividing by the level of foreign reserves at the beginning of 1998, and used, together with the foreign capital flow line ($FCAP$) to construct Figure 5, that shows the relationship between those variables in these controlled experiments.

FIGURE 5
LSFRES *VERSUS* FCAP IN THE TRADE AGREEMENTS

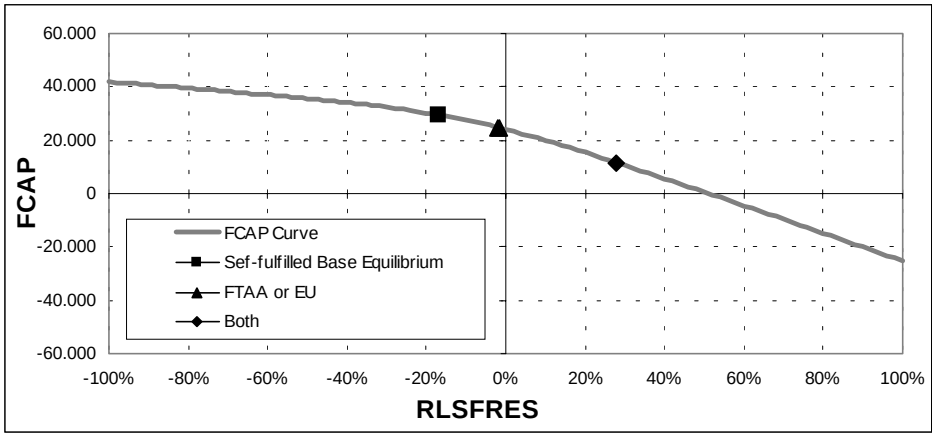


Table 5 shows the effects of the free trade agreements in Production (X), Imports (M) and Exports (E) at the sector level. For each of them we report the base case value and the deviations from it for the equilibrium corresponding to each agreement. In our comments we concentrate on the last set of columns, corresponding to the FTAA&EU agreement, because it is an approximate aggregation of the effects of joining the other two agreements in isolation. The sectors which the largest positive response are: "Footwear, leather products" (increase of 17.2% in production and 26.9% in exports), "Sugar" (increase of 17.5% in production and 31.6% in exports), and "Tobacco" (increase of 6.5% in production and 18.4% in exports). The sectors with the largest losses are: "Machineries and tractors" (reduction of 7.4% in production and 12.5% in exports) and "Other Industries" (reduction of 6.2% in production and 11.7% in exports). It should be noted, however, that the total effect of the FTAA&EU agreement in exports is an increase of only 0.1% relative to the self-fulfilling base equilibrium value. Finally, the sectors with greater increments in imports are: "Machineries and tractors" (18.9%), "Cars, truck and buses" (44.6%), and "Other Industries" (32.3%).

Appendix C reports in Table C1 and C2 the results of simulating the agreements with the conventional CGE model, where the foreign reserves loss and the foreign investment flow are fixed, and equal to the values observed in 1998. By comparing these results with those in Tables 4 and Table 5, we are able to isolate the effects of the introduction in the model of the endogenous determination of the foreign capital flow and the steady-state condition for investment and capital stock (the extended model). The difference between Table 4 (in the text) and Table C1 (in the appendix) is shown in Table 6.

TABLE 5
IMPACTS OF THE FREE TRADE AGREEMENTS AT THE SECTOR LEVEL

Sectors	Gross output (X)				Imports (M)				Exports (E)			
	Base (R$ mil)	FTAA (%)	EU (%)	Both (%)	Base (R$ mil)	FTAA (%)	EU (%)	Both (%)	Base (R$ mil)	FTAA (%)	EU (%)	Both (%)
Agriculture	113.851	0.7	1.1	1.8	2.101	9.4	3.9	12.7	3.687	–0.9	4.5	3.7
Minerals	7.827	–2.9	–1.2	–3.6	0.323	0.0	0.0	0.0	4.069	–3.5	–1.4	–4.4
Petroleum, natural gas, coal and other fuels	6.081	–1.6	–0.8	–2.2	2.666	1.7	0.6	2.2	0.012	0.0	0.0	0.0
Non-metallic minerals	18.943	0.2	0.0	0.3	0.506	2.6	4.5	7.9	0.894	2.6	–2.3	0.7
Iron and steel industry	25.575	–1.7	–1.3	–2.6	0.897	–1.2	–0.4	–1.6	3.973	–0.9	–1.6	–1.8
Non-ferrous metals	11.423	–3.4	–1.5	–4.5	0.953	5.5	3.7	8.8	1.879	–5.1	–1.9	–6.3
Other metallic products	23.155	–1.8	–1.1	–2.7	1.372	6.7	6.5	13.3	1.214	–5.9	–3.3	–8.3
Machineries and tractors	27.079	–3.9	–3.9	–7.4	6.337	8.5	10.1	18.9	3.839	–7.9	–5.9	–12.6
Electrical machinery and apparatus	14.779	–0.2	0.4	0.2	3.316	1.4	1.6	3.0	1.540	–4.1	–1.1	–4.6
Electronic equipment	11.633	0.7	0.6	1.3	7.467	2.5	1.5	3.8	1.204	–2.4	–1.2	–3.1
Cars, trucks and buses	22.130	–3.1	–2.1	–5.2	2.182	17.5	28.8	47.6	4.080	–6.7	–1.2	–7.3
Other vehicles and parts	21.560	–4.1	–0.7	–4.4	5.351	–0.2	0.4	0.2	6.053	–7.9	–0.4	–7.4
Wood and furniture	14.053	–1.0	–0.2	–1.1	0.269	10.4	5.6	15.6	1.610	–4.7	–1.5	–5.6
Paper products, publishing	24.371	–0.5	–0.2	–0.6	1.260	2.7	1.8	4.4	1.999	–3.5	–1.1	–4.1
Rubber industry	7.608	–1.6	–1.9	–3.2	0.766	5.7	4.6	10.3	0.825	–5.3	–3.8	–8.1
Chemical (non-petrochemical) elements	15.896	–1.3	–0.8	–1.9	1.890	5.7	4.3	9.8	1.052	–4.9	–1.6	–5.9
Refined petroleum and petrochemical industry	56.274	–0.2	–0.2	–0.3	5.325	1.1	0.6	1.7	1.786	–3.8	–1.8	–5.0
Other chemical products	21.098	–0.3	–0.1	–0.3	2.344	3.0	2.3	5.2	0.984	–4.2	–2.1	–4.9
Pharmacy and perfume products	15.683	0.3	0.6	0.7	2.496	3.1	3.4	6.3	0.532	–3.9	–1.5	–4.9
Plastic products	10.250	–0.3	–0.2	–0.4	0.686	9.2	1.9	10.8	0.288	–4.2	–2.4	–5.9
Textiles	18.181	1.3	–1.0	0.3	1.449	7.6	6.0	13.3	1.160	8.0	–2.9	5.3
Wearing apparel	9.486	0.9	0.3	1.1	0.252	5.6	3.6	8.7	0.118	10.2	–1.7	8.5
Footwear, leather products	6.991	20.6	–1.1	20.2	0.303	7.6	1.0	8.6	3.139	27.5	–1.7	26.9
Coffee	10.592	–2.2	2.3	0.0	0.002	0.0	0.0	0.0	2.559	–3.7	3.4	–0.1
Tobacco	24.750	3.6	2.6	6.5	0.895	3.2	1.9	4.7	3.267	10.8	7.3	18.4
Meat products	21.679	0.3	1.8	2.0	0.215	9.8	2.8	11.6	1.520	–0.7	5.2	4.5
Dairy products	9.836	0.2	0.4	0.5	0.401	6.2	3.5	9.2	0.022	–4.5	–4.5	–4.5
Sugar	8.315	20.1	–1.8	17.2	0.003	0.0	0.0	0.0	2.462	37.1	–3.9	31.6
Vegetable oils and fats	15.333	–0.5	2.1	1.6	0.340	8.5	1.5	8.8	2.848	–1.1	3.5	2.5
Other food products and beverages	32.027	0.3	0.4	0.6	1.257	3.4	5.5	8.5	1.197	–2.2	–0.8	–2.8
Other industries	8.546	–3.9	–2.4	–6.2	1.444	18.6	12.5	32.3	0.779	–8.2	–4.2	–11.7
Public utilities	39.663	0.0	0.0	0.0	0.941	0.6	0.3	1.0	0.000			
Construction	120.203	0.5	0.6	1.1	0.000	2.1	1.5	3.4	0.000			
Trade	113.675	0.0	0.0	0.1	0.839	10.1	7.7	12.9	0.649	–0.8	–0.5	–1.1
Transportation	54.688	0.0	0.1	0.1	1.896	5.1	2.9	7.4	0.445	–0.7	–0.2	–1.1
Communication	26.081	0.0	0.0	0.0	0.161	14.9	12.4	17.4	0.202	–2.5	–1.5	–3.5
Renting services	127.742	0.4	0.5	0.8	0.005	0.0	0.0	0.0	0.000			
Public admin., defense, education, health	173.006	0.0	0.0	0.0	1.037	1.4	1.1	1.8	0.674	–2.1	–1.3	–3.1
Other services	232.007	–0.2	–0.1	–0.3	8.433	5.5	3.3	8.2	3.695	–1.1	–0.6	–1.7
Total	1,522.069	0.0	0.1	0.1	68.378	4.8	4.2	8.8	66.255	0.1	–0.5	0.1

TABLE 6
DIFFERENCE OF THE IMPACTS OF THE AGREEMENTS IN THE CONVENTIONAL AND THE ENDOGENOUS FOREIGN CAPITAL FLOW MODELS*

	FTAA	EU	FTAA&EU
	(p.p.)	(p.p.)	(p.p.)
GDP	0.17	0.26	0.40
Exchange rate	(2.39)	(2.12)	(3.95)
Composite price index	0.01	0.11	0.12
Government deficit	(2.29)	(2.97)	(6.67)
Entrepreneur saving	0.43	0.62	1.02
Household saving	0.02	0.04	(0.11)
Foreign saving (FSAV)	17.42	16.81	31.84
Exports	(2.42)	(2.66)	(4.71)
Imports	2.99	2.49	5.28

Notes: * Table 4 minus Table C1. + p.p. = percentage points.

The sixth line of Table 6 shows that in the extended model the relative impact of each of the foreign trade agreements on the foreign savings is approximately 17 percentage points (p.p.) larger than that in the conventional model (where it is virtually null). The combined effect of both agreements is 32 p.p. This produces a steady-state GDP in the extended model which is larger than that of the conventional model by between 0.2 p.p. and 0.4 p.p. (first line of Table 6). The exchange rate in the extended model is also smaller by between 2.4 p.p. and 4.0 p.p., an effect which implies positive a welfare effect of the endogenous capital flows, since the domestic output at international prices increases proportionately. The larger appreciation of the exchange rate in the extended model implies that the impact of the agreements on the volume of foreign trade is quite different from that in the conventional model. The relative impact on exports is negative by 2.4 p.p. and 2.6 p.p. for FTAA and EU respectively, and 4.7 p.p. for FTAA & EU together. On the other hand, the relative impact on imports is positive, and equal to 3.0 p.p., 2.5 p.p. and 5.3 p.p., respectively in those three situations.

4 CONCLUSIONS

In this paper we evaluate the impacts of free trade agreements in the Brazilian economy using a static CGE model that, nevertheless, takes into consideration one type of dynamic effect: endogenous foreign capital flows. We do this by relating these flows to the level of foreign reserves of the country, using as motivation the idea that for the foreign investors the reserves are analogous to collateral guarantee to an their investment.

We uncover an empirical relation between the expected relative loss of foreign reserves and the foreign capital flow, in self-fulfilling expectations equilibriums, and incorporate this relation in the CGE model. To perform the comparative static analysis of the foreign trade agreements we have to start from a base case where the

economy can be assumed to be in equilibrium. We verify that the base year of our original model (1998) is not a self-fulfilling expectations equilibrium of the foreign capital flow, and adjust it to correct for this. The static model thus recalibrated is then used to evaluate the impact of the agreements, under the small country assumption. Nevertheless, some of the requirements of the dynamic equilibrium are considered via a steady-state condition that links the capital stock to the flow of investment.

The results of the comparative static analysis in this model with endogenous capital flow and a steady state condition are quite different from those in a conventional model that does not have these features. The model with endogenous capital flows displays significant increases in foreign savings inflow to country, and that sustains a larger impact of the agreements on GDP (in US$). The impact of the agreements is of the order of 4% in the volume of imports and exports in conventional model. In the model with endogenous capital flows the domestic currency appreciation eliminates that impact in exports, and almost triples it for imports.

APPENDIX A

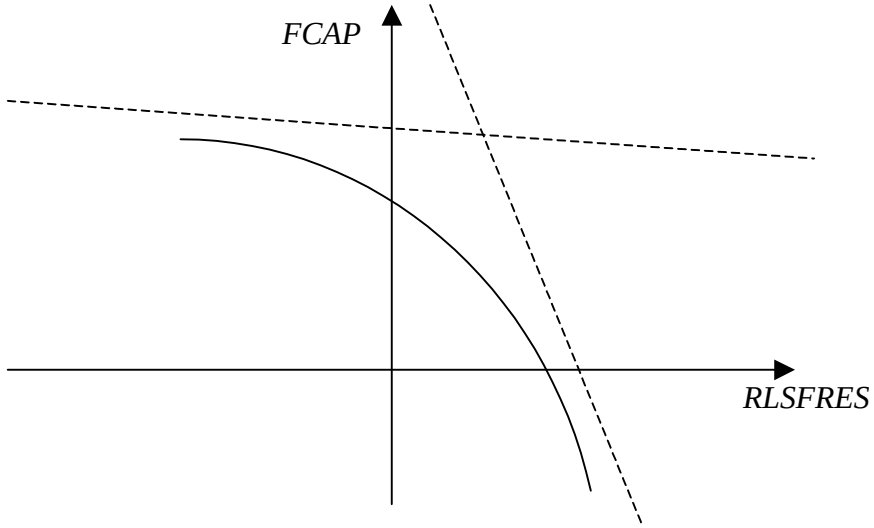
In this appendix we estimate the equation for the supply of foreign capital, represented by equation (1), that relates the foreign capital flow $(FCAP)$ to the rate of expected decrease in foreign reserves $(RLSFRES^e)$. There are two issues that have to be considered in estimating this equation. One is that latter is not observed. The other is that the data corresponds to the reduced-form equilibrium equation (3).

First, in the periods were there are self-fulfilling expectations, that correspond to normal, or non-crisis periods, we can use the observed $RLSFRES$ to substitute for $RLSFRES^e$. If we assume that in crisis periods, which correspond to points joined by dotted lines in Figure 2, the errors in (A1) are symmetric and well-behaved, the equation can be calibrated using all the points in the data base.

Second, there is the issue of identification. This is a classic case of estimation a supply-demand equilibrium that, in general, would have required a simultaneous equation estimation approach. However, we assume that the supply function for foreign capital is identified by the stochastic term of the current account, validating the use of the single equation estimation method.

We have also assumed a hyperbolic functional form for *f*, with axes which are not restricted to the coordinate system axis, as shown in Figure A1, and specified in (A1).

FIGURE A1
SHAPE OF THE FOREIGN CAPITAL FLOW SCHEDULE



$$f(RLSFRES^e) = a_1 + a_2 \bullet RLSFRES^e - \sqrt{a_3 \bullet (RLSFRES^e)^2 + a_4 \bullet RLSFRES^e + a_5} \quad \text{(A1)}$$

Equation (A1) was calibrated using a maximum likelihood-type criterion function, for the data in Table A2, yielding the parameters in Table A1, yielding an $R^2 = 0.954$.

TABLE A1
CALIBRATED PARAMETERS OF THE FOREIGN CAPITAL SUPPLY EQUATION (A1)

Parameter	a1	a2	a3	a4	a5
value	30,156.63	–31,617.77	444,353,086	82,383,062	37,179,389

TABLE A2
DATA FOR ESTIMATION THE ESTIMATION OF THE PARAMETERS OF EQUATION A1

Date	RLSFRES (%)	FCAP (US$ mill)	Date	RLSFRES (%)	FCAP (US$ mill)
Dec/1995	–33.59	29095.4			
Jan/1996	–39.87	31547	Jan/2000	–3.94	26217
Feb/1996	–46.83	33995.3	Feb/2000	–8.20	27728.1
Mar/1996	–65.23	37622.4	Mar/2000	–15.81	30856.7
Apr/1996	–78.03	39836.8	Apr/2000	35.19	10019.2
May/1996	–76.08	40312.1	May/2000	35.52	8978.1
Jun/1996	–79.03	40441.1	Jun/2000	31.64	10103.8
Jul/1996	–42.32	33979.9	Jul/2000	30.70	8888.2
Aug/1996	–25.14	29051.1	Aug/2000	25.13	11930.8
Sep/1996	–20.66	28371	Sep/2000	26.15	11625.6
Oct/1996	–17.92	31078.5	Oct/2000	24.12	14205.9
Nov/1996	–17.98	32579.9	Nov/2000	22.86	14451.5
Dec/1996	–15.95	33968	Dec/2000	9.17	19325.6
Jan/1997	–10.11	30352.3	Jan/2001	5.22	20702.2

(cont.)

(cont.)

Date	RLSFRES (%)	FCAP (US$ mill)	Date	RLSFRES (%)	FCAP (US$ mill)
Feb/1997	–6.47	30071.8	Feb/2001	7.69	20037.2
Mar/1997	–5.79	30448.5	Mar/2001	12.23	18858
Apr/1997	1.05	29346	Apr/2001	–20.65	29615.1
May/1997	0.19	31208.3	May/2001	–24.11	31931
Jun/1997	3.97	30463.1	Jun/2001	–32.03	33773.8
Jul/1997	–1.36	32849.5	Jul/2001	–21.70	32396.7
Aug/1997	–5.72	36593.8	Aug/2001	–15.66	29871.2
Sep/1997	–5.37	36637.3	Sep/2001	–27.43	33864
Oct/1997	8.38	27336.7	Oct/2001	–23.36	31358.9
Nov/1997	13.95	25513.1	Nov/2001	–14.45	28891.9
Dec/1997	13.20	25800.3	Dec/2001	–8.65	27052
Jan/1998	9.92	30811.6	Jan/2002	–1.60	23804.5
Feb/1998	1.05	33671	Feb/2002	–1.39	23622.4
Mar/1998	–16.30	44165.8	Mar/2002	–6.73	23983.5
Apr/1998	–32.91	52872.1	Apr/2002	4.75	18929.2
May/1998	–22.85	48947.2	May/2002	7.25	17292.6
Jun/1998	–23.05	49261.7	Jun/2002	–12.54	23772.6
Jul/1998	–16.37	44233.8	Jul/2002	–9.87	21758.5
Aug/1998	–6.78	39558	Aug/2002	–3.70	17410
Sep/1998	26.03	21847.4	Sep/2002	4.18	11872.7
Oct/1998	21.06	28235.6	Oct/2002	4.37	9423.2
Nov/1998	20.84	27455.9	Nov/2002	4.41	7318.2
Dec/1998	14.60	29701.6	Dec/2002	–5.46	8810.9
Jan/1999	31.95	19642.3	Jan/2003	–7.20	7656.6
Feb/1999	39.68	13741.5	Feb/2003	–7.31	5919.1
Mar/1999	50.65	1036.2	Mar/2003	–15.29	7415.8
Apr/1999	40.64	3837.3			
May/1999	39.16	4419.8			
Jun/1999	41.68	3357.4			
Jul/1999	39.96	6774.7			
Ago/1999	37.75	7597			
Sep/1999	7.09	26040.5			
Oct/1999	5.50	23917.7			
Nov/1999	–2.39	25950.9			
Dec/1999	18.44	17319.2			

APPENDIX B

Table B1 shows the import taxes and export price increases used in Tourinho and Kume (2002) to simulate the effects of international trade agreements that are under consideration currently in Brazil.

TABLE B1
IMPORT TAXES AND EXPORT PRICE VARIATIONS OF TRADE AGREEMENTS

Sectors	FTAA		EU		FTAA&EU	
	Import tariff (%)	Price change (%)	Import tariff (%)	Price change (%)	Import tariff (%)	Price change (%)
Agriculture	1.88		2.64	8.50	1.88	8.50
Minerals	2.73		2.73	0.71	2.73	0.71
Petroleum, natural gas, coal and other fuels	6.03		6.74		6.03	
Non-metallic minerals	9.71	5.24	5.6		4.32	5.24
Iron and steel industry	7.43	3.92	4.82	1.26	4.82	5.18
Non-ferrous metals	5.49		5.37	0.85	3.67	0.85
Other metallic products	8.31		7.39		3.5	
Machineries and tractors	8.08		4.92	0.11	2.27	0.11
Electrical machinery and apparatus	9.3		7.98	0.26	4.47	0.26
Electronic equipment	4.93		6.9		3.49	
Cars. trucks and buses	10.19		5.15	1.71	5.15	1.71
Other vehicles and parts	5.36		3.96	1.55	1.32	1.55
Wood and furniture	13.19		13.19	0.67	13.19	0.67
Paper products. publishing	3.07		2.94	0.86	1.47	0.86
Rubber industry	8.83		7.54		5.05	
Chemical (non-petrochemical) elements	4.38		4.19	0.96	1.95	0.96
Refined petroleum and petrochemical industry	5.71		6.13	0.21	4.39	0.21
Other chemical products	6.57		6.46	0.49	3.96	0.49
Pharmacy and perfume products	5.59		3.67		1.95	
Plastic products	9.05		14.44		9.05	
Textiles	9.2	7.77	8.61		7.02	7.77
Wearing apparel	18.06	10.04	18.06		18.06	10.04
Footwear. leather products	12.03	7.46	12.03	1.33	12.03	8.8
Coffee	8.82		8.82	4.22	8.82	4.22
Tobacco	4.25	15.36	4.25	9.24	4.25	24.6
Meat products	3.77		3.77	13.32	3.77	13.32
Dairy products	6.99	1.35	6.99		6.99	1.35
Sugar	5.71	13.47	5.71		5.71	13.47
Vegetable oils and fats	4.03	1.33	4.03	6	4.03	7.33
Other food products and beverages	9.02		5.33		5.33	
Other industries	8.24		9.3	0.4	4.26	0.4

APPENDIX C

In this appendix we report the results of simulating the agreements with the version of the CGE model where the foreign reserves loss and the foreign investment flow are fixed, and equal to the values observed in 1998. By comparing these results with those in the text, we are able to isolate the effects of the introduction in the model of the endogenous determination of the foreign capital flow and the steady-state condition for investment and capital stock. The difference between Table 4 (in the text) for the model with endogenous capital flows, and Table C1 is shown in Table C2.

TABLE C1
MACROECONOMIC IMPACTS OF TRADE AGREEMENTS IN CONVENTIONAL MODEL

	Units (million)	Equilibrium	FTAA	EU	FTAA&EU
		Value	(%)	(%)	(%)
GDP	R$	899,810	–0.1	–0.1	–0.2
Exchange rate	R$/US$	1,163	–0.7	0.5	–0.3
Composite price index		1,067	–0.2	–0.2	–0.4
Government deficit	R$	66,853	6.8	7.9	15.1
Entrepreneur saving	R$	61,147	0.0	0.1	0.1
Household saving	R$	42,185	0.5	0.6	1.1
Foreign saving (*FSAV*)	US$	38,340	0.0	0.0	0.0
Exports	US$	57,509	2.5	2.2	4.8
Imports	US$	78,130	1.8	1.7	3.5
		Value	Value	Value	Value
Deficit in trade of services	US$	9,872	9,872	9,885	9,881
Deficit in trade of goods	US$	10,749	10,19	10,727	10,453
Deficit in trade of goods and services	US$	20,621	20,594	20,652	20,622

Table C2 describes the impacts of the free trade agreements in the conventional model.

TABLE C2
IMPACTS OF THE FREE TRADE AGREEMENTS AT THE SECTOR LEVEL IN THE CONVENTIONAL MODEL

Sectors	Gross product (X)				Imports (M)				Exports (E)			
	Base	FTAA	EU	Both	Base	FTAA	EU	Both	Base	FTAA	EU	Both
	(R$ mil)	(%)	(%)	(%)	(US$ mil)	(%)	(%)	(%)	(US$ mil)	(%)	%	%
Agriculture	111.996	1.0	1.4	2.4	2.580	4.1	–0.3	4.0	3.440	0.6	5.9	6.5
Minerals	7.478	–1.3	–0.4	–1.8	0.337	–0.9	–1.2	–2.1	3.800	–1.4	–0.2	–1.8
Petroleum, natural gas, coal and other fuels	5.801	–0.4	0.1	–0.4	2.774	0.7	–0.3	0.5	0.011	0.0	0.0	0.0
Non-metallic minerals	20.493	–1.3	–1.7	–3.1	0.602	–1.0	0.8	0.5	0.835	4.7	–1.1	3.2
Iron and steel industry	24.460	–0.4	–0.8	–1.3	0.907	–1.2	–1.0	–2.2	3.411	2.9	1.1	3.8
Non-ferrous metals	10.869	–1.8	–0.7	–2.6	1.125	1.6	0.0	1.6	1.684	–2.1	0.2	–2.1

(cont.)

(cont.)

Sectors	Gross product (X)				Imports (M)				Exports (E)			
	Base	FTAA	EU	Both	Base	FTAA	EU	Both	Base	FTAA	EU	Both
	(R$ mil)	(%)	(%)	(%)	(US$ mil)	(%)	(%)	(%)	(US$ mil)	(%)	(%)	(%)
Other metallic products	23.272	–1.5	–1.3	–3.0	1.601	3.2	2.9	6.4	1.046	–2.2	–0.6	–3.0
Machineries and tractors	26.157	–2.8	–3.5	–6.5	7.893	3.0	5.0	8.3	3.214	–3.7	–2.7	–6.6
Electrical machinery and apparatus	15.364	–0.7	–0.4	–1.2	3.580	–0.1	0.0	–0.1	1.392	–1.4	0.9	–0.6
Electronic equipment	12.255	–0.1	–0.4	–0.7	8.179	0.6	–0.4	0.2	1.121	–0.4	0.4	–0.3
Cars, trucks and buses	20.539	–1.2	–2.2	–3.5	4.003	1.3	13.1	14.8	3.289	–1.6	1.6	–0.3
Other vehicles and parts	19.575	–1.2	0.5	–0.8	5.406	–0.1	–0.2	–0.4	4.761	–1.7	3.8	1.7
Wood and furniture	14.082	–0.7	–0.2	–1.0	0.380	2.1	–1.3	0.8	1.433	–1.7	0.9	–0.9
Paper products. publishing	23.825	0.1	0.3	0.4	1.325	1.4	0.8	2.3	1.776	–0.7	1.4	0.6
Rubber industry	7.100	–0.3	–0.7	–1.0	0.833	3.2	2.6	6.1	0.673	–0.9	0.1	–0.9
Chemical (non-petrochemical) elements	15.230	–0.3	0.1	–0.3	2.123	2.9	1.8	4.9	0.872	–0.8	2.2	1.3
Refined petroleum and petrochemical industry	55.584	0.0	0.1	0.1	5.418	0.6	0.2	0.9	1.556	–0.7	1.0	0.2
Other chemical products	20.689	0.0	0.2	0.3	2.460	1.7	1.3	3.0	0.843	–0.7	0.9	0.9
Pharmacy and perfume products	15.736	0.4	0.6	1.1	2.665	1.8	2.2	4.1	0.464	–0.4	1.3	0.9
Plastic products	10.271	–0.6	–0.3	–0.9	0.775	5.8	–0.8	5.0	0.253	–1.6	0.4	–1.2
Textiles	17.325	1.9	0.1	2.0	1.697	3.6	2.7	6.5	0.968	12.1	0.8	13.0
Wearing apparel	9.543	0.9	0.3	1.3	0.303	1.7	0.0	1.7	0.104	13.5	1.0	14.4
Footwear. leather products	5.293	17.6	4.1	23.8	0.302	5.0	1.0	6.6	2.077	27.8	6.4	37.3
Coffee	9.920	–0.3	3.2	2.8	0.003	0.0	0.0	0.0	2.288	–0.7	5.3	4.5
Tobacco	24.222	3.8	2.9	7.1	0.998	0.9	–0.1	0.8	2.997	12.7	8.9	22.2
Meat products	21.424	0.6	2.0	2.5	0.283	2.8	–2.5	0.7	1.455	0.3	6.0	6.4
Dairy products	9.845	0.4	0.5	0.9	0.488	1.6	–0.4	1.4	0.019	0.0	0.0	0.0
Sugar	7.326	16.3	1.1	17.9	0.003	0.0	0.0	0.0	1.885	36.6	1.9	39.5
Vegetable oils and fats	14.691	0.6	2.8	3.4	0.450	1.8	–3.8	–1.8	2.638	0.9	4.9	5.8
Other food products and beverages	31.768	0.6	0.7	1.3	1.399	1.0	3.4	4.4	1.073	0.4	1.4	1.8
Other industries	8.179	–2.9	–1.6	–4.7	1.884	11.1	6.3	18.6	0.645	–3.9	–0.6	–4.8
Public utilities	39.617	0.1	0.1	0.2	0.960	0.3	0.0	0.3				
Construction	138.259	–2.3	–2.3	–4.8	8.6E–05	–1.9	–2.6	–4.6				
Trade	113.307	0.1	0.1	0.2	0.981	6.2	4.4	6.2	0.631	–0.2	0.0	–0.2
Transportation	54.510	0.1	0.2	0.3	2.206	1.5	–0.2	1.4	0.433	–0.2	0.2	0.0
Communication	26.098	0.1	0.1	0.2	0.189	10.6	9.0	10.6	0.186	–0.5	0.5	0.0
Renting services	128.693	0.4	0.5	0.9	0.006	0.0	0.0	0.0				
Public admin. defense. education. health	172.94	0.0	0.0	0.0	1.059	0.9	0.7	0.9	0.638	–0.8	–0.2	–0.9
Other services	231.982	–0.1	0.0	–0.1	9.955	1.6	–0.1	1.5	3.596	–0.3	0.1	–0.3
Total	1525.717	0.0	0.0	–0.1	78.130	1.8	1.7	3.5	57.509	2.5	2.2	4.8

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