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Devaluation (levels versus rates) and balance of payments in a cash-in-advance economy

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Abstract

This paper investigates the consequences of the currency devalution, both in levels and rates, on the balance of payments in a cash-in-advance economy with finite horizons, endogenous capital accumulation and international capital immobility. In this context, a once and for all currency devaluation induces a balance of payments surplus, whereas a sustained increase in the rate of devaluation produces, in principle, an ambiguous effect on the balance of payments. If however non-restrictive assumptions on some structural parameters are made, an increase in the devaluation rate leads to a balance of payments surplus, the exact opposite of Calvo's result (1981).

JEL classification: E21, E62.

Keywords: Devaluation; Balance of payments; Cash-in-advance constraint; Overlapping generations.

1. Introduction

In a monetary small open economy operating under international capital immobility and a predetermined exchange rate regime, a once and for all currency devaluation leads to a balance of payments surplus while a sustained increase in the rate of devaluation induces a balance of payments deficit. These results have been demonstrated by Calvo (1981) in a very simple macroeconomic setup, characterized by an immortal representative agent with a fixed endowment, real money balances -the only asset of the system that varies according to current account imbalances- inserted into the utility function, consumers that receive lump-sum compensation for the inflation tax and purchasing power parity.

The effect of the simple exchange rate devaluation on the balance of payments relies upon the "monetary approach" mechanism, while the effect of the increase in the devaluation rate depends on the current account determination of the money supply and the long-run reduction of money holdings determined by higher inflation.

Despite the simplified framework considered, Calvo's findings are very general and robust, in the sense that they are not qualitatively affected by other ways of introducing money into the economy and/or by the consideration of an endogenous capital stock, as an alternative asset to real money balances (see, for example, Dornbusch-Giovannini, 1990, Obstfeld-Rogoff, 1996, and Turnovsky, 1997).[1]

[1] Neither is the introduction of an endogenous labor-leisure choice capable of altering these results, as can be easily deduced from the dual characterization of the present economic context represented by monetary growth models (see Wang-Yip, 1992).

This paper investigates the consequences of the currency devaluation, both in levels and rates, on the balance of payments in a cash-in-advance economy with finite horizons and endogenous capital accumulation. We focus on the case of a Clower constraint imposed on consumption spending alone.

We discover that, for the simple devaluation, the effect shown by Calvo is confirmed, whereas for a sustained increase in the rate of devaluation the effect on the balance of payments is, in principle, ambiguous, reflecting a possible departure from Calvo's findings. However, if non-restrictive assumptions on some structural parameters of the model are made and/or the role of government money transfers in financing consumption expenditure is relatively modest, an increase in the rate of devaluation induces a balance of payments improvement, the exact opposite of Calvo's result.

The rationale for the consequence of the rate of devaluation on the balance of payments obtained in our model is due to the endogeneity of capital stock and the OLG demographics without intergenerational altruism, on the one side, and to the cash-in-advance constraint on consumption spending, on the other. In fact, the first two assumptions assure that an increase in the rate of devaluation -equivalent to a rise in inflation since purchasing power parity holds- augments long-run capital stock and consumption because the lump-sum distribution of seignorage increases saving through intergenerational redistribution of income. The latter assumption -ensuring that money demand is a quasi-fixed proportion of consumption as the money-consumption ratio can solely respond to long-run inflation- may imply, as a consequence of the Tobin effect on capital stock, a steady-state increase in real money holdings, namely money balances accumulation along the transition path through a balance of payments surplus.

2. The model

Consider a small open economy operating under a predetermined exchange rate regime and international capital immobility. There are only two assets in the economy, money and real capital, which cannot be traded at world level.

Domestic output is perfectly substitutable with foreign output, i.e. purchasing power parity holds. The monetary authority depreciates the nominal exchange rate at a constant rate. Therefore, the currency devaluation rate coincides with domestic inflation assuming foreign inflation as being zero. Money supply is determined by the balance of payments, since it adjusts to balance the supply of and the demand for foreign exchange. Money is inserted into the economy through a cash-in-advance constraint imposed on consumption spending. The model is specified in continuous time and perfect foresight is assumed throughout.

The demand-side of the economy is based on the uncertain lifetimes approach of Blanchard-Yaari (see Yaari, 1965, and Blanchard, 1985) with no intergenerational bequest motive extended to a cash-in-advance monetary economy.

Identical individuals face uncertainty about the duration of their lives, since they face a constant probability of death, $\lambda \geq 0$, when they are alive. In every instant of time, a large new cohort is born. The size of each cohort is normalized to one. The population, composed of the cohorts of all ages, remains constant over time, since the birth rate is assumed to equal the death rate.[2]

A logarithmic instantaneous utility function is assumed. The consumer seeks to maximize the following time-separable intertemporal utility function

$$\int_t^{\infty} \ln \tilde{c}(s,v) e^{(\theta+\lambda)(t-v)} dv \tag{1}$$

subject to the instantaneous budget constraint

$$\tilde{c}(s,t) + \frac{d\tilde{a}(s,t)}{dt} = [r(t)+\lambda]\tilde{a}(s,t) + w(t) + \tilde{q}(s,t) - [r(t)+\varepsilon]\tilde{m}(s,t) \tag{2}$$

the cash-in-advance constraint on consumption spending

$$\tilde{c}(s,t) \leq \gamma \tilde{m}(s,t) + \sigma \tilde{q}(s,t), \quad 0 < \sigma \leq \gamma \tag{3}$$

and the condition precluding "Ponzi games"

$$\lim_{v\to\infty} \tilde{a}(s,v) e^{-\int_t^v [r(u)+\lambda]du} = 0 \tag{4}$$

where $\tilde{c}(s,t)$, $\tilde{a}(s,t)$, $\tilde{q}(s,t)$, $\tilde{m}(s,t)$ denote at time t consumption of goods, non-human wealth, lump-sum cash transfers and real money balances of a consumer born at time $s \leqslant t$, respectively; $r(t)$ and $w(t)$ denote the interest rate and non-interest income at time t, respectively; θ, ε, γ and σ are the exogenous rate of time preference, the constant rate of currency depreciation and two positive parameters

[2] The same results can be obtained when overlapping infinitely-lived families, which are not altruistically linked to older cohorts, enter the economy continuously (see Weil, 1991).

of the cash-in-advance constraint, respectively. Labor supply is exogenous and hence normalized to one.

The budget constraint (2) asserts that savings, i.e. non-human wealth accumulation, plus consumption of goods must be equal to the disposable income. The disposable income incorporates the hypothesis that consumers receive an actuarially fair premium $\lambda \tilde{a} (s,t)$ from the competitive life insurance company and give all their wealth to the life insurance company contingent on their death. In addition, income available for consumption and savings includes government lump-sum transfers and takes into account the inflation tax (due to the sustained currency devaluation) on money holdings.

Equation (3) represents the cash-in-advance constraint according to which private money holdings and government lump-sum cash transfers are jointly used to purchase consumption goods.[3] The case $\sigma < \gamma$ is aimed at capturing the circumstance in which the role of government money transfers in financing consumption is relatively modest.[4]

As long as the cost of holding money, i.e. the nominal interest rate, is positive, the cash-in-advance constraint (3) binds since people will not hold money in excess

[3]See, for a similar formulation of the cash-in-advance contraint, Stockman (1981), Gomme (1993) and Walsh (1998). The insertion of money balances into the economy through equation (3) is qualitatively similar to the "money in the utility function" approach when instantaneous preferences are of the type $\ln\left\{U\left[\tilde{c}(s,t), \tilde{m}(s,t)\right]\right\}$, where U is homothetic. See Feenstra (1986) and Marini-Van der Ploeg (1988).

[4]The extreme case $\sigma = 0$ -i.e. a cash-in-advance constraint formulated as in Lucas (1981), Feenstra (1984) and Calvo (1991)- is ruled out, since in such a circumstance, due to the economic environment considered, the aggregate dynamic setup exhibits analitycal problems.

of the amount required for consumption.

In order to simplify the derivation of the optimal conditions for the individual maximization problem, define total or comprehensive consumption, $\widetilde{x}\ (s,t)$, as consumption of goods plus the implicit consumption of money services (given by the nominal interest foregone by holding real balances and spending government cash transfers instead of investing them in other assets)

$$\widetilde{x}\ (s,t) = \widetilde{c}\ (s,t) + [r(t)+\varepsilon]\left[\widetilde{m}\ (s,t) + \frac{\sigma}{\gamma}\,\widetilde{q}\ (s,t)\right] \tag{5a}$$

Hence by using the cash-in-advance constraint (3) along with the definition of $\widetilde{x}\ (s,t)$ in equation (5a), we can express physical consumption as a function of comprehensive consumption

$$\widetilde{c}\ (s,t) = \frac{\gamma\,\widetilde{x}\ (s,t)}{\gamma + r(t) + \varepsilon} \tag{5b}$$

Equation (5b) can be used to re-formulate the optimal program (1)-(4) in terms of $\widetilde{x}\ (s,t)$ instead of $\widetilde{c}\ (s,t)$. By substituting out individual consumption of physical goods from the instantaneous utility function and the flow budget constraint through equation (5b), we can express the present value Hamiltonian for the individual optimization problem as

$$H(s,t) = \ln[\frac{\gamma\,\widetilde{x}\ (s,t)}{\gamma + r(t) + \varepsilon}] + \widetilde{\eta}\ (s,t)\{[r(t)+\lambda]\ \widetilde{a}\ (s,t) + w(t) +$$

$$+\ \widetilde{q}\ (s,t) + \frac{\sigma[r(t)+\varepsilon]}{\gamma}\ \widetilde{q}\ (s,t) - \widetilde{x}\ (s,t)\}$$

where $\widetilde{\eta}\ (s,t)$ is the marginal utility of non-human wealth at time t of an individual born at time s.

The optimal choice over total consumption yields the usual Euler equation

$$\frac{d\,\widetilde{x}\ (s,t)}{dt} = [r(t) - \theta]\ \widetilde{x}\ (s,t) \tag{6a}$$

whereas money demand expressed in terms of total consumption is given by the cash-in-advance constraint combined with equation (5b)

$$\widetilde{m}\ (s,t) = \frac{\widetilde{x}\ (s,t)}{[\gamma + r(t) + \varepsilon]} - \frac{\sigma}{\gamma}\ \widetilde{q}\ (s,t) \tag{6b}$$

By integrating the budget constraint (2) forward, using definition (5a) and the condition precluding "Ponzi games", we obtain the consumer's intertemporal budget constraint

$$\int_t^{\infty} \widetilde{x}\ (s,v)e^{-\int_t^v [r(u)+\lambda]du}dv = \widetilde{a}\ (s,t) + \widetilde{h}\ (s,t) \tag{7}$$

where $\widetilde{h}\ (s,t)$ represents consumer's human wealth.[5]

The integration of equation (6a) along with the intertemporal budget constraint yields the following total consumption function

$$\widetilde{x}\ (s,t) = (\theta + \lambda)\left[\widetilde{a}\ (s,t) + \widetilde{h}\ (s,t)\right] \tag{8}$$

[5]Human wealth is the present discounted value of expected future labour income gross of lump-sum transfers, whose discount rate equals the real interest rate plus the probability of death.

As the instantaneous utility function is logarithmic, comprehensive consumption is a linear function of both non-human and human wealth.

After having aggregated the solution of the individual maximization program over all the consumers'cohorts,[6] omitting the time index and substituting out the stock of human wealth, the demand-side of the economy can be described by the following equations

$$\dot{x} = (r - \theta)x - \lambda(\lambda + \theta)a \tag{9a}$$

$$c = \frac{\gamma x}{\gamma + r + \varepsilon} \tag{9b}$$

$$m = \frac{c}{\gamma} - \frac{\sigma}{\gamma} q \tag{9c}$$

$$\dot{a} = ra + w + \frac{[\gamma + \sigma(r + \varepsilon)]}{\gamma} q - x \tag{9d}$$

Non-human wealth of the consumers consists of aggregate physical capital, k, and aggregate real money balances:

$$a = k + m \tag{10}$$

On the production side perfect competition is assumed. The representative firm employs capital and labor, l, to produce output, y, using a neoclassical

[6] Aggregate variables are defined as

$$p(t) = \int_{-\infty}^{t} \widetilde{p}\,(s,t)\lambda e^{\lambda(s-t)} ds$$

where $\widetilde{p}\,(s,t)$ indicates the corresponding individual variable.

production function -$y = F(k,l)$- having the conventional neoclassical properties of positive, but diminishing, marginal physical products and constant returns to scale. The first order conditions for the optimum of the firm are

$$F_k(k,l) = r \tag{11a}$$

$$F_l(k,l) = w \tag{11b}$$

The monetary authority pursues a policy of leaving the nominal exchange rate to depreciate at a constant rate, given by ε. In addition, the government returns the inflation tax to the public as a lump-sum tranfer

$$q = \varepsilon m \tag{12}$$

Finally, we have the balance of payments equation

$$\dot{m} = F(k,l) - c - \dot{k} \tag{13}$$

Equation (13) states that changes in official reserves are equal to the balance of payments, namely domestic output less absorption (consumption plus investment).[7]

[7] We assume there is no banking sector and that no sterilization policies are implemented by the monetary authority.

The complete macroeconomic equilibrium for the economy is obtained by combining the optimal conditions for households and firms, together with the relevant accumulation equations and the equilibrium condition on the labor market (l=1).

The full short-run model can be expressed in compact form as:

$$\dot{x} = [F_k(k) - \theta]x - \lambda(\lambda + \theta)(k + m) \tag{14a}$$

$$c = \frac{\gamma x}{[\gamma + F_k(k) + \varepsilon]} \tag{14b}$$

$$m = \frac{c}{(\gamma + \sigma\varepsilon)} \tag{14c}$$

$$\dot{m} = F(k) - c - \dot{k} \tag{14d}$$

Seignorage, q, and the wage rate, w, are solved residually. Equation (14c) represents the aggregate demand for money, which states that planned money holdings depend positively on consumption and negatively on the long-run inflation rate.[8] The rationale for this latter influence is as follows. A higher devaluation rate, by increasing the amount of seignorage transferred from the government to the public, requires lower private money holdings to finance a given level of consumption.

Equations (14b) and (14c) may be solved for c and k in terms of the endogenous dynamic variables (x and m) as follows:

[8] In the "money in the utility function" approach, when the intratemporal elasticity of substitution between money and consumption is positive, the demand for real balances would depend on consumption and the nominal interest rate.

$$c = c(m, \varepsilon), \quad c_m = \gamma + \sigma\varepsilon > 0; \; c_\varepsilon = \bar{m}\,\varepsilon > 0; \tag{15a}$$

$$k = k(x, m, \varepsilon), \quad k_x = \frac{\gamma}{\bar{c}\,F_{kk}} < 0; \; k_m = -\frac{(\gamma + \sigma\varepsilon)(\gamma + F_k + \varepsilon)}{\bar{c}\,F_{kk}} > 0;$$

$$k_\varepsilon = -\frac{[\bar{c} + \bar{m}\,\sigma(\gamma + F_k + \varepsilon)]}{\bar{c}\,F_{kk}} > 0; \tag{15b}$$

where overbar variables denote long-run equilibrium values.

By using the above short-run solutions for c and k, the model can be easily reduced to the following pair of differential equations linearized around the steady state[9]

$$\begin{bmatrix} \dot{x} \\ \dot{m} \end{bmatrix} = \begin{bmatrix} \omega_{11} & \omega_{12} \\ \omega_{21} & \omega_{22} \end{bmatrix} \begin{bmatrix} x - \bar{x} \\ m - \bar{m} \end{bmatrix} \tag{16}$$

where

$$\omega_{11} = \frac{\{\bar{c}\,F_{kk}(F_k - \theta) + \gamma\,[\bar{x}\,F_{kk} - \lambda(\theta + \lambda)]\}}{\bar{c}\,F_{kk}} > 0;$$

$$\omega_{12} = -\frac{\{\lambda(\theta + \lambda)\,\bar{c}\,F_{kk} + (\gamma + F_k + \varepsilon)(\gamma + \sigma\varepsilon)\,[\bar{x}\,F_{kk} - \lambda(\theta + \lambda)]\}}{\bar{c}\,F_{kk}} < 0;$$

$$\omega_{21} = \frac{\gamma\,\bar{m}\,(F_k - \omega_{11})}{(\bar{m}\bar{c}\,F_{kk} - \gamma\,\bar{x})} \gtrless 0;$$

$$\omega_{22} = -\frac{[\gamma\,\bar{x}\,F_k + \bar{c}^2\,F_{kk} + \gamma\,\bar{m}\,\omega_{12})}{(\bar{m}\bar{c}\,F_{kk} - \gamma\,\bar{x})} \gtrless 0.$$

The sign of the determinant of the coefficient matrix in (16) can be shown to depend on the sign of the following expression

$$\Delta = \bar{c}\,(\bar{k} + \bar{m})[\gamma\,\bar{x} + (F_k - \theta)\,\bar{c}]F_{kk} - \gamma\,\bar{x}\,(F_k - \theta)(\bar{c} - F_k\,\bar{k}) < 0 \tag{17}$$

[9] Equation (15b) is employed, once linearized, to eliminate both $\dot{k}$ and k from equations (14a) and (14d)

Since inequality (17) is always satisfied as $\bar{c} - \bar{k}\ F_k = \bar{y} - \bar{k}\ F_k = \bar{w} > 0$ (by the assumption of liner homogeneity of the production function) and $F_k > \theta$ (as the economy is dynamically efficient), the long-run equilibrium is a saddle-point stable, since m evolves continuously -i.e. $m(0)=m_0$-, while x is a jump variable -i.e. $x(0)$ is free.[10]

The stable solution to the system (16) is given by

$$m = \bar{m} + (m_0 - \bar{m})e^{\eta_1 t} \tag{18a}$$

$$x = \bar{x} + \frac{\omega_{12}}{(\eta_1 - \omega_{11})}(m - \bar{m}) \tag{18b}$$

where $\eta_1 < 0$ denotes the stable eigenvalue of the coefficient matrix in (16).[11] The saddle-path (18b) is positively-sloped in the m-x space.

The long-run equilibrium model, obtained when $\dot{x} = \dot{m} = \dot{k} = 0$, is

$$[F_k(\bar{k}) - \theta]\ \bar{x} = \lambda(\theta + \lambda)(\bar{k} + \bar{m}) \tag{19a}$$

[10] If a simple cash-in-advance constraint was considered, i.e. $\sigma = 0$ in equation (3) and hence $c \leq \gamma m$, it would imply the restrictive feature that consumption only evolves continuously as real money balances are a state variable; this is a clear analytical inconsistency of the setup. Therefore the assumption $\sigma > 0$ is necessary to guarantee that consumption, which is a jump variable, is separated from money balances, which are a predetermined variable.

[11] The solution for capital stock is

$$k = \bar{k} + \frac{[\gamma\omega_{12}/(\eta_1 - \omega_{11}) - (\gamma + \sigma\varepsilon)(\gamma + F_k + \varepsilon)]}{\bar{c}\ F_{kk}}(m_0 - \bar{m})e^{\eta_1 t} \tag{18c}$$

$$\bar{c} = \frac{\gamma\,\bar{x}}{[\gamma + F_k(\bar{k}) + \varepsilon]} \tag{19b}$$

$$\bar{m} = \frac{\bar{c}}{(\gamma + \sigma\varepsilon)} \tag{19c}$$

$$F(\bar{k}) = \bar{c} \tag{19d}$$

3. Devaluations and balance of payments

Firstly, consider a once and for all devaluation. Since the level of the nominal exchange rate does not appear in the long-run equilibrium model (19), a currency devaluation exerts no effects on the steady-state endogenous variables. Therefore, long-run real money balances, i.e. $m = \frac{\bar{M}}{E}$ -where $\bar{M}$ is the stock of the nominal money supply and E represents the nominal exchange rate-, remain unaffected by a parametric change in E. However, an unexpected permanent devaluation reduces real money holdings on impact -as M is a predetermined variable that evolves gradually- and consumption, tied to money balances. Comprehensive consumption is reduced as well. Since output does not change, the reduction of consumption implies that a short-run balance of payments surplus occurs since the trade balance improves. The current account surplus is matched, for the whole convergence along the transition path, by an increase of m aimed at restoring the initial level of real money holdings accompanied by an increase in consumption along the transition path that brings the system back to the *ante*-shock equilibrium.

Secondly, consider a sustained increase in the rate of devaluation. The comparative statics effects of this shock are given by the following multipliers

$$\frac{d\,\bar{k}}{d\varepsilon} = -\frac{\bar{m}\bar{c}\,(F_k-\theta)\left[(\bar{k}+\bar{m})(\gamma+\sigma\varepsilon)+\sigma\,\bar{m}\,(\gamma+F_k+\varepsilon)\right]}{\Delta} > 0 \tag{20a}$$

$$\frac{d\,\bar{x}}{d\varepsilon} = -\frac{\bar{m}\,[\lambda(\theta+\lambda)(\gamma+F_k)-\gamma\,\bar{x}\,F_{kk}]}{\Delta} > 0 \tag{20b}$$

$$\frac{d\,\bar{c}}{d\varepsilon} = F_k\frac{d\,\bar{k}}{d\varepsilon} > 0 \tag{20c}$$

$$\frac{d\,\bar{m}}{d\varepsilon} = -\frac{\bar{m}\,(F_k-\theta)\left[\bar{c}\,(\bar{k}+\bar{m})(F_k+\sigma\,\bar{m}\,F_{kk})+\sigma\,\bar{m}\,(\gamma+F_k+\varepsilon)(F_k\,\bar{m}\,-F_l)\right]}{\Delta}+$$

$$-\frac{\sigma\,\bar{c}\,(\bar{k}+\bar{m})F_{kk}\gamma\,\bar{x}}{\Delta} \lesseqgtr 0 \tag{20d}$$

where Δ <0 has been defined in (17).

In the long-run, an increase in the rate of devaluation raises capital stock and therefore physical as well as comprehensive consumption. The Tobin effect on capital stock derives from the fact that a higher devaluation rate, which corresponds to greater long-run inflation, implies greater lump-sum transfers, namely seignorage, distributed by the government to consumers. A redistribution of income from those who consume more and save less (the "older", in the sense that they were born earlier) to those who consume less and save more (the "younger", in the sense that they are born later) occurs, leading to higher aggregate saving and therefore spurring capital formation.

The overall consequence of the higher rate of devaluation on money demand is, in principle, ambiguous, since the positive effect of the increased consumption may be outweighed by the negative effect of the higher inflation rate on the money-consumption ratio. Therefore, the final sign of the money demand multiplier (20d) depends on which of the two contrasting effects prevails.

However, if non-restrictive assumptions on some structural parameters of the model are made, the positive effect of the higher consumption on the volume of transactions that people want to make unambiguously outweighs the negative effect of the higher devaluation rate on the money-consumption ratio. These non-restrictive assumptions are: i) a money demand that is a quasi-fixed proportion of consumption, i.e. $\sigma < \gamma$ (in this case government lump-sum cash transfers play a minor role in acquiring consumption goods); and /or ii) a production function that is moderately concave in capital stock, i.e. $-F_{kk} < \dfrac{F_k(\gamma + \sigma\varepsilon)}{\sigma\ \bar{c}}$; and/or iii) a highly liquid economy, i.e. $F_k\ \bar{m} > F_l$.

Both steady state nonhuman wealth and long-run real interest rate are increased by the higher steady state inflation. Moreover, as the higher rate of devaluation involves greater consumption, more inflation is welfare-improving.[12]

In the short-run, soon after the unexpected and permanent increase in the rate of devaluation takes place, the positively-sloped saddle-path defined in the

[12]This result is also obtained in the monetary growth analysis with an OLG demographics (see Drazen, 1981, and Van der Ploeg-Marini, 1988).

x-m space shifts upward[13] and comprehensive consumption rises on impact (for a given level of money balances) to bring the economy onto the new saddle-path, undershooting its new long-run equilibrium value if money holdings are increased in the long-run.

The undershooting of comprehensive consumption causes a balance of payments surplus after the shock, since real money balances and capital stock, being constrained to adjust continuously, are fixed at their initial values. This is the exact opposite of Calvo's finding. Soon after the impact adjustment, real money balances and capital stock begin to accumulate. Consumption, money holdings and physical capital increase monotonically along the transition path towards the final equilibrium.[14]

In the case of the devaluation rate, we may depart from Calvo's result (1981) because the Tobin effect (due to the OLG demographics) is combined with a sort of "quantity theory" money demand, i.e. a money demand dependent on

[13]The vertical shift of the saddle-path is given by

$$\frac{dx(0)}{d\varepsilon} = \frac{d\,\bar{x}}{d\varepsilon} - \frac{\omega_{12}}{(\eta_1 - \omega_{11})}\frac{d\,\bar{m}}{d\varepsilon}$$

This expression is always positive either if $\sigma < \gamma$ and $\frac{d\,\bar{m}}{d\varepsilon} > 0$ or if $\frac{d\,\bar{m}}{d\varepsilon} < 0$.

[14]In the less likely case of a steady state reduction of money balances (i.e. when the non-restrictive assumptions mentioned above are not considered and the negative effect of long-run inflation on money holdings prevails over the Tobin effect), consumption overshoots its new long-run equilibrium value on impact; the overadjustment of consumption induces a balance of payments deficit after the shock has occurred. After the system has been placed on the new stable arm, money balances decumulate, while capital formation is deepened along the convergent path.

consumption and a money-consumption ratio independent of the nominal interest rate but moderately dependent on long-run inflation (due to the cash-in-advance constraint).

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