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Nominal interest rates, consumption booms, and lack of credibility: A quantitative examination

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Abstract

Exchange rate-based stabilization programs in chronic-inflation countries have often been accompanied by an initial expansion of private consumption followed by a contraction. This consumption cycle has been attributed to lack of credibility, in the sense that the public views the reduction in the devaluation rate as temporary. This paper assesses the quantitative relevance of the 'temporariness' hypothesis by comparing the predictions of a simple model to the actual figures for seven major programs. The paper concludes that nominal interest rates must fall substantially for the 'temporariness' hypothesis to account for an important fraction of the observed consumption booms.

Keywords: Consumption booms; Credibility; Interest rates; Stabilization

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1. Introduction

Exchange rate-based disinflation programs in chronic-inflation countries have often been accompanied by an initial expansion of private consumption followed

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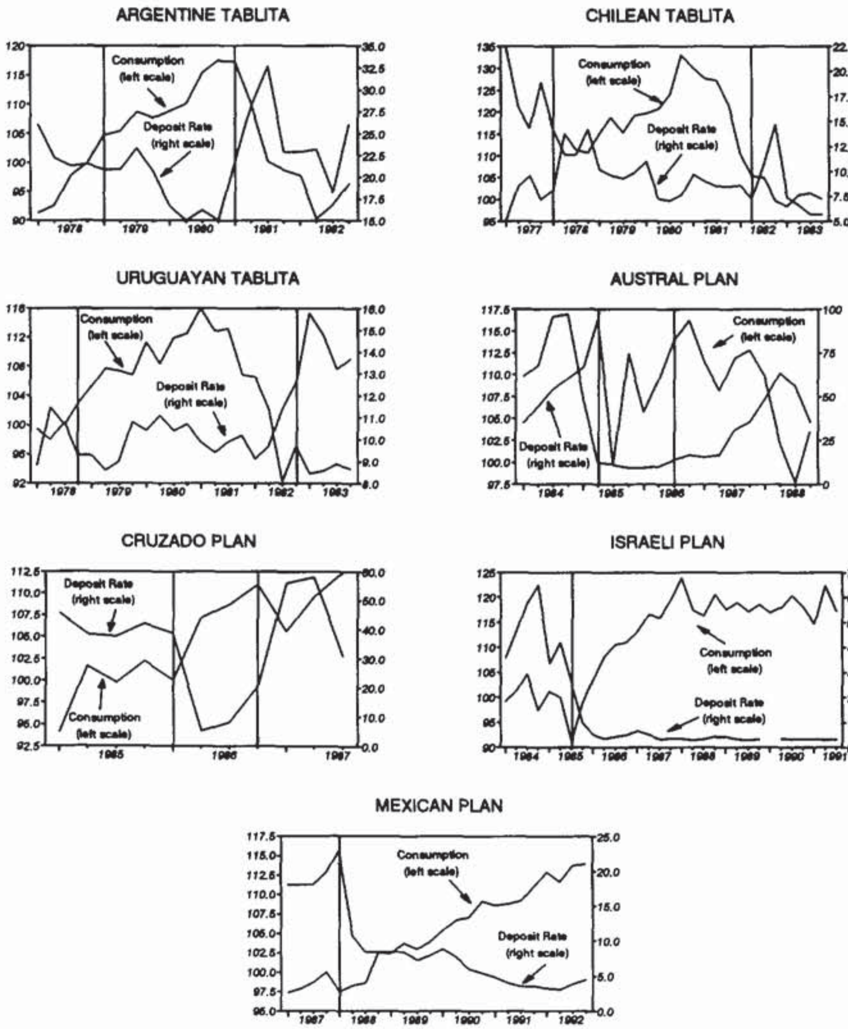

Fig. 1. Private consumption and nominal interest rates.

Notes: Vertical lines indicate the beginning and end (if applicable) of the program. Consumption refers to an index of real private consumption except for Argentina where total consumption has been used. Interest rates are expressed in percent per quarter.
Sources: International Financial Statistics, IMF and various central bank bulletins.

by a later contraction (see Kiguel and Liviatan, 1992; Végh, 1992). [1] Fig. 1 illustrates this consumption pattern for seven major exchange rate-based stabilization programs: the Southern-Cone orthodox stabilization plans of the late 1970s in

[1] In industrial countries, consumption booms have also been observed in the first stages of the 1982 Danish and 1987 Irish exchange rate-based stabilizations (see Giavazzi and Pagano, 1990).

Argentina, Chile, and Uruguay (the so-called 'tablitas'), and the heterodox plans of the mid-1980s in Argentina (Austral plan), Brazil (Cruzado plan), Israel, and Mexico. Interestingly, this consumption cycle seems to take place irrespective of whether the program is eventually successful or not. In effect, as Fig. 1 illustrates, the late recession took place in both failed programs (the tablitas, and the Austral and Cruzado plans) and successful programs (Israel). [2]

Several hypotheses have been advanced to explain the consumption cycle associated with exchange rate-based stabilization. A first explanation, suggested by Rodriguez (1982), relies on an initial fall in real interest rates, which results from the assumption of adaptive expectations, to generate an expansion in aggregate demand. Later in the program, the effects of an appreciated real exchange rate prevail and a recession ensues. Rodriguez's (1982) hypothesis, however, cannot explain the boom in those programs in which real interest rates rose. [3] Furthermore, his results may not hold in a utility-maximizing framework (see Calvo and Végh, 1994).

A second explanation is based on wealth effects, which may result from lack of Ricardian equivalence (Helpman and Razin, 1987), future reductions in government spending (Drazen and Helpman, 1988), or increases in labor supply (De Gregorio et al., 1993; Roldos, 1993). A problem with relying on a wealth effect to generate the initial consumption boom, however, is that the late recession is left unexplained. [4]

A third hypothesis, first suggested by Calvo (1986), is based on the idea that the program may lack credibility in the sense that the public expects the program to be discontinued in the future. In Calvo's (1986) model, money is introduced through a cash-in-advance constraint. Therefore, the opportunity cost of holding money (i.e., the nominal interest rate) is part of the 'effective' price of consumption. A reduction in the nominal interest rate which is viewed as temporary reduces the effective price of today's consumption relative to future consumption, thus inducing a rise in consumption.

Calvo and Végh (1993) introduce a second (non-traded) consumption good and sticky prices into the picture and show how a non-credible stabilization leads to a consumption boom in both the traded and non-traded goods sectors. Furthermore, the inflation rate of home goods falls by less than the rate of devaluation on impact, thus generating a sustained real appreciation of the domestic currency, which reduces aggregate demand. Hence, a recession may occur even before the program is expected to be discontinued, as was the case, for instance, in the Chilean and Uruguayan tablitas (see Fig. 1). Thus, as argued by Végh (1992), the

[2] Mexico is a notable exception in that no late recession occurred.

[3] Real interest rates rose in four of the seven programs illustrated in Fig. 1 (Austral, Cruzado, Israeli, and Mexican plans); see Végh (1992).

[4] De Gregorio et al. (1993) is an exception, in that the initial 'bunching' in durable goods consumption caused by the wealth effect leads to a later recession.

'temporariness' hypothesis is capable of generating predictions that match most of the stylized facts of exchange rate-based stabilization in chronic inflation countries.

A key issue regarding the 'temporariness' hypothesis, however, is its empirical relevance. Specifically, the question is whether the fall in nominal interest rates that has been observed in exchange rate-based stabilization programs can explain the rise in private consumption. Skeptics point out that intertemporal elasticities of substitution are low (or, even worse, not significantly different from zero) and proceed to dismiss the 'temporariness' hypothesis on these grounds. However, much of the empirical evidence that suggested little or no role for intertemporal considerations was based on highly simplified one-good, non-monetary models. More recent empirical work – including the one presented in this paper – which uses models that allow for more than one good and/or money, has mostly yielded higher, statistically significant estimates of the intertemporal elasticity of substitution. Using these recent estimates, this paper provides a first attempt to evaluate the quantitative importance of the 'temporariness' hypothesis in explaining the observed consumption booms.

The paper develops a one-good model of a small open economy in which money is held to reduce transactions costs. [5] The model yields a closed-form solution for consumption as a function of the intertemporal elasticity of substitution, the time path of the nominal interest rate, and the credibility horizon (i.e., the number of periods that the program is expected to last). Assuming that the initial nominal interest rate is expected to prevail again at some time in the future, we compute (using our own and other available parameter estimates) the predicted increases in consumption for the seven stabilization programs shown in Fig. 1. The model's predictions are then compared with the actual consumption data.

The main conclusion that emerges from the analysis is that in those episodes in which nominal interest rates fell by at least 15 percent per quarter (i.e., the Austral, Cruzado, Israeli, and Mexican plans), the predicted increase in consumption is of an order of magnitude that compares well with the actual figures. In the other three episodes (the Southern-Cone 'tablitas'), the fall in nominal interest rates, which was in the order of 5 percent per quarter, produces an increase in consumption that fails to account for any significant fraction of the actual increase. In sum, the numerical results presented in this paper suggest that, in spite of low elasticities of substitution, the 'temporariness' hypothesis may still be quantitatively important in programs in which nominal interest rates fell sharply.

The paper proceeds as follows. Section 2 presents the model and derives a closed-form solution for consumption. Section 3 reviews estimates of the intertemporal elasticity of substitution and parameters of the demand for money (including

[5] Introducing money in such a way retains the intuitive appeal of cash-in-advance models but allows for a variable velocity, an essential ingredient in any empirically oriented model.

our own estimates, which are presented in an Appendix). These parameter values are used in Section 4 to compute predicted increases in consumption, which are then compared to the actual figures. Section 5 concludes.

2. The model

Consider a small open economy inhabited by a large number of identical, infinitely lived individuals, who are blessed with perfect foresight. The representative consumer maximizes

$$\sum_{t=0}^{\infty} \beta^t \frac{c_t^{1-(1/\rho)} - 1}{1-(1/\rho)}, \tag{1}$$

where $\beta \in (0,1)$ is the discount factor; c denotes consumption of the only (non-storable) good; and $\rho(>0)$ is the intertemporal elasticity of substitution.

Money will be introduced through a transactions-costs technology (see, for instance, Reinhart, 1990; Kimbrough, 1992). Transactions costs (s), which are assumed to be increasing in consumption and decreasing in real money balances, are given by

$$s_t = c_t v\left(\frac{m_t}{c_t}\right), \quad v'(\cdot) < 0,\ v''(\cdot) > 0, \tag{2}$$

where $m(\equiv M/P)$ stands for real money balances (M and P denote nominal money balances and the price level, respectively). [6]

In addition to money, there is an internationally traded bond (b) whose constant real rate of return is r. The intertemporal budget constraint is thus

$$(1+r)\left(b_{-1} + \frac{m_{-1}}{1+i_{-1}}\right) + \sum_{t=0}^{\infty}\left(\frac{1}{1+r}\right)^t (y_t + \tau_t) = \sum_{t=0}^{\infty}\left(\frac{1}{1+r}\right)^t \times (c_t + s_t + I_t m_t), \tag{3}$$

where y denotes the endowment of the tradable good, τ are real transfers from the government, i is the nominal interest rate, and $I(\equiv i/(1+i))$ is the opportunity cost of holding real money balances.

The consumer maximizes (1) subject to (2) and (3), given his initial assets, b_{-1} and m_{-1}. In addition to (3), the first-order conditions are: [7]

$$c_t^{-(1/\rho)} = \lambda p_t, \tag{4}$$

$$-v'\left(\frac{m_t}{c_t}\right) = I_t, \tag{5}$$

[6] For simplicity, we assume that the transactions-costs technology is homogeneous of degree one in real money balances and consumption. This implies that the consumption-elasticity of money demand is unity (see below), which is generally supported by the data (see the Appendix).

[7] To ensure the existence of a steady state, it is assumed that $\beta(1+r)=1$.

where

$$p_t \equiv 1 + v\left(\frac{m_t}{c_t}\right) - v'\left(\frac{m_t}{c_t}\right)\frac{m_t}{c_t} \tag{6}$$

denotes the effective price of consumption and λ is the (time-invariant) multiplier associated with the budget constraint (3). Eq. (4) is the familiar optimality condition whereby the consumer equates the marginal utility of consumption to the shadow value of wealth, λ, times the 'effective' price of consumption, p. The effective price of consumption, given by (6), consists of the market price of the good (equal to unity) plus the transactions costs incurred by purchasing an additional unit of the good.

Eq. (5) indicates that the consumer equates, at the margin, the reduction in transactions costs that results from holding an additional unit of real money balances to its opportunity cost, I. This first-order condition implicitly defines a demand for money with standard properties:

$$m_t = c_t L(I_t), \quad L'(I) = -\frac{1}{v''(m/c)} < 0. \tag{7}$$

Substituting Eq. (7) into (6), if follows that

$$p_t \equiv 1 + v[L(I_t)] - v'[L(I_t)]L(I_t) \equiv p(I_t), \quad p'(I) = L(I) > 0, \tag{8}$$

which indicates that the effective price is an increasing function of I. [8]

Consider now the behavior of the government. The government is assumed to transfer to the consumer all proceeds from money creation. Furthermore, it will be assumed that transactions costs are a private rather than a social cost. [9] Formally, the government is posited to provide shopping services to the consumer at no cost to the government. The proceeds from such an activity are then transferred back to the consumer in a lump-sum way. [10] The government's intertemporal budget constraint is thus

$$\sum_{t=0}^{\infty}\left(\frac{1}{1+r}\right)^t \tau_t = (1+r)\left(h_{-1} - \frac{m_{-1}}{1+i_{-1}}\right) + \sum_{t=0}^{\infty}\left(\frac{1}{1+r}\right)^t (I_t m_t + s_t), \tag{9}$$

where h_{-1} denotes the government's initial stock of bonds. [11]

[8] For a general transactions technology, the effective price of consumption is increasing in both c and I. The assumption of constant returns to scale implies that the effective price depends only on I.

[9] This assumption is intended to capture the spirit of cash-in-advance models in which transacting is not costly from a social point of view. It also enables us to isolate the quantitative effects of intertemporal consumption substitution. As discussed in the Appendix, assuming that transacting is socially costly implies that a temporary stabilization has a positive wealth effect, which would only reinforce the initial consumption boom discussed below.

[10] Alternatively, it could be assumed that private firms provide these services. As the owner of these firms, the consumer would receive the proceeds from such an activity.

[11] Note that since the initial stock of real money balances is in the hands of the consumer, it constitutes a liability for the government.

Finally, the economy's resource constraint follows from (3) and (9):

$$(1+r)(h_{-1}+b_{-1})+\sum_{t=0}^{\infty}\left(\frac{1}{1+r}\right)^{t} y_t=\sum_{t=0}^{\infty}\left(\frac{1}{1+r}\right)^{t} c_t. \tag{10}$$

Eq. (10) simply states that the present discounted value of consumption must equal the present discounted value of tradable resources.

Using (4), (8), and (10), a closed-form solution for consumption obtains:

$$c_t=\bar{y}\frac{\left[\sum_{t=0}^{\infty}\left(\frac{1}{1+r}\right)^{t}\frac{r/(1+r)}{[p(I_t)]^{\rho}}\right]^{-1}}{[p(I_t)]^{\rho}}, \tag{11}$$

where

$$\bar{y}\equiv\frac{r}{1+r}\left[(1+r)(h_{-1}+b_{-1})+\sum_{t=0}^{\infty}\left(\frac{1}{1+r}\right)^{t} y_t\right] \tag{12}$$

defines permanent income as of time 0.

Eq. (11) expresses equilibrium consumption in period t as a function of the elasticity of substitution and the time path of the nominal interest rate. Consumption at time t is proportional to (initial) permanent income, $\bar{y}$. The factor of proportionality, which can be viewed as the marginal propensity to consume (MPC) out of (initial) permanent income, consists of the ratio of an average effective price of consumption over the consumer's lifetime to the current effective price. [12] To illustrate this point, suppose that $\rho=1$. It is then apparent that the numerator of the MPC in Eq. (11) takes the average of the inverse of the effective price at each point in time and then inverts it, thus yielding an average effective price over the period $[0,\infty)$. This average is compared to the current effective price (the denominator of the MPC in Eq. (11)). If the effective price remains constant forever, then the average price equals the current price (i.e., the MPC is unity), and consumption is always equal to permanent income. It immediately follows that a once and for all change in the effective price has no impact on the time path of consumption. [13] In contrast, whenever the current effective price is below (above) the average effective price, the MPC is above (below) unity, and consumption is higher (lower) than initial permanent income. The reason is that consumption is cheaper (more expensive) at that point in time that it will be on average. Therefore, if the effective price is expected to increase

[12] This interpretation follows Calvo and Végh (1990).

[13] If transactions costs were a social cost, then a permanent reduction in the nominal interest rate would lead to a wealth effect (by reducing transactions costs), and thus to a higher level of consumption. The path of consumption, however, would still be flat over time.

at a future date (say $t = T$) and remain at that higher level thereafter, the current effective price during $[0,T)$ will be *lower* than the average price, and consumption will be *higher* than initial permanent income during $[0,T)$. When the current effective price increases at T, it will be *higher* than the average price and consumption will be *below* initial permanent income from T on.

When the elasticity of substitution is different from unity, the same interpretation remains valid. The only difference is that the ratio between the average and the current effective price is 'adjusted' by the intertemporal elasticity of substitution, in the sense that effective prices are raised to the power ρ. As a result, a given difference between the average and current prices will be magnified if $\rho > 1$ or dampened if $\rho < 1$.

To capture a temporary stabilization, we assume the following path of the nominal interest rate. [14] Suppose that initially (i.e., for $t < 0$), the nominal interest rate is expected to remain constant at i^{H}, which implies that consumption equals permanent income. [15] At $t = 0$, the interest rate falls, but is expected to go back to its initial level at time T. Formally,

$$i_t = i^{\mathrm{L}}, \quad 0 \leqslant t < T,$$
$$i_t = i^{\mathrm{H}}, \quad t \geqslant T, \tag{13}$$

where $i^{\mathrm{L}} < i^{\mathrm{H}}$. Letting $I^j \equiv i^j/(1 + i^j)$, for $j = \mathrm{L,H}$, it follows that $I^{\mathrm{L}} < I^{\mathrm{H}}$. By Eq. (8), consumption will be cheaper during $[0,T)$ than after time T, which induces consumers to increase consumption. [16] Using (11) and (13), we obtain

$$c\left[\rho, T, \frac{p(I^{\mathrm{L}})}{p(I^{\mathrm{H}})}\right] = \bar{y}\frac{1}{1 + \left(\dfrac{1}{1+r}\right)^T \left[\left(\dfrac{p(I^{\mathrm{L}})}{p(I^{\mathrm{H}})}\right)^\rho - 1\right]}, \quad 0 \leqslant t < T, \tag{14}$$

which expresses the (higher and constant) level of consumption between 0 and T as a function of T, ρ, and $p(I^{\mathrm{L}})/p(I^{\mathrm{H}})$. Eq. (14) constitutes the basis for the numerical analysis of Section 4.

The key comparative-statics results of temporary stabilization follow from Eq. (14). First, the shorter the period of time during which the low price prevails, the

[14] In the presence of perfect capital mobility, the nominal interest rate moves one-to-one with the rate of devaluation through the interest rate parity condition. Hence, the interest rate should be thought of as reflecting policy changes in the rate of devaluation.

[15] The initial value of the nominal interest rate is formally irrelevant since permanent changes in i are superneutral. In other words, all that matters is the path of i for $t \geqslant 0$. For conceptual purposes, however, it is useful to interpret this path as a temporary fall in the nominal interest rate.

[16] It can be shown that, for the interest rate path specified in (13), the average effective price of consumption is a weighted average of $p(I^L)$ and $p(I^H)$, with the weights depending on the length of time during which each effective price is in effect.

higher is consumption (i.e., $c_T < 0$).[17] Intuitively, a lower T implies that the average price is higher, which, given the time path of the effective price, results in a higher MPC. Second, the higher is the elasticity of substitution, the higher is consumption (i.e., $c_\rho > 0$). Third, the lower is the ratio of the low effective price to the high effective price, the higher is consumption (i.e., $c_x < 0$, where $x \equiv p(I^L)/p(I^H)$), because the good is cheaper during $[0,T)$.

To quantify the effects of the different parameters on consumption, the transactions technology needs to be specified. Let

$$v\left(\frac{m}{c}\right) = k_0\left(\frac{m}{c}\right)^{1-k_1}, \quad k_0 > 0,\ k_1 > 1. \tag{15}$$

Using Eqs. (5), (6) and (15), the effective price of consumption is given by

$$p(I_t) = 1 + \frac{k_1 k_0^{1/k_1}}{(k_1 - 1)^{(k_1-1)/k_1}} I_t^{(k_1-1)/k_1}. \tag{16}$$

For given values of the parameters of the transactions technology (k_0 and k_1), the intertemporal elasticity of substitution (ρ), the credibility horizon (T), the real interest rate (r), i^H, and i^L, Eqs. (14) and (16) allow us to compute the increase in consumption that results from a fall in nominal interest rates. The next section discusses estimates of these parameters in order to carry out the calculations in Section 4.

3. The parameters of consumer preferences: empirical evidence

The magnitude of the change in consumption in response to a temporary change in the nominal interest rate critically depends on the elasticity of intertemporal substitution, ρ. As discussed in Section 2, a given temporary reduction in the nominal interest rate will induce a larger increase in consumption when current and future consumption are close substitutes (i.e., ρ is high) than when the degree of intertemporal substitutability is low. This section first reviews the relevant empirical evidence on this crucial parameter, and then briefly summarizes the estimates of the parameters of money demand which also affect consumption behavior.

3.1. Intertemporal elasticity of substitution

This brief survey is not intended to cover the vast literature which has estimated ρ for industrial countries, but rather to summarize the relatively infrequent

[17] Subscripts denote partial derivatives.

Table 1
The intertemporal elasticity of substitution: A brief survey of the estimates

Country(ies)	Point estimates and/or range in point estimates [a]	Sample and frequency	Type of model	Source
Argentina	0.21 (0.03)	quarterly 1978:1–1989:2	transactions-costs model	Table A.1 in Appendix
	0.15 to 0.19 (0.16) (0.11)	annual 1960 to 1977	Hall's one-good, pure consumption model	Giovannini (1985)
Brazil	−0.017 to 0.01 (0.13) (0.14)	annual 1967 to 1979	Hall's one-good, pure consumption model	Giovannini (1985)
Chile	0.19 (0.10)	quarterly 1976:2–1989:2	transactions-costs model	Table A.1 in Appendix.
	1.59 (n.a.)	quarterly 1971:3–1981:4	Sidrauski's money in the utility function model	Arrau (1990)
Israel	0.15 to 1.32 (n.a.) (n.a.)	quarterly 1970:1–1988:3	Sidrauski's money in the utility function model	Eckstein and Leiderman (1991)
Mexico	2.87 (n.a.)	quarterly 1980:1–1987:4	Sidrauski's money in the utility function model	Arrau (1990)
	0.07 to 0.12 (0.10) (0.12)	annual 1965 to 1979	Hall's one-good, pure consumption model	Giovannini (1985)
Uruguay	0.53 (0.22)	quarterly 1977:2–1989:3	transactions-costs model	Table A.1 in Appendix.
Panel of 4 Latin American countries: Brazil, Colombia, Costa Rica, and Mexico	0.37 to 0.43 (0.11) (0.14)	annual 1968–1987	pure consumption two-good disaggregated model	Ostry and Reinhart (1992)
Panel of 9 South American countries: Bolivia, Brazil, Chile, Colombia, Ecuador, Paraguay, Peru, Uruguay, and Venezuela	0.09 (0.07)	annual 1973–1983	Hall's one-good, pure consumption model, allowing for liquidity constraints	Rossi (1988)
	0.09 (0.04)	annual 1973–1981		Rossi (1988)

[a] The lowest and highest point estimates are reported. Standard errors are in parentheses. 'n.a.' denotes that a standard error for that parameter was not reported.

application of the Euler-equation approach to developing country data. Specifically, our focus is on the six countries which, as illustrated in Fig. 1, undertook major exchange rate-based stabilization programs. Table 1 summarizes existing estimates of ρ for these countries. As the table highlights (see the fourth column), the types of models used for estimation purposes vary considerably across studies. The earlier work of Giovannini (1985) and Rossi (1988) used Hall's linearized Euler equation, which results from a one-good, non-monetary model. However, as Hall (1988) finds for the United States, Giovannini's (1985) estimates for an array of developing countries suggest that ρ is generally not significantly different from zero. Rossi (1988), who allows for the presence of liquidity constraints, finds more evidence of consumption smoothing, but estimates for South America still yield ambiguous results. [18]

A more recent line of research has relaxed some of the restrictive assumptions embodied in the one-good, non-monetary model. Models that disaggregate consumption by allowing for more than one type of good have found greater empirical support and, in general, yielded higher and statistically significant estimates of ρ. This literature includes the work of Ostry and Reinhart (1992), whose estimates for Latin America are shown in Table 1. [19]

Another group of papers, including the present one, maintains the one-good assumption but incorporates monetary considerations into the consumer's choice problem. Some of these models have taken the form of Sidrauski's money-in-the-utility-function framework (see, for example, Eckstein and Leiderman, 1991; Arrau, 1990). [20] The transactions-costs model outlined in Section 2 presents an alternative way of incorporating money into the consumer's problem. This model, which yields both an Euler equation and a demand-for-money function, was estimated for three of the countries analyzed here (see the Appendix). As reported in Table 1, the estimates of the intertemporal elasticity of substitution are statistically significant in all three cases (Argentina, Chile, and Uruguay).

The inclusion of money in consumption decisions thus improves the models' ability to fit the data. Monetary models often yield more plausible parameter estimates than their pure consumption counterparts and generally perform well in the overidentification tests that typically accompany the estimation of rational-expectations models. For these reasons, and because of the monetary nature of the underlying theoretical framework, the simulations that follow will use, whenever possible, the parameter estimates obtained from monetary models.

[18] The coefficient of intertemporal substitution is statistically significant only when the debt crisis years 1982–83 are excluded from the sample.

[19] Papers by Ceglowski (1991) and Mankiw (1985) apply the multi-good approach to the United States data.

[20] For an application to U.S. data, see Poterba and Rotemberg (1987). Their estimate of ρ is low, around 0.15, but significantly different from zero.

Table 2
Parameters of the demand for money for selected countries

Country	Money demand elasticities [a]		Sample and frequency	Source
	Scale variable	Opportunity cost		
Argentina	0.86	−0.1	quarterly	Table A.1 in Appendix.
	(0.17)	(0.02)	1978:1–1989:2	
Brazil	0.6	−3.26	quarterly	Arrau et al. (1991)
	(0.23)	(0.80)	1975:1–1985:4	
	0.57	−0.92	quarterly	Rossi (1989)
	(0.24)	(0.38)	1980:1–1985:4	
Chile	1.56	−0.09	quarterly	Table A.1 in Appendix.
	(0.14)	(0.04)	1976:2–1989:2	
	1.04	−0.5	Quarterly	Arrau et al. (1991)
	(0.19)	(0.34)	1975:1–1989:3	
Israel	0.89	−0.15	quarterly	Arrau et al. (1991)
	(0.38)	(0.28)	1974:2–1988:3	
Mexico	1.02	−0.54	quarterly	Arrau et al. (1991)
	(0.43)	(0.49)	1980:1–1989:2	
Uruguay	1.26	−0.22	quarterly	Table A.1 in Appendix.
	(0.17)	(0.10)	1977:2–1989:3	

[a] Standard errors are in parentheses.
In all but Rossi (1989), the scale variable used was consumption.

3.2. Parameters of money demand

While ρ takes center stage as the most crucial parameter in determining the responsiveness of consumption to nominal interest rate shocks, other parameters also come into play. As Eqs. (15) and (16) illustrate, the parameters of the money demand are needed to determine the path of the effective price of consumption. In the most general case, this involves having estimates of both the elasticity of the demand for money with respect to consumption and the opportunity cost of holding money, $i/(1+i)$. Such estimates for the countries of interest are summarized in Table 2. [21]

Table 2 does not review the considerable literature on the demand for money in developing countries, because most studies rely on annual data and use income as the scale variable and i as the measure of opportunity cost. Rather, the approach is selective, and includes mostly the results of studies that conform closely to the

[21] Note, however, that in the specific technology outlined in the previous section (Eq. (2)), it is assumed that the consumption-elasticity of money demand is unity. As Table 2 indicates, this restriction appears to accord rather well with the data.

specification suggested by the theoretical model. As outlined in the Appendix, we obtained some of these estimates by jointly estimating the Euler equation with the first-order condition that defines the demand for money. Most of the other estimates also follow from transactions-costs models (see Arrau et al., 1991). [22]

4. Numerical results

This section uses the closed-form solution for consumption derived in Section 2 and the parameter estimates discussed in Section 3 to undertake some numerical exercises aimed at assessing the quantitative importance of the 'temporariness' hypothesis. Under this hypothesis, the public expects that the stabilization plan announced by the authorities will be reverted in the future. Therefore, it will be assumed throughout this section that the *initial* interest rate is expected to be restored sometime in the future. Hence, the initial fall in the nominal interest rate is the same as the *expected* future increase, which is what is relevant for consumption decisions. [23]

The first numerical exercise is intended as an illustration of the order of magnitudes involved for a plausible range of parameters. Based on Eqs. (14) and (16), Table 3 reports increases in consumption (in percentage points) as a function of the fall in the nominal interest rate, for different values of the intertemporal elasticity of substitution (ranging from 0.1 to 0.8), and the credibility horizon (ranging from 1 to 20 quarters). [24] Four initial values of i – which roughly correspond to the actual stabilization episodes discussed below – are considered, ranging from 15 to 95 percent per quarter. The nominal interest rate is always assumed to fall to 10 percent. From Table 3, four important observations follow:

(i) There is a wide range of predictions for the rise in consumption depending on the parameter configuration, the lowest being 0.68 percent and the highest being 55.11 percent.

[22] In addition to using the specification implied by theory, the estimates presented in Table 2 also have the advantage that the sample periods covered include most of the stabilization episodes of interest.

[23] The advantage of this criterion is that it can be applied to both successful and unsuccessful programs. An alternative strategy for the failed programs would be to take the nominal interest rate prevailing at the end of the program as the 'terminal' condition. As discussed below, using this alternative criterion would not change the basic message of this section since, in most of the failed programs, nominal interest rates at the end of the programs did not differ markedly from their pre-stabilization levels (see Fig. 1).

[24] The parameters k_0 and k_1 were set to 48.29 and 8.26, respectively, which are the averages of the estimates for Argentina, Chile, and Uruguay reported in the Appendix (under the assumption that $k_1 = 1 + k_2$, as discussed in the Appendix). In addition, r was set to 0.007417 (3% in annual terms) and $\bar{y}$ to unity.

Table 3
Increase in consumption under alternative parameter configurations [a]

	Intertemporal elasticity of substitution	Fall in quarterly interest rates (in percentage points)			
		15 to 10	25 to 10	45 to 10	95 to 10
$T=1$	0.1	0.78	1.91	3.59	5.65
	0.3	2.37	6.08	11.14	17.92
	0.5	3.98	10.34	19.25	31.60
	0.8	6.45	17.04	32.51	55.11
$T=4$	0.1	0.77	1.94	3.50	5.52
	0.3	2.32	5.94	10.87	17.46
	0.5	3.89	10.09	18.75	30.69
	0.8	6.30	16.60	31.57	53.26
$T=8$	0.1	0.74	1.89	3.40	5.35
	0.3	2.25	5.76	10.52	16.86
	0.5	3.78	9.76	18.10	29.54
	0.8	6.10	16.04	30.38	50.92
$T=12$	0.1	0.72	1.83	3.30	5.19
	0.3	2.18	5.58	10.18	16.29
	0.5	3.66	9.45	17.48	28.43
	0.8	5.92	15.50	29.23	48.72
$T=20$	0.1	0.68	1.72	3.10	4.87
	0.3	2.05	5.24	9.54	15.21
	0.5	3.40	8.86	16.31	26.37
	0.8	5.60	14.48	27.10	44.67

[a] The increase in consumption is expressed in percentage points.
The credibility horizon, T, is measured in terms of quarters.

(ii) For given ρ and T, the magnitude of the fall in i has a dramatic effect on the rise in consumption. Consider, for instance, the row in Table 3 corresponding to $T=4$ and $\rho=0.3$. The rise in consumption varies from 2.32 to 17.46 percent depending on the magnitude of the fall in i.

(iii) For a given fall in i and a given T, changes in ρ substantially affect the initial rise in consumption. Consider, for instance, a fall in i from 45 to 10 percent. For $T=4$, the rise in consumption varies from 3.5 percent (for $\rho=0.1$) to 31.57 percent (for $\rho=0.8$).

(iv) For a given fall in i and a given value of ρ, the increase in consumption responds very little to changes in the credibility horizon. For instance, consider the case in which i falls from 95 to 10 percent and $\rho=0.1$. When $T=1$, the rise in consumption is 5.65 percent; when $T=20$, the rise in consumption is still 4.87 percent. For higher values of ρ, the impact of a higher T is larger but still relatively unimportant compared to changes in other parameters. Intuitively, this lack of responsiveness of the rise in consumption to the credibility horizon is explained by the fact that the weight given to the low effective price (which depends on T) in computing the average effective price remains small compared to the relevant time horizon (infinity). [25]

We now turn to the main numerical exercise, reported in Table 4, which consists in computing the predicted rises in consumption for the seven major stabilization programs illustrated in Fig. 1 and comparing these predictions to the actual figures.

Column (1) in Table 4 reports the first quarter during which the plan was in effect. [26] Column (3) indicates the (deposit) nominal interest rate prevailing in the quarter before the plan was implemented, which is taken as i^{H}. [27] The criteria used for columns (2), (4) and (5) vary according to whether the plans were successful or not. For the plans that failed (the three 'tablitas,' the Austral, and the Cruzado plans), the basic criterion was to identify a point in time (reported as 'last quarter' in column (2)) at which the nominal interest rate went back to values comparable with those prevailing at the beginning of the stabilization, thus identifying an 'interest-rate cycle.' [28] [29] The value of T in column (5) is the number of quarters that the interest-rate cycle lasted. The lowest nominal interest rate observed during this period, reported in column (4), was taken as i^{L}.

For the successful stabilizations of Israel and Mexico, a period of five years following the implementation of the programs was taken as the relevant time frame. The final quarter of this period is reported as the 'last quarter' (column (2)). [30] Column (4) reports the lowest nominal interest rate during this period, which is used as i^{L}. The parameter T (column (5)) was chosen as the number of quarters in the program after which private consumption reached its maximum value.

In all cases, column (6) reports the relevant value of ρ, based on the discussion in Section 3, while column (7) indicates the value of the actual increase in consumption, computed by comparing the peak level of (seasonally adjusted)

[25] The relative unimportance of T should be viewed as an appealing feature of the model because too much responsiveness of the rise in consumption to T would make any actual value consistent with the predictions of the model, given that T is an unobservable variable.

[26] If a program started late in a given quarter, then the first quarter of the program is taken to be the following one.

[27] The complete data set for each program is available upon request.

[28] This seems a natural criterion since the 'temporariness' hypothesis is based on the idea that the nominal interest rate is expected to go back to its initial level.

[29] Note that, with the exception of the Austral plan, the 'last quarter' so chosen roughly coincides with the actual end of the programs (Fig. 1). In the case of the Austral plan, a succession of plans delayed the return of nominal interest rates to levels comparable (although still lower) to those prevailing before the plan.

[30] Although this is an arbitrary choice, it was inspired by the Israeli plan where the consumption boom–recession cycle covered a period of five years (Fig. 1).

Table 4
Actual and predicted increases in consumption

Stabilization program	First quarter (1)	Last quarter (2)	Initial interest rate (3)	Lowest interest rate (4)	T (no. of quarters) (5)	Intertemporal elasticity of substitution (6)	Increase in consumption		Share of predicted to actual (9)
							Actual (7)	Predicted (8)	
Argentine tablita	79.1	81.1	21.5	15.0	9	0.21	17.5	1.6	9.1
Chilean tablita	78.1	82.4	18.9	7.1	20	0.19	33.0	3.1	9.4
Uruguayan tablita	78.4	82.4	10.8	8.6	17	0.53	16.0	1.8	11.3
Austral plan	85.3	88.2	93.9	9.6	12	0.21	16.2	11.3	69.8
Cruzado plan	86.2	86.4	38.7	5.2	3	0.43	12.5	18.7	150.0
Israeli plan	85.3	90.2	41.9	2.8	11	0.33	23.9	16.0	66.9
Mexican plan	88.1	92.4	20.9	3.3	20	0.43	13.9	11.5	82.7

Interest rates are expressed in percent per quarter. The increase in consumption is expressed in percentage points. See the text for a discussion of the criteria used for different columns.

Sources: International Financial Statistics, IMF, various central bank bulletins, and the authors.

private consumption during the period determined by columns (1) and (2) to the initial value. [31] Column (8) reports the predicted increase in consumption, which results from using the chosen values of T, ρ, i^L, and i^H in Eqs. (14) and (16). Finally, column (9) compares actual versus predicted values.

Column (9) suggests that, in the Southern-Cone 'tablitas,' the 'temporariness' hypothesis accounts only for about 10 percent of the actual increase in consumption. [32] Given the magnitude of the observed fall in nominal interest rates, Table 3 suggests that the results are robust in the sense that even somewhat higher elasticities of substitution would imply increases in consumption that fall way short of actual ones. [33]

In contrast, for the shock programs of the mid 1980s, the 'temporariness' hypothesis works fairly well since it predicts increases in consumption that account from 66 to 83 percent of the actual increase in three of the four plans (see column (9)). In the Cruzado Plan, the model overstates the actual rise. Hence, in spite of relatively low elasticities of substitution, the fall in nominal interest rates was large enough to lend support to the 'temporariness' hypothesis. Furthermore, Table 3 suggests that, given the observed declines in nominal interest rates, elasticities of substitution would have to be substantially lower for the overall conclusion to change.

5. Final remarks

This paper represents a first attempt to evaluate the quantitative importance of the 'temporariness' hypothesis in explaining the initial consumption boom observed in exchange rate-based stabilizations. A closed-form solution for consumption was used to compute the predicted increases in consumption in seven major stabilizations programs. In four out of seven cases, the model predicts increases in consumption that account for at least two thirds of those observed. In the three remaining cases, the predicted rises in consumption account for only a small share of the actual increase in consumption. Our results thus suggest that the 'temporariness' hypothesis might be quantitatively relevant in episodes in which nominal interest rates fell by a substantial amount (i.e., by more than 15 percentage points

[31] For Argentina, consumption figures refer to total (private and public) consumption.

[32] Elsewhere (Reinhart and Végh, 1992), we argue that taking into account the effects of lower real interest rates improves considerably the predictive power of the model for Chile, somewhat for Argentina, and not at all for Uruguay.

[33] If interest rates observed around the end of the program were used as i^H, the share of predicted to actual increase in consumption would be 6.5 percent for Chile, 21.7 percent for Argentina, and 34.5 percent for Uruguay. Hence, although there is an improvement in the predictions of the model for Argentina and, in particular, Uruguay, the fact remains that the temporariness hypothesis accounts for at most a third of the actual consumption increase.

per quarter). Since intertemporal elasticities of substitution are small, large declines in interest rates are needed to generate consumption booms of the order of magnitude that has been observed.

We feel that, if anything, the estimates provided in this paper should be viewed as a lower bound for the importance of the 'temporariness' hypothesis. The reason is that the model does not incorporate durable goods, which play an important role in practice since a large part of the upsurge in consumption takes the form of imported durable goods. [34] The presence of durable goods is likely to increase the quantitative importance of intertemporal substitution for two main reasons. First, the introduction of durable goods might yield higher intertemporal elasticities of substitution, as found by Fauvel and Sampson (1991) for Canada. Second, in addition to intertemporal *consumption* substitution, durable goods would introduce intertemporal *price* substitution because goods can be stored (see Calvo, 1988). Unfortunately, data on durable goods consumption for most of these countries (with Israel being a notable exception) is not readily available, which makes an empirical verification of the importance of these effects rather difficult.

Appendix

A.1. Consumption path with wealth effect

Suppose that transactions costs constitute a social cost. Then, proceeding as in the text, and under the assumption that i follows the path given by (13), it can be shown that the path of consumption is given by

$$c_t = \frac{\bar{y}}{1+v\left[L(I^{\mathrm{H}})\right]} \times \frac{1}{\left(1-\left(\frac{1}{1+r}\right)^T\right)\left(\frac{1+v\left[L(I^{\mathrm{L}})\right]}{1+v\left[L(I^{\mathrm{H}})\right]}\right)+\left(\frac{1}{1+r}\right)^T\left[\frac{p(I^{\mathrm{L}})}{p(I^{\mathrm{H}})}\right]^{\rho}}, \quad 0 \leqslant t < T, \tag{A.1}$$

$$c_t = \frac{\bar{y}}{1+v\left[L(I^{\mathrm{H}})\right]} \times \frac{1}{\left(1-\left(\frac{1}{1+r}\right)^T\right)\left(\frac{1+v\left[L(I^{\mathrm{L}})\right]}{1+v\left[L(I^{\mathrm{H}})\right]}\right)\left(\frac{p(I^{\mathrm{H}})}{p(I^{\mathrm{L}})}\right)^{\rho}+\left(\frac{1}{1+r}\right)^T}, \quad t \geqslant T. \tag{A.2}$$

[34] The role of durable goods in stabilization programs has been emphasized by, among others, Dornbusch (1985), Calvo (1988), Drazen (1990), and De Gregorio et al. (1993).

Note that setting $\{1+v[L(I^{\mathrm{L}})]\}/\{1+v[L(I^{\mathrm{H}})]\}=1$ is equivalent to eliminating the wealth effect. If $\bar{y}$ is adjusted so as to ensure that initial consumption is the same in both cases (i.e., with and without wealth effect), Eq. (A.1) indicates that consumption increases by more in the presence of the wealth effect. This is to be expected because transactions costs per unit of consumption after $t=0$ are, on average, lower than before, which results in a positive wealth effect.

Eq. (A.2) indicates that consumption falls at time T, as was the case before. However, depending on how strong the wealth effect is, it follows from Eq. (A.2) that consumption after T could be higher than initially. Note, incidentally, that this is a sufficient condition to ensure that a temporary stabilization could be welfare *improving*. In sharp contrast, temporary stabilization is always welfare *decreasing* in cash-in-advance models (i.e., Calvo, 1986), because there are no wealth effects which may offset intertemporal distortions (see Kimbrough (1992) for a related discussion).

A.2. Empirical estimates

Consider the following general transactions technology:

$$s_t = k_0 c_t^{k_1} m_t^{-k_2} \theta_t^{k_3}, \quad k_0,\, k_2,\, k_3 > 0,\; k_1 > 1, \tag{A.3}$$

where θ represents a proxy for financial innovation (which often takes the form of dollarization), an important phenomenon in high-inflation countries. In this more general setting (with uncertainty), the first-order conditions are given by:

$$\log(m_t) = \frac{1}{1+k_2}\log(k_0 k_2) + \frac{k_1}{1+k_2}\log(c_t) - \frac{1}{1+k_2}\log(I_t) + \frac{k_3}{1+k_2}\log(\theta_t), \tag{A.4}$$

$$E_t\left(\left(\frac{c_t}{c_{t+1}}\right)^{1/\rho}\frac{p_t}{p_{t+1}}(1+r_t)\right) = \frac{1}{\beta}, \tag{A.5}$$

Eq. (A.4) defines the demand for money, while Eq. (A.5) describes the dynamics of consumption. [35] The effective price of consumption, p_t, is defined as

$$p_t = 1 + \frac{k_1}{k_2}\frac{i_t}{1+i_t}\frac{m_t}{c_t}. \tag{A.6}$$

The two first-order conditions (A.4) and (A.5) were jointly estimated using Hansen's (1982) generalized method of moments (GMM). The estimation results

[35] Note that the theoretical model of Section 2 assumes that $k_1 = 1 + k_2$ (which sets to unity the consumption-elasticity) and $k_3 = 0$.

Table A.1
Transactions Technology and Household Behavior: Estimation Results

	Argentina	Chile	Uruguay
Sample period	1978:1–1989:2	1976:2–1989:2	1977:2–1989:3
Transactions technology			
k_0	58.34	86.52	0.01
	(748.68)	(473.98)	(0.08)
k_1	8.40	16.42	5.74
	(2.67)	(7.11)	(3.01)
k_2	8.71	9.54	3.54
	(2.24)	(4.30)	(1.99)
k_3	6.20	−0.15	1.27
	(1.69)	(0.43)	(0.67)
Money demand elasticities			
Consumption: $k_1/(1+k_2)$	0.86	1.56	1.26
	(0.17)	(0.14)	(0.17)
Interest rate: $-1/(1+k_2)$	−0.1	−0.09	−0.22
	(0.02)	(0.04)	(0.10)
Financial innovation: $k_3/(1+k_2)$	0.64	−0.01	0.28
	(0.06)	(0.04)	(0.03)
Consumption parameters			
Discount factor	1.03	1.02	0.96
	(0.03)	(0.03)	(0.02)
Intertemporal elasticity	0.21	0.19	0.53
of substitution	(0.03)	(0.10)	(0.22)
J statistic	15.67	17.51	16.03
	(0.63)	(0.49)	(0.59)

Standard errors and probability values appear in parentheses for the parameter estimates and the J statistic, respectively. A negative time trend proxies for the unobserved process of financial innovation.

are presented in Table A.1, which also describes the sample period and provides the J-statistics that test the overidentifying restrictions of the model. [36]

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[36] The reader is referred to Reinhart and Végh (1992) – who estimate a variant of this model – for greater detail of the data, the estimation methods, and a discussion of some of the problems encountered.

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