Journal of Applied Economics, Vol. II, No. 2 (Nov 1999), 211-245

WHY GOVERNMENTS IMPLEMENT TEMPORARY STABILIZATION PROGRAMS

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This paper provides a political economy explanation for temporary exchange-rate-based stabilization programs (where the exchange rate is used as a nominal anchor) and their optimal duration by focusing on the distributive effects of real exchange rate appreciation. In a small-open-economy model, a temporary reduction in the devaluation rate leads to a reduction in the nominal interest rate and to a temporary appreciation of the real exchange rate. Owners of tradable-goods are hurt, while for reasonable parameter values, the owners of non-traded goods' welfare improves.

JEL classification code: E6, F31, F41.
Key words: temporary policies, exchange-rate-based stabilization programs, real exchange-rate appreciation.

I. Introduction

This paper examines a political economy explanation for why governments undertake policies that are presumed not to be sustainable in the long run. In particular, it explains temporary exchanged-rate-based stabilization programs (where the exchange rate is used as a nominal anchor) in Latin America by focusing on the distributive effects of real exchange rate appreciation.

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Latin American countries have recurrently dealt with inflationary problems. Argentina, Bolivia, Brazil, Chile, Ecuador, Mexico, Peru and Uruguay have all suffered from “chronic” inflation episodes in the second half of this century as can be observed in Table 1.a.[1]

A variety of approaches have been used to try to reduce inflation. The literature tends to classify them under money-based programs (those that rely on restrictions on monetary expansion) and exchange-rate-based ones (where exchange rate pegging is used to provide a nominal anchor). The latter programs have been characterized by an initial expansion of economic activity and by large exchange-rate appreciations (Calvo and Vegh, 1997). Additionally, the elimination of large public sector deficits has proven to be a necessary condition for their success. Programs where fiscal adjustment has been either partial or absent have failed. Latin American governments have often followed stabilization policies that, due to the lack of fiscal adjustment and credibility, were recognized to be unfeasible in the long run.

From a representative agent’s point of view, temporary policies are not necessarily welfare improving because they distort intertemporal choices (Calvo, 1987). Heterogeneity in the population and the distributive consequences of policies are crucial to understanding why temporary policies are implemented. Previous literature has already proposed that distributive issues are an important factor for understanding stabilization policies. In Alesina-Drazen (1991), the process leading to stabilization is described as a war of attrition between different socioeconomic groups. Each group waits for another group to give in. The most anxious group will give in and adjustment takes place, thus explaining delays in stabilization.

In contrast, the focus of this paper is to comprehend the rationale behind short-lived stabilization programs, policies that are ex-ante known to be

[1] Israel has experienced inflation rates of over 20% from 1950 to 1954 and from 1974 to 1986 (this last period can also be classified as a “chronic inflation” one). Israel pursued an exchange-rate-based stabilization program in July of 1985.

Table 1.a. Percent Changes in Consumer Prices: Selected Countries

	Argentina	Bolivia	Chile	Brazil	Mexico	Peru	Uruguay
1960	27.3	11.5	11.6	**29.5**	4.9	8.7	38.5
1961	13.4	7.6	7.7	**33.4**	1.6	5.9	22.7
1962	**28.3**	5.9	14.0	**51.8**	1.2	6.6	10.9
1963	**23.9**	-0.7	44.1	**70.1**	0.6	6.1	21.3
1964	**22.2**	10.2	46.0	**91.9**	2.3	9.8	**42.4**
1965	**28.6**	2.9	28.8	**65.7**	3.6	16.4	**56.6**
1966	**31.9**	7.0	23.1	**41.3**	4.2	8.8	**73.5**
1967	**29.2**	11.2	18.8	**30.5**	3.0	9.8	**89.3**
1968	16.2	5.5	**26.3**	**22.0**	2.3	19.1	**125.3**
1969	7.6	2.2	**30.4**	**22.7**	3.4	6.2	21.0
1970	13.6	4.0	**32.5**	**22.4**	5.2	5.0	16.3
1971	**34.7**	3.7	**20.0**	**20.1**	5.3	6.8	24.0
1972	**58.4**	6.5	**74.8**	16.6	5.0	7.2	**76.5**
1973	**61.2**	31.5	**361.5**	12.7	12.0	9.5	**97.0**
1974	**23.5**	62.8	**504.7**	**27.6**	23.8	16.9	**77.2**
1975	**182.9**	8.0	**374.7**	**29.0**	15.2	23.6	**81.4**
1976	**444.0**	4.5	**211.8**	**42.0**	15.8	**33.5**	**50.6**
1977	**176.0**	8.1	**91.9**	**43.7**	29.0	**38.1**	**58.2**
1978	**175.5**	10.4	**40.1**	**38.7**	17.5	**57.8**	**44.5**
1979	**159.5**	19.7	**33.4**	**52.7**	18.2	**66.7**	**66.8**
1980	**100.8**	**47.2**	**35.1**	**82.8**	**26.4**	**59.1**	**63.5**
1981	**104.5**	**32.1**	19.7	**105.6**	**27.9**	**75.4**	**34.0**
1982	**164.8**	**123.5**	9.9	**97.8**	**58.9**	**64.4**	19.0
1983	**343.8**	**275.6**	27.3	**133.2**	**101.8**	**111.2**	**49.2**
1984	**626.7**	**1281.3**	19.9	**188.8**	**65.5**	**110.2**	**55.3**
1985	**672.2**	**11749.6**	30.7	**224.6**	**57.7**	**163.4**	**72.2**
1986	**90.1**	**276.3**	19.5	**147.1**	**86.2**	**77.9**	**76.4**
1987	**131.3**	14.6	19.9	**228.3**	**131.8**	**85.8**	**63.6**
1988	**343.0**	16.0	14.7	**629.1**	**114.2**	**667.0**	**62.2**
1989	**3079.8**	15.2	17.0	**1430.7**	**20.0**	**3398.7**	**80.4**
1990	**2314.0**	17.1	26.0	**2947.7**	**26.7**	**7481.7**	**112.5**
1991	**171.7**	21.4	21.8	**432.8**	**22.7**	**409.5**	**102.0**
1992	**24.9**	12.1	15.4	**951.6**	15.5	**73.5**	**68.5**
1993	10.6	8.5	12.7	**1928.0**	9.8	**48.6**	**54.1**
1994	4.2	7.9	11.4	**2037.8**	7.0	23.7	**44.7**
1995	3.4	10.2	8.2	**66.0**	35.0	11.1	**42.2**
1996	0.2	12.4	7.4	15.8	34.4	11.5	**28.3**
1997	0.5	4.7	6.1	6.9	20.6	8.6	19.8

Chronic Inflation: Annual inflation of 20% or more for at least five consecutive years.
Source: IMF Financial Statistics

unfeasible in the long run. For that, I will study the distributive consequences of real exchange rate changes.

I propose a small-open-economy model where agents differ in their endowment. One type is endowed with tradable goods and the other one with non-tradables. A temporary stabilization program is modeled as temporary reduction in the devaluation rate, which leads to a reduction in the nominal interest rate. Under a cash-in-advance assumption, lower nominal interest rates reduce the effective price of today's consumption relative to the future one and induce a consumption boom accompanied by an appreciation of the real exchange rate (price of tradable goods in terms of non-tradables). This hurts the tradable goods' owners. The owners of non-tradable goods have to weight two opposite effects: a positive wealth effect (a real appreciation increases the present value of non-tradable goods wealth) and a negative intertemporal substitution effect. We find that for reasonable parameter values, the owners of non-traded goods are better off when facing a transitory reduction in the devaluation rate.

This paper is organized as follows: first, we review the main stylized facts that characterize the periods surrounding exchange-rate-stabilization programs and briefly comment about Argentina's and Mexico's experience with inflation. The next section describes the model using a representative agent setup while Section IV extends it to allow for heterogeneous agents. The last section concludes.

II. Temporary Exchange-Rate Based Stabilization Programs: Stylized Facts

During the past 35 years, there have been 11 major exchange-rate-based stabilization programs in Argentina, Brazil, Chile, Mexico and Uruguay, of which most have failed and ended in balance of payment crises. Table 2 summarizes the main features of 11 major exchange-rate-based stabilization programs observed in Latin America since the 60's (Calvo and Vegh, 1999).

Table 2. Exchange Rate Stabilization Programs in Latin America

Program	**Beginning-Ending Dates**	**Exchange Rate Arrangement**	**Did Program end in Crises?**
Brazil, 1964	03/1964 - 08/1968	Fixed Exchange Rate with periodic devaluations	No
Argentina, 1967	03/1967 - 05/1970	Fixed Exchange Rate	Yes
Uruguay, 1968	06/1968 - 12/1971	Fixed Exchange Rate	Yes
Chilean Tablita	02/1978 - 06/1982	Pre-announced crawling peg (02/978-06/1979) Fixed Exchange Rate	Yes
Uruguayan Tablita	10/1978 - 11/1982	Pre-announced crawling peg	Yes
Argentine Tablita	12/1978 - 11/1981	Pre-announced crawling peg	Yes
Austral (Arg.)	06/1985 - 09/1986	Fixed Exchange Rate (06/1985-03/1986) Pre-announced crawling peg	Yes
Cruzado (Brazil)	02/1986 - 11/1987	Fixed Exchange Rate	Yes
Mexico 1987	12/1987 - 12/1994	Fixed Exchange Rate (02/1988-12/1988) Pre-announced crawling peg (01/1989-11/191) Exchange rate band	Yes
Uruguay 1990	12/1990-Present	Exchange rate band with declining rate of devaluation	No
Convertibility (Arg.)	04/1991-Present	Currency board 1-1 parity	No

Additionally, there have been money based stabilization programs in Chile (1975-1977), Argentina (1989-1991) and Brazil (1990-1991).
Source: Calvo and Vegh (1998).

These programs have been characterized by a slow convergence of inflation to the devaluation rate, due partially to an initial boom in consumption and an expansion of economic activity. The slow convergence in the inflation rate led to a large exchange rate appreciation and deterioration of the external accounts. Later, contraction in the real activity “kicked in” even before the program had collapsed. Eight out of the eleven exchange-rate-based stabilization programs observed in Latin America ended in balance of payment crisis and large international reserve losses. It is important to notice that programs where fiscal adjustment was either partial or absent failed. Successful programs exhibited large fiscal adjustments.

Stabilization programs in Latin America have been widely studied by Calvo (1986) and Calvo and Vegh (1993). One of their crucial conclusions is that the boom in consumption takes place if and only if agents believe the stabilization program to be temporary, because government policies fail to be credible or not sustainable. An evidence of the lack of credibility is provided by the sustained high differentials between domestic and international interest rates observed in most stabilization programs.

Describing the stabilization experience in Israel, Bruno and Piterman (1988) comment:

“firms and workers apparently did not expect price stability to last. Both firms and workers expected devaluation and a renewal of the inflation and therefore they set nominal wage increases at excessively high levels. It could reasonably be assumed, on the basis of more than a decade of experience on this regard, that the government could not be able to resist for long the pressure of exporters and of potential unemployment for devaluation… The currency was in effect devalued in January 1987.”

The “lack of credibility” assumption, however, raises a very important question: Why would a rational government carry out a stabilization policy that every one expects not to be sustainable in the long run? In this paper, we propose that some groups within the economy are benefiting from these temporary policies and therefore they will try to favor it. In particular, agents whose income derives primarily from tradable resources will be hurt by an exchange rate appreciation. Owners of non-tradable goods might benefit from higher purchasing power and favor even a temporary stabilization policy.

A. Coping with Inflation: The Argentine Experience

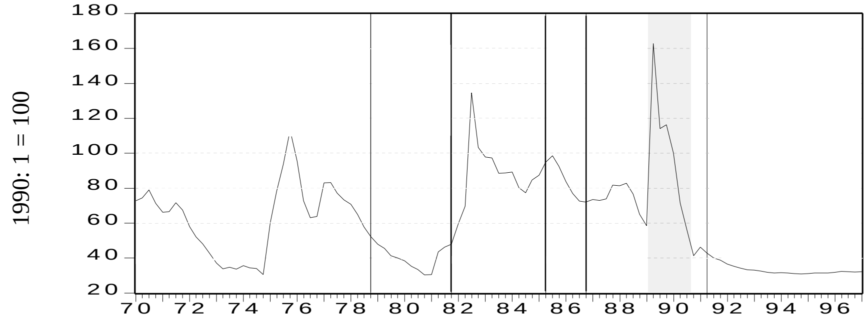
In the last 20 years, Argentina has implemented four major stabilization programs. The 1978 "Tablita" program, the "Heteredox" program in the mid-eighties and the 1991 "Convertability" one, all used the exchange rate to provide a nominal anchor to the economy. On the other hand, the 1989 stabilization program relied on restrictions to the rate of monetary creation. In the case of Argentina, all but the latest stabilization program ("Convertibility") have ended in crises and high international reserve losses and failed to bring inflation down to sustainable levels.

Graph 1 plots Argentina's real exchange rate since 1970. The stabilization periods have been highlighted. In all exchange-rate base programs we can observe sharp real appreciations. For example, in the "Tablita" program, at its peak, the real exchange rate appreciated around 60% from December's 1977 level. In the "Heterodox" program, peak appreciation was 30% from June 1985 level. The appreciation of the real exchange rate has been accompanied by a deterioration of the external accounts as observed in graph 2. Both graph 3, which plot real product growth together with real consumption growth and graph 4, which compares the real consumption series to its Hodrick-Prescott's trend, allow us to observe the consumption boom that has been known to characterize most exchange-rate base programs.

As expressed by Bordo and Vegh (1995):

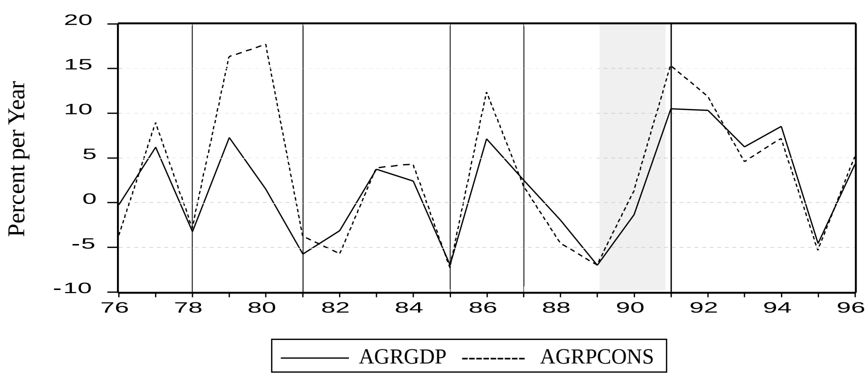
"Up until the 1991 Convertibility plan, Argentina provided a consummate example of a chronic inflation country. In the twentieth century, it experienced chronic inflation since the early 1950s in spite of repeated

Graph 1. Argentina: Real Exchange Rate

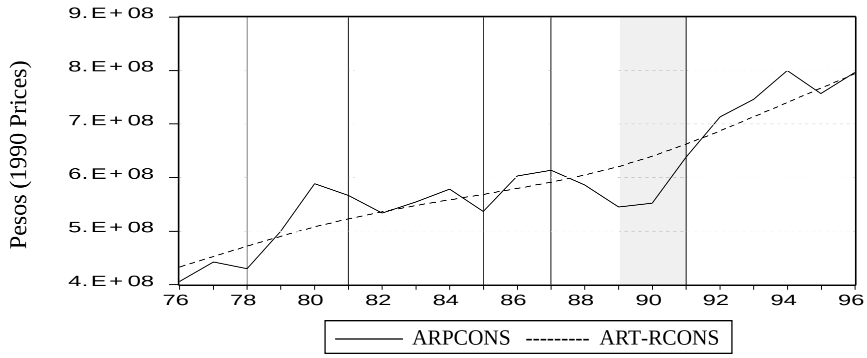


Graph 2. Argentina: Trade Balance

Graph 3. Argentina: Growth Real GDP and Real Consumption



Graph 4. Argentina: Real Consumption (HP-trend)

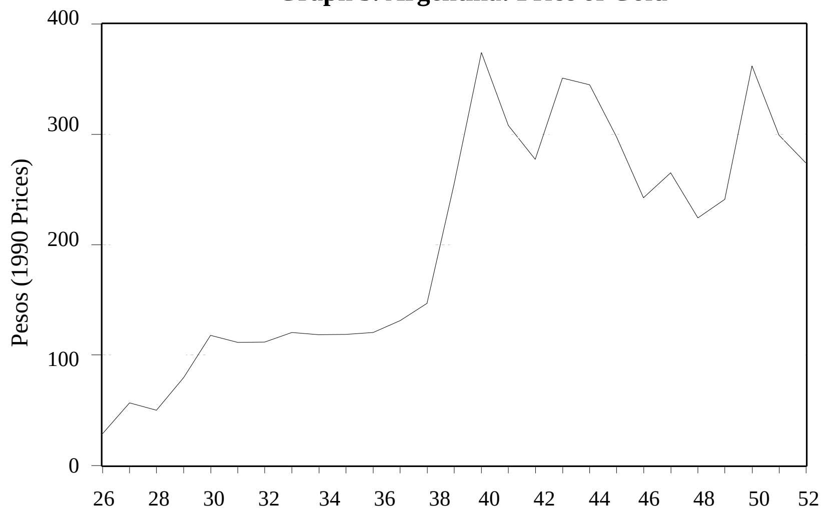


stabilization attempts. Argentina's stormy relationship with inflation, however, goes back to the early nineteenth century.... Indeed the first high inflation (in what would later officially become Argentina) goes from the mid 1820s to the early 1860s."

Graph 5 shows the price of one ounce of gold in Argentina from 1826-1852. We can observe a long-term trend of increasing price level, with various relatively stable periods and some deflationary years. The objective of this section is not to formally discuss the causes of Argentina's early experience with chronic inflation and the incapability to restore price stability through the use of alternative financing methods (taxes/borrowing). However, it is worth mentioning that already in this early experience we can observe how inflationary process favored certain groups while hurt others.

"…after 1826 – inflation began to benefit some of the most powerful economic groups: the "hacendados" (cattle-ranchers) and the "saladeristas" (meat exporters). Specifically, the inflationary process had led to a substantial increase in the relative price of traded goods (a real exchange rate depreciation), as export prices matched the exchange rate depreciation but wages and prices of home goods lagged behind…." Bordo and Vegh (1995).

Graph 5. Argentina: Price of Gold



The first failed stabilization attempt was proposed by Viamonte in 1829. His objective was to restore the gold-peso parity through a deflationary process that involved the retirement of bank notes.

"From the very outset, Viamonte's program of financial rehabilitation by way of deflation was doomed to failure…Of all of the economic groups in Buenos Aires the hacendados (cattle-ranchers) and the saladeristas (meat exporters) stood to lose most from deflation and were therefore least interested in seeing Viamonte's program realized…." Burgin (1946).

In 1833, during Viamonte's second administration, Garcia proposed a similar plan of returning to the gold-peso parity of the early 1820's through monetary deflation, which also failed.

During Rosas's rule (1835-1851) money and trade taxes became the main fiscal revenue sources. In the transition years (1852-1867) monetary financing was prevalently used to cover the military expenditure of the civil war years.

From then on, the authorities tried with continuous halts to adhere to the Gold Standard, which was finally suspended in 1914 at the outbreak of World War I.

The low inflation rates observed during the first half of the twentieth century seemed to have been the exception more than the rule in Argentina's history. From 1950 to 1974 inflation was high compared with almost all other developing countries, but much lower than in the 1970s and 1980s, as observed in Table 1.a and Table 1.b.

In 1959, under President Frondizi's rule, the authorities attempted an important stabilization program that brought inflation down to 13% in 1961, but failed to keep it down after that. Another attempt to control inflation was undertaken in 1967, when it was restrained under 20% for three years.

When the Peronist government took power in 1973, inflation and fiscal deficits were running high. The measures of the government included a short-term stabilization program based on a so-called pact "Social Pact" between business sectors and labor unions. The program involved price freezes and a rise and subsequent control of wages. Soon, it became evident that this plan was inconsistent with the expansionary policy to finance a fiscal deficit close to 8% of GDP.

"In December1973, the authorities realized the need to modify the price policy but the attempt conflicted with the public campaign advertising their success with zero-inflation. Under the pressure from both their own propaganda and the trade unions, who threatened to withdraw from the ´social pact' if prices were relaxed, the authorities stopped all attempts to unfreeze prices." Di Tella and Rodríguez (1990).

By the middle of 1974, the authorities began to loosen certain prices together with some reduction of monetary and fiscal expansion. However, the exchange rate continued to be kept under control, which only led to a further appreciation of the real currency. (See Graph 1).

Table1.b. Percent Consumer Price Index and Inflation (1913-1950)

	CPI 1913=100	Inflation (%)
1913	100	
1914	100	0.00
1915	107	7.00
1916	115	7.48
1917	135	17.39
1918	169	25.19
1919	160	-5.33
1920	186	16.25
1921	167	-10.22
1922	139	-16.77
1923	137	-1.44
1924	139	1.46
1925	136	-2.16
1926	132	-2.94
1927	131	-0.76
1928	117	-10.69
1929	131	11.97
1930	133	1.53
1931	114	-14.29
1932	102	-10.53
1933	108	5.88
1934	102	-5.56
1935	108	5.88
1936	118	9.26
1937	121	2.54
1938	120	-0.83
1939	122	2.00
1940	125	1.96
1941	128	2.88
1942	136	5.61
1943	137	0.88
1944	137	0.00
1945	163	19.30
1946	193	18.38
1947	218	13.04
1948	248	13.74
1949	319	28.50
1950	425	33.08

Source: Mitchell’s International Historic Statistics, The Americas.

"Price distortions began to be apparent and prices of tradable goods were reduced by more than 22% compared to those of non-tradables. The price of agricultural produce and meat in particular was lowered to the point of arousing an extremely strong reaction in the agricultural sector." Di Tella (1989).

This was the beginning of the chronic high inflation period. By 1976, year in which a military coup took place, the necessity of a restrictive policy was clear. After failed monetary restrictions and price controls followed by recession and higher inflation, the authorities decided in December of 1978 to launch a program that used the exchange rate as the main anti-inflationary weapon. This was the "Martínez de Hoz" episode of 1978-1981, which involved the use of the famous "tablita", or a system of pre-announced declining devaluation rates Though inflation was reduced, the "tablita" experiment caused a strong real appreciation as observed in Graph 1.

"The productive sectors saw their level of activity impaired by increasingly cheap imports, constraints on exports, high real interest rates and lack of growth. This produced a deep political rift and a new realignment as both the agricultural and industrial sectors, who had wholeheartedly supported the government, began to turn their back on a policy that attacked their interests…" Di Tella and Rodríguez (1990).

In 1981, after massive capital outflows, the system finally collapsed into repeated devaluations and high inflation. Following the Austral Plan (1985-1986), which involved wage, price and exchange rate control together with fiscal and monetary policies, Argentina entered its hyperinflation phase.[2] The 1991 "convertibility" plan has finally allowed Argentina to enjoy low inflation levels.

[2] Additionally, a failed money-based stabilization attempt was made from 1989 to 1991.

B. Mexico's Social Pact

Mexico's inflationary history before 1972 is that of a low-inflation country (see Table 1a). However, the 1954 exchange rate devaluation fired up inflation and caused uneasiness among the workers.

"The peso devaluation of 1954 that fixed the exchange rate at the old rate of 12.50 pesos to a dollar, was a traumatic event indeed. Policymakers of that time comment to this day that the labor union's response, triggered by the devaluation, shook up the whole party structure. (A wage increase was granted to appease the workers)." Solis (1981).

During the 1960s, the inflation rate was kept below 5% and averaged less than 3%. Mexico joined the moderate-inflation countries from 1973 to 1981 and the high-inflation group after 1982.

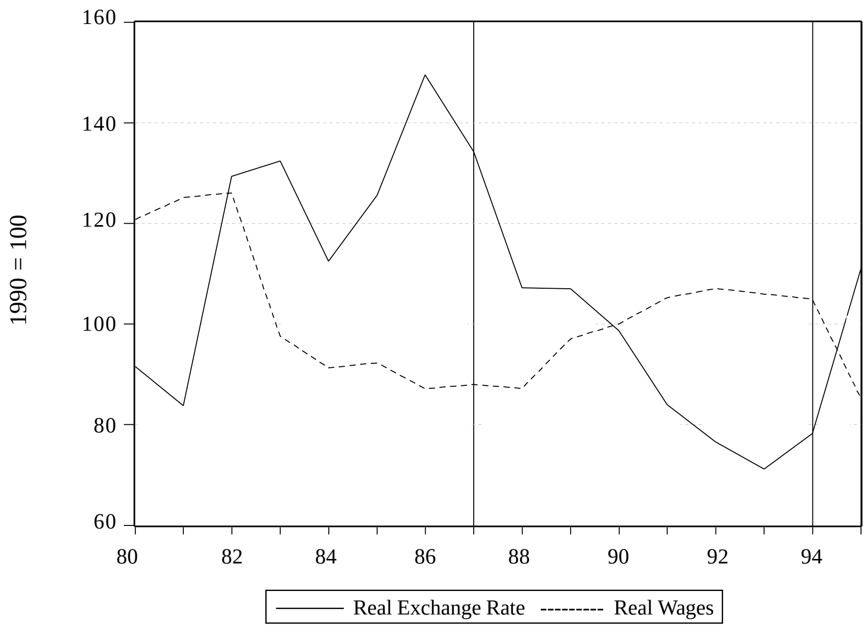
In 1987, the authorities initiated a stabilization program that included a three-party agreement (Pacto de Seguridad Social) among the government, the largest labor union and representatives of the private sector. Despite the initial success in reducing the inflation rates, the authorities acknowledged that the current account gap observed during 1992 and 1993 could not be sustained in the long run. Additionally, the political events that shocked the Mexican economy during 1994 –assassination of a presidential candidate, social problems in Chiapas, among others– translated into a major loss of foreign reserves. However, the authorities avoided, as long as they could, devaluating the peso.

"Under orthodox macroeconomic management, this situation would have called for the implementation of a defensive macroeconomic stance, resulting in higher interest rates and under flexible exchange rate regimes in a weakening of the domestic currency. This, however, was not an attractive option in a election year…" "…because of the tripartite agreement with business and unions - the pacto - it was decided not to implement an early

devaluation as a way to correct the accumulated overvaluation and help the adjustment." Edwards (1995).

Throughout this period, real exchange-rate appreciation and higher real wages benefited the working classes (see Graph 6). The peso was finally devalued at the end of 1994, with the consequent increase in inflation and reduction in real wages.

Graph 6. Mexico: Real Exchange Rate vs Real Wages



The next section will present a model that captures the interplay among inflation, the real exchange rate, income distribution and the implementation of temporary stabilization policies.

III. Model: Representative Agent's Problem

Consider a small open economy where there is free capital mobility. The economy is populated by two types of infinitely lived agents that are characterized by the same utility over the consumption of tradable and non-tradable goods but different endowments. One type of agents is endowed with the tradable goods (y_s^T) and the other one with the non-tradable ones (y_s^N). Goods are non-storable. Agents earning income from only one sector is a reasonable assumption if we consider that reallocation across sectors is usually costly and diversification tends to be limited in developing countries due, partly, to the financial sector's development.

Given the heterogeneity in the population, instead of proposing a social function to aggregate preferences, we allow the median voter to implement her/his most preferred policy.[3]

We begin, though, by describing an economy with one representative agent who is endowed with both the tradable and the non-tradable good. This will serve not only as a comparison to the heterogeneous agent model but also facilitate its analysis. Since preferences are assumed to be homothetic and identical for all agents, many of the properties of the representative agent model hold under all possible distribution of wealth.[4] Therefore, by using the representative agent model, we can easily obtain the equilibrium prices that hold also in the heterogeneous agent's economy.

To further simplify the analysis, we assume the endowment of tradable and non-tradable to be constant and equal in every period; $y_s^N = y^N \;\; \forall s,$ $y_s^T = y^T \, \forall s.$

There is free good mobility in the tradable goods market, therefore, purchasing power parity holds in terms of tradable goods: $P_s^T = E_s P^{T*},$ where

[3] We can appeal to the median voter theorem since we defined an unidimensional issue space and single peaked preferences.

[4] With homothetic preferences, the demand functions are a linear function of income; $x_i(p, m) = x_i(p)\, m$.

P_s^T is the price of tradables at home, E_s is the nominal exchange rate and P^{T*} is the price of tradables abroad. The world price of the tradable good in terms of foreign currency is assumed to be constant and equal to one. Using the Fisher equation; $(1+ i_s) P_s^T = (1+r) P_{s+1}^T$; for both the domestic and foreign economy, together with interest parity conditions; imply that the nominal interest rate factor is equal to the real interest rate times the devaluation rate:

$$(1 + i_s) E_s = (1 + r) E_{s+1}$$

Assuming constant foreign prices, $P_s^{T*} = P_{s+1}^{T*} = 1$. Defining the devaluation factor between s and $s+1$, (E_{s+1} / E_s), as ε_{s+1}, we finally obtain that (one plus) the domestic interest rate is equal to (one plus) the international real interest rates times the devaluation factor:

$$(1 + i_s) = (1 + r) \varepsilon_{s+1} \quad (1)$$

A. The Consumer

The representative consumer maximizes the lifetime utility function given by:

$$\sum_{s=t}^{\infty} \beta^{s-t} u(c_s^T, c_s^N)$$

where c_s^T denotes consumption of tradables goods and c_s^N the consumption of non-tradables goods; $0 < \beta < 1$ is the rate of time preference; and $u(.)$ is an increasing, twice continuously differentiable and strictly concave function. We assume time separability, which greatly simplifies our analysis, however the period utility function, $u(c_s^T, c_s^N)$, will generally not be separable between traded and non-traded goods.

Money is introduced through a cash-in-advance constraint. We assume that the government prints money, collects seignorage taxes and redistributes them back to the consumers.[5]

The consumer's budget constraint is given by:

$$P_s^T B_{s+1} + M_{s+1} + P_s^T c_s^T + P_s^N c_s^N \leq P_s^T y_s^T + P_s^N y_s^N + P_s^T (1+r) B_s + M_s + TR_s \quad (2)$$

where B_s represents the stock of bonds issued by foreigners denominated in terms of tradable goods and held by the domestic agent; M_s is the nominal stock of money in terms of local currency; TR_s are the nominal transfers received by the consumer from the government; $(1+r)$ is the international real interest factor; P_s^T is as defined before, the money price of tradable goods at time s and P_s^N the money price of non-tradable goods at time s.

Additionally, consumers face a cash-in-advance constraint[6] given by:

$$P_s^T c_s^T + P_s^N c_s^N \leq M_s + TR_s \quad (3)$$

substituting (3) into (2),

$$P_s^T y_s^T + P_s^N y_s^N + P_s^T [(1+r) B_s - B_{s+1}] - P_s^N c_s^N + TR_s \geq P_s^T c_s^T \quad (2')$$

and maximizing respect to B_{s+1} and c_s^N we obtain the following first order conditions:

$$\frac{u_{c^T}(c_s^T, c_s^N)}{u_{c^N}(c_s^T, c_s^N)} = \frac{P_s^T}{P_s^N} = \frac{1}{\rho_s} = e_s \quad (4)$$

[5] We assume that each consumer receives back the same amount she/he was taxed. This allows us to abstract away from results driven by redistribution considerations where people of low endowment might favor inflation tax because of positive net transfer payments.

[6] If the nominal interest rate is positive, the cash-in-advance constraint will be binding: the consumer will not hold cash in excess of what he/she requires to consume.

where e_s is defined as the real exchange rate and ρ_s as the price of non-tradable to tradable goods, i.e. $\frac{P_s^N}{P_s^T}$; and the Euler equation:

$$\frac{u_{c^T}(c_s^T, c_s^N) P_{s-1}^T}{P_s^T} = \beta (1+r) \frac{u_{c^T}(c_{s+1}^T, c_{s+1}^N) P_s^T}{P_{s+1}^T} \tag{5}$$

Using the Fisher Equation, $(1 + i_s) P_s^T = P_{s+1}^T (1 + r)$; where i_s denotes the nominal interest rate, and assuming $\beta(1+r)=1$, we can express the equation (5) as:

$$u_{c^T}(c_s^T, c_s^N) = u_{c^T}(c_{s+1}^T, c_{s+1}^N) \frac{(1+i_{s-1})}{(1+i_s)} \tag{5'}$$

The nominal interest rates for dates *s-1* and *s* enter equation (5') because agents can enjoy a unit of consumption on date *s* (as opposed to consuming on date *s+1*) only if he/she had held money on date *s-1* and had foregone the interest payment on date *s-1*. From this equation we observe that the nominal interest rate affects the path of consumption.

From the budget constraint (2') and imposing the transversality condition $\lim_{T \to \infty} \frac{B_{t+T+1}}{(1+r)^T} = 0$, we obtain the consumer life-time budget constraint in terms of tradable goods:

$$\sum_{s=t}^{\infty} \left(\frac{1}{1+r} \right)^{s-t} \left(c_s^T + \rho_s c_s^N + \frac{M_{s+1}}{P_s^T} \right) = (1+r) B_t + \sum_{s=t}^{\infty} \left(\frac{1}{1+r} \right)^{s-t} \cdot \left(y^T + \rho_s y^N + \frac{M_s}{P_s^T} + TR_s \right) \tag{6}$$

B. Government's Constraint

The government prints money, makes lump sum transfers to private agents and holds interest bearing foreign denominated assets. Let R_s be the government's net foreign assets; and E_s the nominal exchange rate; then the government's budget constraint is given by:

$$E_s(R_{s+1} - R_s) = M_{s+1} - M_s + r E_s R_s - TR_{s;} \qquad (7)$$

Imposing the transversality condition, $\lim_{T\to\infty} \frac{R_{t+T+1}}{(1+r)^T} = 0$, to the government's budget constraint (7), we obtain the government's intertemporal budget constraint:

$$\sum_{s=t}^{\infty}\left(\frac{1}{1+r}\right)^{s-t}\left(\frac{TR_s}{P_s^T}\right) = \frac{(1+r)E_t R_r}{P_t^T} - \frac{M_t}{P_t^T} + \sum_{s=t}^{\infty}\left(\frac{1}{1+r}\right)^{s-t}\left(\frac{i_s}{1+i_s}\frac{M_{s+1}}{P_s^T}\right) \qquad (8)$$

which simply states that the present value of government revenues from period *t* onward (in this case seignorage) must equal the real present value of governments debts outstanding at the start of period *t*, the initial monetary liability and the present value of government transfers.

C. Resource Constraint

Adding the private agent's intertemporal budget constraint (6) to the government's one (8) we obtain the economy's resource constraint:

$$\sum_{s=t}^{\infty}\left(\frac{1}{1+r}\right)^{s-t}(c_s^T + \rho_s c_s^N) = (1+r)x_t + \frac{1}{1+r}\left(y^T + \rho_s y^N\right) \qquad (9)$$

where $x_t = B_t - E_t R_t / P_t$ denotes net foreign assets.

Given the non-tradable sector consumption of non-tradable goods has to equate production, ($y_s^N = c_s^N$), the current account for this economy is obtained by adding the consumer budget constraint (2) to that of the government's (7) and

$$x_{s+1} = (1+r)x_s + y_s^T - c_s^T \qquad (10)$$

D. Equilibrium Conditions

An equilibrium consists of prices and quantities where: i) given the equilibrium prices, agents maximize utility and ii) markets for all goods clear. Equilibrium in the non-tradable sector implies:

$y^N = c_s^N$.

In the tradable sector:

$$\sum_{s=t}^{\infty}\left(\frac{1}{1+r}\right)^{s-t}(c_s^T) = (1+r)x_t + \frac{1+r}{r}y^T \tag{11}$$

E. Temporary Stabilization Policies

Temporary stabilization programs are modeled as temporary (Calvo and Vegh, 1997) reductions in the devaluation rate. At $s = t$, the government announces a reduction in the devaluation rate. However, the public expects the program to be abandoned at $s = S+1$ with the devaluation rate increasing to a new level. The length of temporary policy is taken to be exogenous.

$\varepsilon_s = \varepsilon_1$ *for* $t \leq s \leq S$;

$\varepsilon_s = \varepsilon_2$ *for* $s \geq S+1$.

In a small open economy, a reduction in the devaluation rate leads to a reduction in the nominal interest rate. Under the cash-in-advance constraint assumption, lower nominal interest rates reduce the effective price of today's consumption relative to future consumption. The higher desire for tradables goods will be fullfilled through a current account deficit. Given the restrictions imposed by the local market in the non-tradables sector, the only way in which agents can be satisfied with the amount of non-tradable goods available in the economy is if their cost increased. Therefore, the real exchange rate appreciates between $t \leq s \leq S$.

From equation (5'):

$$c_s^T = c_1^T \quad \forall t \leq s \leq S; \qquad \rho_s = \rho_1 \quad \forall t \leq s \leq S;$$
$$c_s^T = c_2^T \quad \forall s \geq S+1; \qquad \rho_s = \rho_2 \quad \forall s \geq S+1;$$
$$c_s^T > c_2^T \qquad \rho_1 > \rho_2$$

Since $c^T_1 > y^T$, the current account will deteriorate on impact at $s=t$ and will worsen throughout $t \leq s \leq S$ (because of the interest payments on the accumulating debt).

Figures 1 through 4 plot the dynamics of the nominal interest rate, the consumption of tradable and non-tradable goods, and the price of non-tradable to tradable goods in the presence of a temporary stabilization policy.

F. Current Account Dynamics

To derive a closed form solution for the current account dynamics we impose the following functional form on the utility function:

$$V^i = \sum_{s=t}^{\infty} \beta^{s-t} \left\{ \frac{\left(C_s^i\right)^{1-\frac{1}{\sigma}}}{1-\frac{1}{\sigma}} \right\}$$

$$C_s = u(c_s^{i,T}, c_s^{i,N}) = (c_s^{i,T})^{\gamma} (c_s^{i,N})^{1-\gamma}$$

From the first order condition:

$$c_1{}^T = c_2{}^T \Delta^a \text{, with } a = \frac{\sigma}{(\sigma-1)(1-\gamma)+1} \tag{5''}$$

Figures 1 - 5. Effects of Temporary vs. Permanent Stabilization Programs

Figure 1

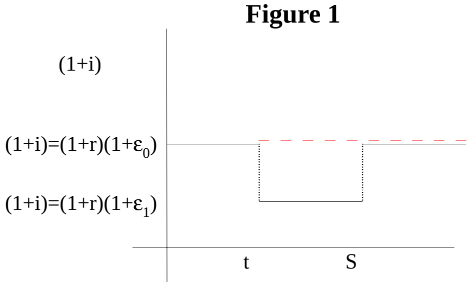


Figure 2

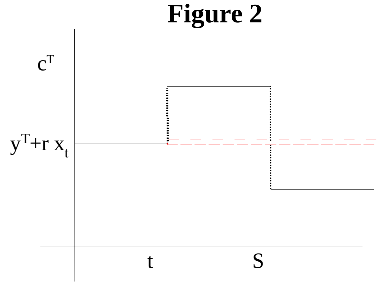


Figure 3

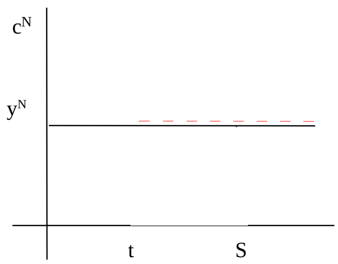


Figure 4

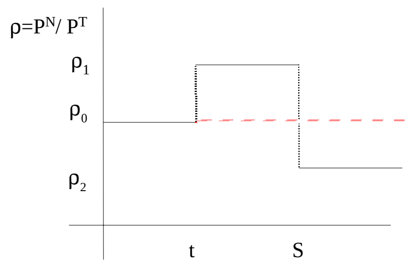
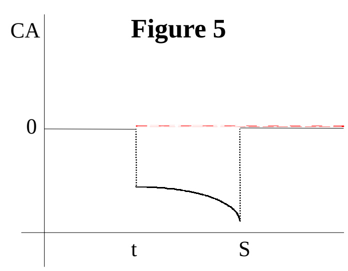


Figure 5



——— Temporary - - - - No Program

where $\Delta = \frac{1+i_{S-1}}{1+i_S}$ and $(1 + i_s) = (1 + r)\, \varepsilon_{s+1}$. For $c_1^T > c_2^T$, since $\Delta < 1$, $a < 0$ is required.

Using the Euler equation (5''), together with the resource constraint for tradable goods (11), we can find the value for c^T_1:

$$c_1^T\left[1-\left(\frac{1}{1+r}\right)^S+\left(\frac{1}{1+r}\right)^S\Delta^a\right]=y^T+rB_t$$

The current account for t < S, is then:

$$CA_t = x_{t+1} - x_t = y^T + r\,x_t - c_1^T = \left(y^T + r\,x_t\right)\left[\frac{\Delta^a - 1}{(1+r)^S + \Delta^a - 1}\right]$$

$$CA_S = x_{S+1} - x_S = y^T + r\,x_S - c_1^T$$

$$\frac{x_{s+1}}{y_s^T} = \frac{x_s}{y_s^T}\left[\frac{(1+r)^S + (1+r)(\Delta^a - 1)}{(1+r)^S + \Delta^a - 1}\right] + \left[\frac{\Delta^a - 1}{(1+r)^S + \Delta^a - 1}\right]$$

The change in the asset accumulation depends on the duration of the program (S), the expected devaluation (Δ), the real interest rate, and the values for the intra-temporal and inter-temporal elasticities of substitution (a). For $\Delta^a<1$, the value of the debt is growing. However, the value of the debt will not explode because at time S[7] the agents expect a change in regime (the actual devaluation), consumption will be adjusted so that the current account returns to balance. Figure 5 shows the time path for the current account.

G. Welfare Effects

What is the representative agent's welfare effect of a temporary stabilization program?

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[7] There is no uncertainty in this model.

Let Δ be the ratio of (one plus) the nominal interest rates at dates *S - 1* and $\Delta = \dfrac{1+i_{S-1}}{1+i_S}$. The utility effects of a temporary program that is expected to end at date $s = S+1$ is given by:

$$V = \sum \beta^{s-t} u\,(c_s^T, c_s^N)$$

$$\frac{\partial V}{\partial \Delta} = \left(\frac{1-\beta^{S+1}}{1-\beta}\right)\frac{\partial u}{\partial c_1^T}\frac{\partial c_1^T}{\partial \Delta} + \frac{\beta^{S+1}}{1-\beta}\frac{\partial u}{\partial c_2^T}\frac{\partial c_2^T}{\partial \Delta}$$

Substituting the following condition derived from the tradable-goods resource constraint:

$$\left(\frac{1-\beta^{S+1}}{1-\beta}\right)\frac{\partial c_1^T}{\partial \Delta} = -\frac{\beta^{S+1}}{1-\beta}\frac{\partial c_2^T}{\partial \Delta}$$

we find:

$$\frac{\partial V}{\partial \Delta} = \left(\frac{1-\beta^{S+1}}{1-\beta}\right)\frac{\partial c_1^T}{\partial \Delta}\left[\frac{\partial u}{\partial c_1^T} - \frac{\partial u}{\partial c_2^T}\right] \tag{12}$$

The first factor in equation (12) is positive since $0 < \beta < 1$. The second factor is positive (negative) if $\Delta < 1$ ($\Delta > 1$), because since agents expect higher (lower) future nominal interest rates, they will increase (decrease) tradable goods consumption. Given concave utility functions, the last term is negative (positive) for $\Delta < 1$ ($\Delta > 1$).

Under a temporary plan, the consumption profile is not smooth. Because of the “smoothing cost” the representative agent is worse under the temporary plan.

IV. Heterogeneous Agents Model

We now characterized an economy populated by infinitely lived agents who belong to two possible types. Consumers of type *A* are endowed only with tradable goods; consumers of type *B* are endowed only with non-tradable goods.

Each agent *i* maximizes $V^{i} = \sum \beta^{s-t} u\,(c_s^{i,T}, c_s^{i,N})$ subject to their own budget constraint:

$$P_s^T B_{s+1}^i + M_{s+1}^i + P_s^T c^{i,T} + P_s^N c_s^{i,N} \leq P_s^T y^{i,T} + P_s^N y_s^{i,N} +$$
$$+ P_s^T (1+r) B_s^i + M_s^i + TR_s^i$$

and a cash-in-advance constraint:

$$P_s^T c_s^{i,T} + P_s^N c_s^{i,N} \leq M_s^i + TR_s^i$$

First order conditions for each agent are given by:

$$\frac{u_{c^T}(c_s^{i,T}, c_s^{i,N})}{u_{c^N}(c_s^{i,}, c_s^{i,N})} = \frac{1}{\rho_s} = e_s \tag{4''}$$

$$u_{c^T}(c_s^{i,T}, c_s^{i,N}) = \beta(1+r) u_{c^T}(c_{s+1}^{i,T}, c_{s+1}^{i,N}) \frac{(1+i_{s-1})}{(1+i_s)} \tag{5''}$$

We will assume that the government returns to each agent, as transfer payments, the same exact amount of seignorage revenues collected from him/her. Given this assumption, imposing transversality conditions and setting the initial stock of bonds equal to zero for both agents, the lifetime budget constraints for type *A* and type *B* are respectively given by:

$$\text{Type A: } \sum (1+r)^{-(s-t)} (c_s^{A,T} + \rho_s c_s^{A,N}) = \sum (1+r)^{-(s-t)} (y_s^T)$$

$$\text{Type B: } \sum (1+r)^{-(s-t)} (c_s^{B,T} + \rho_s c_s^{B,N}) = \sum (1+r)^{-(s-t)} (\rho_s y_s^N)$$

Let λ represent the fraction of the present value of total resources that corresponds to traded goods, that is:

$$\lambda = \frac{\sum_{s=t}^{\infty} (1+r)^{-(s-t)} \left(y_s^T \right)}{\sum_{s=t}^{\infty} (1+r)^{-(s-t)} \left(y_s^T + \rho_s y_s^N \right)} \tag{13}$$

similarly, we can define *(1 - λ)* to be the proportion of the value of total wealth that corresponds to non-traded goods:

$$1 - \lambda = \frac{\sum_{s=t}^{\infty} (1+r)^{-(s-t)} \left(\rho_s y_s^N \right)}{\sum_{s=t}^{\infty} (1+r)^{-(s-t)} \left(y_s^T + \rho_s y_s^N \right)} \tag{13'}$$

To solve the heterogeneous agent's model, we will use some of the results obtained from the representative agent case. Under homothetic preferences, demand functions are a linear function of income. Therefore, each agent's consumption will be a fraction of that of the representative agent's. The weights will be given by the proportion of the value of the resources each consumer owns to those of the total economy.

Using the definition for λ and *(1 - λ)*, types A and B period *s* consumption as a function of the representative agent period consumption are:

$$c_s^{A,T} = \lambda \, c_s^T \qquad c_s^{B,T} = \lambda \, c_s^T$$

$$c_s^{A,N} = \lambda \, c_s^N \qquad c_s^{B,N} = (1-\lambda) \, c_s^N$$

These expressions imply that given the income distribution, if we solve for the representative agent's consumption profile, we can directly obtain the consumption for A and B.

To proceed and obtain the real exchange rate's level and thus the distribution of wealth and the utility effect of a temporary policy on both types of agents, we need to impose additional structure to the utility function.

We propose an isoelastic period utility function and constant elasticity of substitution between traded and non-traded goods.

$$V^i = \sum_{s=t}^{\infty} \beta^{s-t} \left\{ \frac{\left(C_s^i\right)^{1-\frac{1}{\sigma}}}{1-\frac{1}{\sigma}} \right\}$$

$$C_s^i = u(c_s^{i,T}, c_s^{i,N}) = \left[\gamma^{\frac{1}{\theta}} \left(c_s^{i,T}\right)^{\frac{\theta-1}{\theta}} + (1-\gamma)^{\frac{1}{\theta}} \left(c_s^{i,N}\right)^{\frac{\theta-1}{\theta}} \right]^{\frac{\theta}{\theta-1}} \tag{14}$$

with $\gamma \in (0,1)$, where $\sigma > 0$ is the elasticity of intertemporal substitution and $\theta > 0$ is the elasticity of substitution between tradables and non-tradables.

This functional form is general enough to include most forms used in previous applied studies for example, goods are perfect substitutes if $\theta \rightarrow \infty$; the Cobb-Douglas case is obtained when $\theta = 1$.

Using first order conditions –equation (4') and (5'')– the price of non-tradable goods and the Euler equation under the utility function (14) are given by:

$$\frac{(1-\gamma) c_s^{i,T}}{\gamma c_s^{i,N}} = \rho_s^{\theta} \tag{15}$$

$$P_s = \left[\gamma + (1-\gamma) \rho_s^{1-\theta} \right]^{\frac{1}{1-\theta}}$$

$$c_{s+1}^{i,T} = \left(\frac{P_s}{P_{s+1}} \right)^{\sigma-\theta} \left(\frac{1+i_{s-1}}{1+i_s} \right)^{\sigma} c_s^{i,T} \tag{16}$$

To analyze the wealth effects for this utility function, we need to impose some parameter values to both the intratemporal and the intertemporal substitution elasticities. Since we have two types of agents, we need to consider in addition to the smoothing cost that will be faced by both types, a wealth or redistributing effect that occurs due to the real appreciation of the exchange rate.

$\partial V^i/\partial\Delta$ = *wealth effect* - *smoothing cost*

$$\frac{\partial V^i}{\partial \Delta} = \left(\frac{\partial(1-\lambda)}{\partial \Delta}\right)\left(\frac{(1-\lambda)^{\frac{-1}{\sigma}}}{(1-\beta)}\right)\left\{(1-\beta^{S+1})(c_1^{i,T})^{1-\frac{1}{\sigma}} + \beta^{S+1}(c_2^{i,T})^{1-\frac{1}{\sigma}} + (c^{i,N})^{1-\frac{1}{\sigma}}\right\} +$$

$$+ \left(\frac{\partial c_1^{i,T}}{\partial \Delta}\right)\left(\frac{(1-\beta^{S+1})(1-\lambda)^{1-\frac{1}{\sigma}}}{(1-\beta)}\right)\left\{(c_1^{i,T})^{-\frac{1}{\sigma}} - (c_2^{i,T})^{-\frac{1}{\sigma}}\right\}$$

The first term is the wealth effect. Its sign will be given by how the stabilization policy affects the distribution of wealth between owners of tradable and non-tradable goods. Therefore, this term can be positive or negative. The second term is the "smoothing cost". Hence, the overall utility effect will depend on the parameter values of the utility function and the initial distribution of wealth.

Tables 3a-3b report the utility effects of a temporary stabilization policy for different parameter values of the intertemporal and intratemporal substitution elasticities. At $s = t$ the government announces a reduction in the devaluation rate that is not expected to be sustained after $s = S + 1$. We assume an expected increase in the devaluation of 50% (D = 1.5) after $s = S + 1$, which is consistent with the observed data in failed stabilization programs**.** Beta is calibrated so that half of the period is spent in the stabilization phase. We set the endowment level of tradables and non-tradables equal to one in every period. At $s = t$, the proportion of the value of the endowment for the owners of tradables and non-trades is the same, that is $\lambda = 0.5$ and $1 - \lambda = 0.5$

Tables 3a-3b also report the uniform (compensating) percentage change in consumption across all dates required to leave the consumer indifferent between the constant devaluation rate scenario and that where agents expect an increase in the devaluation rate of 50 %. *NT %* is the compensating change

Tables 3a-3b. Percentage Change Increase in Consumption across all Dates Required to Compensate the Consumer between the $\Delta = 1$ and an Expected $\Delta = 1.5$ at $s = S+1$.

Parameters	Benchmark
Δ	1.000
C_1^T	1.000
C_2^T	1.000
λ	0.500
$1-\lambda$	0.500

$\sigma > 0$ is the elasticity of intertemporal substitution;
$\theta > 0$ is the elasticity of substitution between tradables and non-tradables.

Table 3a

θ	**0.100**	**0.100**	**0.100**	**0.100**
σ	**0.100**	**0.500**	**0.999**	**2.000**
1-λ	0.504	0.513	0.515	0.516
NT %	0.814	2.348	2.804	3.082
λ	0.495	0.487	0.485	0.484
T %	-1.019	-2.691	-3.177	-3.474
RA%	-0.103	-0.171	-0.187	-0.196

Table 3b

θ	**0.500**	**0.500**	**0.500**	**0.500**
σ	**0.100**	**0.500**	**0.999**	**2.000**
1-λ	0.500	0.503	0.504	0.506
NT%	-0.114	0.008	0.206	0.453
λ	0.400	0.497	0.496	0.494
T %	-0.228	-1.018	-1.574	-2.097
RA%	-0.171	-0.513	-0.684	-0.822

for the owner of non-tradables while *T%* represents the change for the tradables' owners. *RA %* is the compensating change for the representative agent (who owns both the tradable and the non-tradable goods)

We can observe how the owners of the tradable goods are worse off because in addition to the negative smoothing cost they face, the real appreciation of the exchange rate implies an extra negative wealth effect.

The owners of non-tradables, on the other hand, face a positive wealth effect. However this positive wealth effect is not always strong enough to compensate the smoothing cost. This will depend on the estimates for the intertemporal and intratemporal elasticities.

In Table 3a, $\theta = 0.1$. For this parameter value, a temporary stabilization policy increases the owners of non-traded goods' utility. Notice that as σ increases the positive change in the utility increases. As agents become more willing to substitute future consumption for today's consumption, the real exchange rate appreciates more and the "wealth effect" increases.

In Table 3b, $\theta = 0.5$. In this case, for $\sigma < 0.5$, the owner of non-tradable goods looses from the temporary policy, but otherwise he/she is better off.

Therefore, for $\theta < \sigma$, agents endowed with non-tradable goods would favor a temporary stabilization and the owners of tradable goods will oppose it. This statement is one of central importance in this paper. It gives a rationale for the observed temporary stabilization programs that were implemented by showing that for certain parameter values, one political group benefits from such programs.

We can also calculate through simulations (since there is no closed form solution) the optimal duration time of the program for either the owners of tradable goods or the owners of non-tradable goods. Table 4 shows the effects of changes in the duration of the stabilization program for $\theta = 0.1$ and $\sigma = 0.1$ for both the owners of tradable and non-tradable goods. The positive (negative) welfare effect for the owners of non-tradable (tradable) goods increases initially as duration of the program enlarges. However, welfare effect for the owners of non-traded goods reaches a maximum, when the program fails after 10.1 quarters (3.3 years) for these parameter values. In the limit, since a permanent program has no wealth or intertemporal substitution effects, there are no welfare effects.

Table 4. Changes in the Duration of the Stabilization Program.

Parameters	Benchmark
Δ	1.000
C_1^T	1.000
C_2^T	1.000
λ	0.500
1-λ	0.500
θ	0.100
σ	0.100
β	0.947

Duration[1]	**22.9**	**17.8**	**12.7**	**10.1**	**5.0**	**2.5**
1-λ	0.504	0.504	0.504	0.505	0.504	0.502
NT %	0.619	0.734	0.814	0.818	0.657	0.422
λ	0.496	0.496	0.495	0.495	0.496	0.498
T %	-0.795	-0.933	-1.019	-1.023	-0.800	-0.507
RA%	-0.088	-0.103	0.089	-0.091	-0.136	-0.039

[1] Duration in Quarters.

It is interesting to notice that once a stabilization program is implemented, the owners of tradable goods will want it to fail rapidly or not at all, since in both cases, they would be minimizing their own welfare cost.

V. Conclusions

In the above analysis, we have considered an endowment setup where wealth effects are solely related to changes in the real exchange rate due to intertemporal consumption substitution. In this simple framework, we found that under certain parameter restrictions, the welfare of the owners of non-tradable goods increases when a temporary stabilization program is implemented. This same policy has a negative welfare cost for the owners of tradable goods.

Future research should incorporate additional welfare effects from production/investments, labor/leisure decisions, and others.

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