Chapter 1: The Literature on ERBS

1.1 Introduction

The difference between an exchange-rate-based stabilization (ERBS henceforth) and a money-based stabilization formally lies in the selection of the nominal anchor: the exchange rate or a monetary aggregate. However, the consequences of the choice of the nominal anchor differ considerably: Inflation stabilization programs that use money as the nominal anchor involve an initial recession followed by the recovery of economic activity. Tight monetary policy brings down inflation gradually at the cost of higher unemployment and lower output. The recessionary effect of money-based stabilization programs has been observed in a wide range of countries including industrial low inflation countries and chronic inflation countries.¹

Based on the experience from money-based stabilization programs, disinflation has been viewed as contractionary in the literature. Although the conventional view about the contractionary effects of inflation stabilization has not gone unchallenged², the fundamental challenge emerged in the late 1970s when Chile, Argentina and Uruguay established an active crawling peg regime as

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the main instrument of disinflation. These programs, known as the Southern Cone tablitas, followed strict orthodox lines in the sense that exchange rate was the sole nominal anchor. Inflation was to decline quickly to the rate of devaluation. Contrary to the expectations, however, the inflation declined only slowly, which resulted in a sustained and large real exchange rate appreciation.³ Disinflation was accompanied by a boom in private consumption and real GDP. A more striking fact was the surge in consumers’ demand for durable goods.⁴ The recessionary phase appeared only later in the programs. And the programs eventually ended in full-blown balance of payments crises with costly devaluations and large losses of international reserves. In the mid 1980s, Argentina, Brazil, and Israel supplemented exchange rate with wage-price controls to bring down inflation quickly. In these heterodox ERBS plans inflation came down rapidly to much lower levels compared with the Southern Cone orthodox ERBS episodes. Real

³ In Uruguay, real exchange rate appreciated by a staggering 78.8% (Table.5 in Calvo and Vegh, 1995). During the Chilean tablita, real exchange rate appreciated by 25%. And in Argentina, real appreciation was 15% (Table.1 in Helpman and Razin, 1987).

⁴ In Chile, real per capita consumption of durable goods rose by 120-130% from the beginning of the program to the year in which private consumption peaked. In Uruguay, real per capita car sales (a proxy for durable goods) rose by 140% from the beginning of the program to the year in which private consumption peaked (Figure.1 in De Gregorio et.al, 1998). In the case of Argentine tablita, the average annual real rate of growth of car sales in the three years before the plan was -7.2%. The growth rate jumped to 31.9% in the early stages of the program (Table.1 in De Gregorio et.al, 1998).
appreciation remained as an issue however, and the boom-recession cycle observed in the Southern Cone tablitas reemerged.

The experience from the ERBS programs generated a very controversial literature regarding the effects of disinflation programs especially on real consumption and output. This chapter provides a critique of the literature on ERBS. In the first section I discuss the empirical studies attempted to document the macroeconomic regularities associated with ERBS plans. In the second section I discuss diverse theoretical models that have been advanced in order to explain the ERBS syndrome.

1.2 Empirical Studies of ERBS

Based on the twelve major ERBS programs which were undertaken in Argentina, Brazil, Chile, Israel, Mexico and Uruguay, first-generation studies described below have identified the following stylized facts associated with ERBS: After the exchange rate is fixed, private consumption rises rapidly driven mainly by a boom in consumption of durable goods and continues to increase for several years. Large increases in imports of durable goods lead a considerable deterioration in trade balance. The increase in consumption is accompanied by an expansion in output in the early stages. Inflation usually falls, but convergence to
the devaluation rate is slow and incomplete, which results in sustained real exchange rate appreciation. During the program, the current account deficit increases sharply and is financed by large capital inflows, leading to an increase in foreign liabilities. The capital inflows are also associated with a large increase in the ratio of money balances to GDP. The duration and depth of this expansionary phase varies considerably across stabilization episodes. Later on, however, the initial boom is reversed and real output contracts. The recession may occur either before or when the program ends. Most of the time, it starts before the program ends and as the recession sets in the real exchange rate continues to appreciate. The program ends usually with a massive attack on currency, is followed by a sharp nominal devaluation; sometimes inflation then surges to a level even higher than before the program was implemented.

By analyzing raw data from the ERBS episodes in Latin America and Israel, Kiguel and Liviatan (1992) and Vegh (1992) concluded that the business cycle associated with ERBS are strikingly different from those associated with money based stabilization plans: ERBS is characterized by an initial increase consumption and real GDP followed by a later contraction, pronounced deterioration in current account, and sustained real exchange rate appreciation.
Then, Reinhart and Vegh (1995b) analyzed the real effects of ERBS associated with twelve major ERBS plans which took place in six chronic inflation countries. By using panel regressions they found a boom-bust cycle in real GDP, real private consumption and fixed investment: During the early stages of an ERBS, growth in real GDP is 2.4%, growth in real private consumption is 5%, and growth in fixed investment is 5.9% higher than the historical trends. The main driving force behind the faster growth is consumption however, rather than investment. The consumption-GDP ratio rises significantly during the early stages while the investment-GDP ratio does not change significantly. De Gregorio, Guidotti, and Vegh (1998) extended the type of analysis in Reinhart and Vegh (1995b) to account for the behavior of durable good. Their panel data estimates from seven major ERBS plans in five chronic inflation countries suggest that the real rate of growth of per-capita consumption of durable goods is 29.06% higher relative to trend in the early phases of ERBS programs and 21.46% lower in the late stages. Later, panel regressions in Calvo and Vegh (1999) support the notion that the boom-bust cycle associated with ERBS is most pronounced for durable goods and least pronounced for GDP, with private consumption falling somewhere in between. The evidence with regard to investment on the other hand is
inconclusive.\textsuperscript{5} The International Monetary Fund (IMF) also considered the expansionary effects of ERBS and the recessionary effects of MBS to be an important stylized fact of inflation stabilization programs.\textsuperscript{6}

First-generation empirical studies have been criticized mainly because of the small samples they were based on. In an attempt to produce a larger sample Easterly (1996) used a rule based selection of inflation stabilization episodes. He defined a stabilization episode as a switch from a period of at least two consecutive years of inflation above 40 percent to a period of at least two consecutive years of inflation below 40 percent. The problem associated with this sort of sample selection is that stabilization episode is defined by its success. Hence, short-lived stabilization attempts would not have been picked up. In fact, Easterly’s (1996) list excludes a number of well-known ERBS episodes such as Argentine and Chilean tablitas of the late seventies and the heterodox plans of Argentina and Brazil in the mid 1980s. As comes to the results, based on a sample of 28 stabilization episodes, Easterly (1996) argued that inflation stabilizations are expansionary regardless of the nominal anchor.

\textsuperscript{5} Other first-generation empirical studies aimed at identifying the stylized facts include Calvo and Vegh (1994b) and Reinhart and Vegh (1994).
\textsuperscript{6} See IMF Survey (1995).
Following an approach similar to Easterly (1996), Hamann (2001) reexamined the stylized facts by using a sample of 51 stabilization episodes. The results he found challenged some of the stylized facts uncovered in the first-generation case studies: Output dynamics do not differ significantly between ERBS programs and non-ERBS programs in the sense that economic growth improves following the stabilization in either case. Private consumption surges following the implementation of the ERBS program, but it does not exhibit a unique pattern. In some cases, consumption boom lasts until the end of the program hence the current account deficit increases continuously; in others, the initial consumption boom is followed by a contraction and the current account deficit turns into a surplus sometime before the program ends. The only fact he agreed on with small sample studies is that real exchange rate appreciates continuously during ERBS episodes. In contrast to Easterly (1996) and Hamann (2001), in a study based on 27 stabilization episodes, Fisher et.al (2002) found statistical support for initial expansionary effects of ERBS on output and consumption.

Recently, Hamann (2005) analyzed the issue whether ERBS programs generate a distinctive boom-bust cycle in output, but focusing on de facto ERBS
programs where the exchange rate anchor was not preannounced. Since he did not find any statistical evidence to support boom-bust cycle during de facto ERBS episodes, Hamann (2005) concluded that among episodes where a preannounced exchange rate anchor was used, the preannouncement of the policy may have led to a temporary surge in demand and output. For a couple reasons, however, the evidence presented in Hamann (2005) is questionable: First, the selection procedure, gave the wrong start date for the Uruguay (1978) ERBS plan. Hamann (2005) says that a stabilization episode starts when inflation declines significantly after remaining above a threshold value for at least 24 months. Since the inflation increased initially in the wake of 1978 program in Uruguay, the program is dated as 2 years late. For similar reasons Argentine (1978) tablita is also dated a year late. Second, all programs where the rate of crawl was reduced for a sustained period was defined as ERBS programs, even when many are not. Peru (1986) for example, was a program that eliminated hyperinflation, not an ERBS. Another work aimed at reexamining the stylized facts by using panel data sets is Fischer et.al (1996). Based on a 25 country sample, they found evidence for the transition

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7 For instance, central bank buys and sells foreign currency on a daily basis to keep the real exchange rate constant even though there is no preannounced exchange rate path (ie.,Turkey 1981 stabilization program).
economies in favor of expansionary stabilizations; however the level of growth was more pronounced for the case of ERBS.

Even though second-generation findings based on panel data sets dispute the validity of empirical regularities associated with ERBS, the results found can be doubted considering the major obstacles that these studies face about the definition of stabilization episodes, the classification of episodes by type of nominal anchor, and the need to control for other domestic and external shocks. Overall, the evidence supports the view that there exists a boom-bust cycle associated with exchange rate based stabilization plans.

1.3 Theoretical Models of ERBS

Aside from the empirical studies, various optimizing models have been advanced in order to generate and explain the stylized facts. Based on explanations that the models have relied on, theoretical literature can be separated into two main categories: demand-side based models and supply-side based models. Early demand side theories, Dornbusch (1982) and Rodriguez (1982) focused on the inflation inertia. Rodriguez (1982) was the first to point out that a credible disinflation can actually induce a consumption boom and a sharp real exchange rate appreciation simultaneously. In his model, inflation of nontraded goods is
determined by excess demand/supply and expectations of inflation in that market while inflation expectations are guided by an adoptive mechanism with respect to prices of nontraded goods.

\[ \pi_N = \pi_N^e + aED_N, \quad 0 < a < 1 \]

\[ \pi_N^e = z(\pi_N - \pi_N^e), \quad 0 < z < 1 \]

Since the economy is assumed to be perfectly integrated with international capital markets, the nominal domestic interest rate is equal to the nominal foreign interest rate plus the rate of devaluation plus risk premium which is assumed to be constant. The domestic real interest rate on the other hand is given by the difference between domestic nominal interest rate and the expected rate of domestic inflation.

\[ i = i^* + \chi + k, \quad r = i - \pi^e \]

Furthermore, it is assumed that excess demand for nontraded goods responds negatively to the real interest rate. In this setup, a reduction in the rate of devaluation immediately reduces the nominal interest rate and hence the real interest rate. Lower real interest rate generates excess demand for nontraded goods implying an actual rate of inflation in excess of the expected rate of
inflation in the nontraded goods market. Accelerated nontraded goods inflation then increases the expected domestic inflation through

\[ \pi^e = b\pi_r + (1-b)\pi^e_N \]

The increase in inflation reduces the real interest rate even more, and hence stimulates aggregate demand more. But this situation is eventually reversed as adoptive expectations combined with exchange rate peg leads to a sustained real exchange rate appreciation.

Rodriguez (1982) was motivated from the fall in real interest rates observed in the initial stages of Argentine tablita. So, his model relies on ex-post lower domestic real interest rates, which is too specific to qualify as a general explanation for the stylized facts considering that the impact response of domestic real interest rates has been usually ambiguous during ERBS episodes.³⁸

Dornbusch (1982) emphasizes the eventual recession instead of initial boom associated with ERBS. In the model inflation is governed by real appreciation and the deviation of output from its full employment level. That is

\[ \dot{\pi} = \alpha(e + \pi^e - \pi) + \beta(y - \bar{y}) \]

³⁸ Ex-post domestic real interest rates have declined in the initial stages of orthodox Southern Cone tablitas. However, they have increased in the early stages of the heterodox programs of the mid 1980s. Following the launch of the Turkish 2000-2001 heterodox program on the other hand, domestic real interest rates declined substantially.
Accordingly reduced rate of depreciation, $e + \pi^*$, causes persistent real appreciation since disinflation would be very gradual due to widespread indexation, hence leads a severe recession in the economy. His explanations however, rely on an ad-hoc equation of inflation instead of a solid theory.

Another demand-based explanation belongs to Helpman and Razin (1987) and Drazen and Helpman (1988). In an attempt to examine the consumption boom, sustained real appreciation and the deterioration in trade deficit brought about by disinflation attempts in Argentina (1978-1981), Chile (1978-1979), and Israel (1982-1983), Helpman and Razin (1987) constructed an overlapping generations model. Via Ricardian nonneutralitiy channel, the paper analyzes the real effects of a cut in the rate of currency devaluation which is not accompanied by a fiscal adjustment thereby implying the need for a future policy change. Accordingly, an unexpected nominal currency peg at time $t = 0$ creates an unexpected capital gain on real money balances and an unexpected real loss due to increase in future tax liabilities. To the agents who are alive in period zero, currency peg creates a wealth effect and stimulates consumption spending since the increase in the present value of future tax liabilities is smaller than the period zero capital gain.
In Drazen and Helpman (1988), real effects of a reduction in the rate of currency devaluation stem from the expectations of a future policy change. To be more specific, authorities reduce the rate of currency devaluation without any fiscal adjustment which then induces expectations of a further policy change. In order to explain the dynamics following the reduction in the rate of devaluation, the paper concentrates on the role of expected policy adjustments. When fiscal adjustment is expected to materialize through a budget cut on traded goods for instance, private consumption of traded goods increases and generates a current account deficit prior to fiscal adjustment. If fiscal adjustment is expected to happen through a future tax increase on the other hand, time profile of private consumption does not change prior to increase in taxes.

The most popular demand-side theory “weak credibility” has been introduced by Calvo (1986) as the driving force of the ERBS syndrome. Calvo and Vegh (1993) developed this theory further by adding non-traded good and sticky prices. Models of weak credibility rely on intertemporal substitution effects as the key channel through which stabilization plans may have real effects. When the reduction in the rate of devaluation is not credible, in the sense that the public expects that the program will be abandoned at some point in the future, the fall in
the nominal interest rate resulting from the lower devaluation rate and perfect capital mobility, is viewed as temporary. Because of the cash-in-advance constraint this temporary fall in the nominal interest rate reduces the effective price of consumption today relative to the future. Hence, demand for both traded and non-traded goods increases and leads to an initial expansion in the non-traded goods sector and a current account deficit. Since prices are sticky, the slow convergence of inflation results in a sustained real exchange rate appreciation, which eventually reduces the demand for non-traded goods. As a consequence, output falls and a recession sets in. The recession may occur either before or when the program ends. Furthermore, the real effects caused by a non credible stabilization do not depend on whether the program is eventually abandoned, as the public expected, or not. The qualitative predictions of Calvo and Vegh (1993) are generally consistent with the stylized facts except one thing. The model cannot generate gradually increasing consumption in the early phase. Consumption jumps at the moment the program is announced and immediately begins to decline steadily until the date of the collapse. In the data however, consumption usually increases rapidly for several years and then slows toward the end of the program.
In some cases, consumption declines in absolute terms before the program collapses.

The most common criticism of weak credibility is that it relies critically on intertemporal elasticity of substitution which is small in developing countries. Reinhart and Vegh (1995a) have examined the empirical relevance of this hypothesis, by estimating the intertemporal elasticity of substitution for five chronic inflation countries (Argentina, Brazil, Israel, Mexico, and Uruguay). Using these estimates, ranging from 0.19 to 0.53, they computed the predicted increases in consumption for seven major ERBS programs (the Southern-Cone orthodox stabilizations of the 1970s in Argentina, Uruguay, and Chile; and the heterodox stabilizations of the 1980s in Brazil, Argentina, Israel, and Mexico). Unfortunately, weak credibility could account for 60 percent of the observed increase in consumption in the four heterodox plans, whereas it could account for only about 10 percent of the actual increase in consumption in the Southern Cone tablitas.

Rebelo (1993), Roldos (1995, 1997), and Uribe (1997) proposed supply-side hypothesis, which combines perfect credibility, flexible prices, capital

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9 Estimates places intertemporal elasticity of substitution between .20 and .50 for developing countries (Table 10.1 in Agenor and Montiel, 1996).
accumulation, and endogenous labor supply. The role of capital accumulation in generating a sustained real exchange rate appreciation has been first emphasized by Rebelo (1983). Later, Roldos (1995) presented a model in which consumption and capital goods are both subject to cash-in-advance constraint and capital is used only in the traded goods sector. In this set up, a perfectly credible reduction in the rate of devaluation lowers nominal interest rate, which in turn reduces the wedge between the rate of return on foreign bonds and domestic physical capital, thus encouraging capital accumulation. Due to convex adjustment costs capital adjusts slowly to its higher long-run level. The instantaneous increase of consumption of traded goods combined with slow adjustment of output in the traded goods sector causes a cumulative current account deficit. Meanwhile, capital accumulation in the traded goods sector draws labor away from nontraded goods sector causing a sustained real exchange rate appreciation. Searching for an explanation regarding the stylized facts of ERBS programs without resorting to weak credibility, adaptive expectations, or sticky prices, Uribe (1997) constructed a similar model in which capital is used in both traded and nontraded goods sector. The model was calibrated to the Argentine economy so as to compare its quantitative performance with the Argentine Convertibility plan of 1991.
Although the numerical results are close to the actual magnitudes observed during the Convertibility plan; they rely critically on some unsatisfactory features such as gestation lags, shoe-leather costs, and particularly cash-in-advance constraint on purchases of capital goods, which does not have a clear economic interpretation. It is highly implausible that all investment activity is carried out through cash payments upfront. Furthermore, the notion that purchases of capital goods are subject to cash-in-advance constraint implies a strict negative relationship between investment and inflation while the evidence presented in Easterly (1996), Bruno and Easterly (1998), and Calvo and Vegh (1999), casts some doubts on the empirical relevance of the investment channel: “Higher investment is absent in the early years of disinflation episodes, thus observed growth is not driven by investment”.

Other major channel for real effects in supply-side models is labor supply. Roldos (1997) and Lahiri (2001) have used endogenous labor-leisure choice based on the idea previously investigated by Aschauer and Greenwood (1983) and Stockman (1985). Consumption is subject to cash-in-advance constraint, and inflation creates a distortion between consumption and leisure. Lower nominal interest rate changes the marginal rate of substitution between consumption and
leisure thus altering the optimal mix of two. Specifically, private agents increase consumption and reduce leisure. In Lahiri (2001), the consequent rise in labor supply then increases marginal product of capital in the traded goods sector thereby inducing higher investment and capital accumulation. Consumption boom combined with sluggish adjustment of output causes cumulative current account deficit. Accumulation of capital draws labor away from leisure and nontraded goods sector leading to a gradual appreciation of the real exchange rate.

As long as they are supplemented by either weak credibility or some nominal rigidity, supply-side models can capture the stylized facts associated with ERBS at a qualitative level. However, their ability to generate strong quantitative short-run effects, especially sizable real exchange rate appreciation, comparable to those observed in data is highly skeptical. The difficulties involved in accounting for the real appreciation could be demonstrated by using a very simple example from Rebelo and Vegh (1995): Suppose a two sector model with Cobb-Douglas production functions representing the technologies

$$Y_T = aL_T^K K^{1-\alpha}$$

$$Y_N = bL_N^\eta T^{1-\eta}$$
The nontraded good is produced by labor and land, \( T \). The traded good is produced by labor and capital. To keep things simple, assume that the stock of land in nontraded goods sector and the stock of capital in traded goods sector are fixed. Also assume that the labor supply is exogenous. Optimal allocation of labor requires equality of marginal productivities across the sectors

\[
P \eta L_N^{\eta-1} T^{1-\eta} = a \alpha L_T^{\alpha-1} K^{1-\alpha}
\]

where, \( P \) is the relative price of nontraded goods, real exchange rate in other words. Instead of nontraded goods sector being labor intensive\(^{10}\), which is the usual case in developing countries, suppose \( \alpha = \eta = 0.5 \) and labor is equally distributed. Under these assumptions, the real exchange rate appreciation, which is the increase in relative price of nontraded goods, coincides with the percentage increase in the hours of work devoted to the nontraded goods sector. In order to explain the 60% appreciation observed in Mexico over the period from 1987 to 1994 for example, \( L_N \) would have to increase by an implausible 60% at the cost of employment in the traded goods sector. The bottom line is, generating large real exchange rate appreciations, while maintaining empirically reasonable income shares of labor requires implausible labor allocations. Even if we consider the fact

\(^{10}\) See chapter 5, p. 153 in Buffie (2001).
that the total labor supply usually increases during inflation stabilization periods, there is very limited support for the hypothesis that labor supply has increased strongly in ERBS episodes. ¹¹

To overcome the problem regarding to real appreciation, supply-side models limit capital to the traded goods sector and use cash-in-advance constraint on capital goods, so that capital accumulation in the traded goods sector in response to disinflation, draws labor away from nontraded goods sector causing a sustained real appreciation over time. A realistic model instead would have capital accumulation in the nontraded goods sector. Because the evidence suggests that during ERBS episodes, typically output in the nontraded goods sector has expanded far more than output in the traded goods sector, which even contracted in some cases: During the Israeli 1985 plan for example, the traded goods sector grew at the same rate as before the program, while the nontraded goods sector grew at an annual rate of 7.5% in 1986-1987, compared to 2% per year growth in 1981-1986. In Uruguay, nontraded goods sectors like construction and retail grew by 20% and 22%, respectively, in the first three years of the 1978 tablita, while manufacturing (traded good sector) grew by only 4.7%. In the first two years of

¹¹ For some evidence on Mexico and Argentina, see Roldos (1995).
1988 Mexican heterodox program, some traded goods sectors contracted and nontraded goods sectors typically expanded.\textsuperscript{12} In the case of Turkey, value added in domestic trade sector, which is part of the nontraded goods sector, increased by 11\% (mainly from wholesale and retail) in 2000 compared to a 6.5\% increase in manufacturing industry.

Rebelo and Vegh (1995) have nested almost all of the theories described above in a two sector general equilibrium model to compare their quantitative and qualitative power and the key conclusion was that “Existing models produce consumption booms and real exchange rate appreciations that are too small relative to those observed in the data”. Later, Mendoza and Uribe (1999) have relaxed the perfect foresight assumption and introduced uncertain policy duration in a general equilibrium context. The model can successfully replicates the boom-recession cycle with recession beginning before the collapse. Furthermore, they have managed to generate an initial expansionary phase with continuously rising consumption and gradually appreciating real exchange rate. But, the real appreciations and consumption boom that are produced are still smaller than measured in the data although they are 4 or 5 times larger than those produced by

\textsuperscript{12} See Rebelo and Vegh (1995).
previous models. Then, Uribe (2002) introduced habit formation in a general equilibrium context with flexible prices and weak credibility. When combined with habit formation, weak credibility generates the stylized facts very well at a qualitative level with consumption increasing gradually in the expansionary phase. However, adding habit formation has not improved the quantitative aspect of the results.

Recently, an important contribution came from Atolia and Buffie (2005). In the model they developed, the private sector consumes both durable and nondurable goods, domestic and foreign currency are imperfect substitutes, prices are sticky, and fiscal adjustment is delayed until after ERBS collapses. Incorporating durable consumer goods particularly improves the quantitative power of the weak credibility cum sticky prices hypothesis by generating a strong consumption boom even with very low values for the intertemporal elasticity of substitution. Durables expenditure is a form of investment because most of the good is consumed in the future. Therefore, irrespective of whether the intertemporal elasticity of substitution is large or small, there is an incentive to make large purchases of durable good when its price is temporarily low. This is what Calvo (1988) calls intertemporal price speculation. Besides, durables
expenditure depends on two more factors, which operate even more strongly when the intertemporal elasticity of substitution is low. One of them arises from the interaction of imperfect asset markets and delayed fiscal adjustment. Because the program is believed to be ended soon, the private agent wants to save most of his temporarily higher disposable income. Since access to foreign capital markets is limited, a large part of saving materializes through heavy purchases of durable goods. Other factor arises from the fact that lower inflation increases demand for liquidity services and induces reverse currency substitution. If currency substitution is easy, then the private agent may consume more liquidity services by holding more domestic currency but less total money while consuming part of his broad-money assets.

Consumption boom and real exchange rate appreciations generated in this model are in the order of magnitude that has been observed in ERBS programs. But, the shape of the consumption boom is not in line with the data. After a huge once-and-for-all increase, consumption declines steadily. Seeking better results, Atolia and Buffie (2006) experimented with different ways of adding habit formation to the model. The results suggest that a model with habit affecting deliberation costs may induce hump-shaped profile of consumption.