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Abstract

This paper examines the effects of exchange-rate policies in an overlapping-generations small open economy facing perfect capital mobility. We find that a once-and-for-all devaluation spurs wealth formation and leads to a current account surplus, while a sustained increase in the rate of devaluation leaves nonhuman wealth and the current account balance unperturbed. Our results differ substantially from those obtained in homologous small open economies with infinite horizons.

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1 Introduction

This paper examines the consequences of exchange-rate policies on wealth formation and the current account balance in a non-altruistic life-cycle small open economy facing perfect capital mobility and operating under a crawling-peg exchange-rate regime. We find that a once-and-for-all devaluation spurs wealth formation and leads to a current account surplus, while a rise in the rate of devaluation leaves nonhuman wealth and the current account balance unperturbed.

Our results differ substantially from those obtained in infinite-lived small open economies perfectly integrated with the world financial market. The analysis of the exchange-rate policies based on representative agent models has been carried out, for example, by Obstfeld (1981), Mansoorian (1996), and Moshin (2004). By considering agents with an endogenous rate of time preference à la Uzawa (1968), Obstfeld (1981) discovers that an exchange-rate devaluation is neutral for the current account dynamics, while an increase in the rate of devaluation generates a current account surplus. In the Obstfeld (1981) analysis, the current account invariance with respect to a simple devaluation is a manifestation of the neutrality of monetary policy. The positive effect of a sustained increase in the rate of devaluation on the external balance, instead, derives from a portfolio reallocation mechanism combined with the nonsuperneutrality of money (due to intertemporally dependent preferences); in fact, an increase in the devaluation rate, i.e. a hike in the inflation tax, causes saving to be reallocated away from real money balances towards the alternative asset, i.e. a foreign interest yielding asset. Consumption initially declines, implying a current account surplus, which
over time leads to an accumulation of foreign asset. The decline of real money balances, by lowering agent utility and hence the subjective discount rate, implies higher long-run consumption so as to leave the rate of time discount (pinned down by the exogenous world interest rate) invariant.¹

Mansoorian (1996) discovers, by incorporating habit-persistent preferences in the context studied by Obstfeld (1981), that a rise in the devaluation rate causes a current account deficit, if preferences are adjacent complementary, namely, if the marginal utility of consumption is strongly increasing in the habitual standard of living; the same qualitative results as in Obstfeld (1981) are registered, instead, if preferences are not adjacent complementary. In the Mansoorian (1996) analysis, like in the Obstfeld one, a one-time devaluation has no effect on the current account. Mohsin (2004) confirms the Obstfeld (1981) findings on the currency devaluations by assuming that the subjective discount rate depends positively on financial wealth.

As we will show below, the consideration of the overlapping-generations demographics overturns the Obstfeld (1981), Mohsin (2004) and, to a lower extent, Mansoorian (1996) results. Two crucial assumptions underpin our findings: the generational diversity of agents, on the one hand, and interest-

¹The Obstfeld (1981) analysis departs, in terms of setup and results, from the contribution of Calvo (1981), which investigates the effects of exchange-rate policies in a financially autarchic small open economy. In a representative agent model where money is the only asset, Calvo (1981) obtains that a simple currency devaluation improves the balance of payments, whereas an increase in the rate of devaluation deteriorates the balance of payments. In the Calvo (1981) analysis, the absence of a foreign interest yielding asset, as an alternative to money balances, precludes the consideration of portfolio shifts induced by the exchange-rate policies. See Dornbusch and Giovannini (1990) for a clear explanation of the mechanisms that support the Calvo (1981) and Obstfeld (1981) findings.
yielding foreign-exchange reserves that enter the government budget constraint, on the other. A devaluation of the exchange-rate, by raising the central bank reserves and hence government interest proceeds, increases transfer payments received by the private sector, thereby redistributing resources across age-heterogeneous generations, stimulating saving, and improving the current account. The absence of such a redistributive mechanism due to the invariance of government entitlements, instead, determines that there are no consequences on wealth formation and the current account in the case of a rate of devaluation shift.

The rest of the paper is organized as follows. Section 2 presents the analytical setup; section 3 analyzes the steady state and dynamic consequences of the currency devaluation in levels and rates; section 4 concludes.

2 The model

Consider an intergenerational monetary small open economy, having free access to a perfect world capital market, producing a single tradable good, and operating under a crawling-peg exchange-rate regime. In this economy, purchasing power parity holds as domestic output is perfectly substitutable with the foreign produced good, i.e. $P = EP^*$, where $P$ is the domestic price level, $E$ the nominal exchange rate (i.e. the domestic currency price of foreign currency), and $P^*$ the foreign price level expressed in foreign currency. The monetary authority allows the nominal exchange rate to depreciate at a constant rate $\varepsilon$; the currency devaluation rate coincides with domestic inflation, assuming zero foreign inflation.
Private wealth is composed of real money balances, \( m \), and interest-bearing foreign bonds, \( b \), whose rate of return is the exogenous world interest rate \( \rho \). In this economy, foreign assets, \( f \), are given by interest-yielding central bank reserves, \( r \), and foreign bonds, i.e. \( f = r + b \); the rate of return earned by holding foreign reserves is \( \rho \). We assume the absence of the banking sector; hence, the money supply, namely, the monetary base, is given by domestic credit, \( d \), and foreign reserves: \( m = d + r \). As we consider a managed-float exchange-rate regime and assume that no sterilization policies are implemented by the monetary authority, the stock of domestic credit in real terms is fixed, i.e. \( d = \tilde{d} \), while \( r \) adjusts endogenously according to the balance of payments imbalances so that any pressure on the exchange-rate is eliminated. Domestic output is exogenous.

The consumers’ behavior is described through the OLG apparatus with uncertain lifetime and no bequest motives formulated by Yaari (1965) and Blanchard (1985). In this demographic setup, agents face a constant mortality rate \( \theta \) when they are alive. As the birth rate is assumed to equal the death rate, the population, composed of cohorts of all ages, remains constant. Money balances are inserted into the household utility function à la Sidrauski.

The consumer-side of the economy is described by the following aggregate relationships\(^2\)

\[
\check{c} = (\rho - \delta)c - \alpha \theta (\theta + \delta)(m + b), \tag{1a}
\]

\(^2\)The demand-side (1) is based on the assumption of logarithmic individual preferences. Details on the derivation of system (1) are relegated to the Appendix.
\[ m = \frac{(1 - \alpha)c}{\alpha(\rho + \varepsilon)} \tag{1b} \]

\[ \dot{m} + \dot{b} = \rho b + y + \tau - \varepsilon m - c, \tag{1c} \]

where \( c \) is consumption, \( \delta \) the exogenous rate of time preference, \( \alpha \) a positive preference parameter, \( y \) the given domestic output level and \( \tau \) government lump-sum transfers.

Equation (1a) describes the Blanchard-Yaari law for consumption growth; since nonhuman wealth \( m + b \) is considered to be strictly positive, the condition \( \rho > \delta \) must hold. Equation (1b) represents the demand for money, while (1c) the private sector’s budget constraint.

The government and the central bank are consolidated. The government runs a balanced-budget policy. Revenues from interest-income earned by holding foreign reserves and seigniorage are used to finance lump-sum transfers to consumers; that is,

\[ \rho r + \varepsilon m = \tau. \tag{2} \]

We assume that the government budget is balanced through the endogenous accommodation of \( \tau \).

The equation for the current account, which dictates the foreign asset dynamics, is

\[ \dot{f} = y - c + \rho f. \tag{3} \]

Consider the dynamic properties of the model. Substituting the expression \( m + b = f + \tilde{d} \) into (1a), and expressing this equation in terms of deviations from the steady state equilibrium, we obtain
\[ \dot{c} = (\rho - \delta)(c - \bar{c}) - \alpha \theta (\theta + \delta)(f - \bar{f}). \] (4a)

Equation (4a) is depicted in the phase diagram of Fig. 1 for \( \dot{c} = 0 \); the \( \dot{c} = 0 \) locus is upward-sloping.

Taking (3) in terms of deviations from the long-run equilibrium yields

\[ \dot{f} = -(c - \bar{c}) + \rho (f - \bar{f}). \] (4b)

The \( \dot{f} = 0 \) locus slopes upwards in the \( c - f \) space of Fig. 1.

Since \( c \) is a jump variable and \( f \) a backward-looking one, saddle-point stability requires, as a necessary and sufficient condition, that the two eigenvalues of the dynamic system (4a)-(4b) have opposite signs. For this condition to be satisfied, it is required that \( \alpha \theta (\theta + \delta) > \rho (\rho - \delta) \); this inequality holds if we reasonably assume that \( y > \rho \tilde{d} \). Diagrammatically speaking, saddle-point stability implies that the \( \dot{c} = 0 \) locus is steeper than the \( \dot{f} = 0 \) locus. The saddle-path SS, positively sloped, has a slope that lies in between the slopes of the \( \dot{c} = 0 \) and \( \dot{f} = 0 \) loci (see Fig. 1).

\[ \text{[Insert Fig. 1]} \]

\(^3\)Note that the hypothesis of finite horizons, i.e. \( \theta > 0 \), guarantees the existence of a well-defined steady state of a small open economy, having a fixed discount rate and facing perfect capital mobility; in the Obstfeld (1981) analysis, instead, it is the consideration of an endogenous rate of time preference that makes it possible to avoid a dynamically degenerate steady state; see Obstfeld and Rogoff (1996), and Turnovsky (1997).

\(^4\)The equation of the saddle-path SS is given by

\[ c = \bar{c} + (\rho - \eta_1)(f - \bar{f}), \]

where \( \eta_1 < 0 \) denotes the stable eigenvalue of the dynamic system (4a)-(4b).
3 Exchange-rate policies

In this section, we analyze the steady state and dynamic consequences of the following shifts:

1) a once-and-for-all devaluation, i.e. a parametric increase in $E$;
2) a sustained increase in the rate of devaluation $\varepsilon$.

3.1 A once-and-for-all devaluation

Consider the long-run effects of a rise in the level of the nominal exchange rate. The long-run model can be written as

\begin{align*}
\bar{c} &= \frac{\alpha \theta (\theta + \delta)}{(\rho - \delta)} (\bar{f} + \bar{d}), \quad (5a) \\
\bar{c} &= y + \rho \bar{f}, \quad (5b) \\
\bar{r} + \bar{d} &= \frac{(1 - \alpha) \bar{c}}{\alpha (\rho + \varepsilon)}. \quad (5c)
\end{align*}

Lump-sum transfers, which can be expressed as $\tau = \frac{(1 - \alpha) \bar{c}}{\alpha (\rho + \varepsilon)} - \rho \bar{d}$, are solved residually.\(^5\)

\(^5\)Note that, in the long-run, the Obstfeld (1981) model corresponds to system (5) once (5a) is replaced by the following relationship

\begin{align*}
\bar{c} &= \Phi(\bar{m}), \Phi' < 0, \quad (5a')
\end{align*}

where $\bar{m} = \bar{r} + \bar{d}$. This equation is obtained by solving the "modified golden rule" with an endogenous rate of time preference à la Uzawa (1968) – i.e. $\delta(\bar{c}^* \bar{m}^{1-\alpha}) = \rho$, where $\delta' > 0$ – for consumption. In such a model, (5a') and (5c) jointly determine $\bar{c}$ and $\bar{m}$, while
A rise in $\tilde{E}$ implies, for a given stock of domestic credit in nominal terms $\tilde{D}$, a drop in $\tilde{d} = \frac{\tilde{D}}{\tilde{E}}$. The currency devaluation expands, through the fall in $\tilde{d}$, consumption, foreign assets, and nonhuman wealth.\(^6\) The higher consumption in turn increases real money balances and the stock of the central bank reserves. Despite the foreign asset increase, an unambiguous reduction in the foreign bond holdings takes place.\(^7\) Since government revenues obtained from foreign reserve holdings and the inflation tax are pulled up, transfer payments from the government to the private sector expand.

The consequences of the increase in $\tilde{E}$ on nonhuman wealth and consumption have an intergenerational ratio, imputable to the change of lump-sum transfers from the government. The rise in $\tilde{T}$ causes an income redistribution from the older generations to the younger ones. Aggregate saving is spurred, as the younger generations have a higher propensity to save than the older ones, and therefore the stock of nonhuman wealth and consumption are increased. The chronological disconnection of generations and the rise in government transfer payments render money non-neutral.\(^8\)

\(^{(5b)}\) determines $\tilde{f}$, once $\tilde{e}$ is known. The steady state mechanics of the Obstfeld findings are as follows. Since (5a'), (5b) and (5c) are independent of $\tilde{E}$, consumption, real money balances $\tilde{m}$, and foreign assets are unaltered by a simple devaluation shift. A rise in the devaluation rate $\varepsilon$, instead, by decreasing real money balances and raising, through (5a'), consumption and, through (5c), foreign assets, renders money non-superneutral.

\(^6\)The relative steady state multipliers are:

\[
\begin{align*}
\frac{d \tilde{e}}{d \tilde{d}} & = -\frac{\alpha\theta(\theta + \delta)}{[\alpha\theta(\theta + \delta) - \rho(\rho - \delta)]} < 0; \quad \frac{d \tilde{f}}{d \tilde{d}} = \frac{1}{\rho} \frac{d \tilde{e}}{d \tilde{d}} < 0; \quad \frac{d (\tilde{m} + \tilde{b})}{d \tilde{d}} = \frac{(\rho - \delta)}{\alpha\theta(\theta + \delta)} \frac{d \tilde{e}}{d \tilde{d}} < 0; \quad \frac{d (\tilde{m} + \tilde{b})}{d \tilde{d}} = \frac{(\rho - \delta)}{\alpha\theta(\theta + \delta)} \frac{d \tilde{e}}{d \tilde{d}} < 0;
\end{align*}
\]

where $\tilde{d} = -\frac{1}{\tilde{E}} \frac{d \tilde{E}}{d \tilde{d}} < 0$.

\(^7\)The foreign bond multiplier is:

\[
\frac{d \tilde{b}}{d \tilde{d}} = \frac{(\rho - \delta)}{[\alpha\theta(\theta + \delta) - \rho(\rho - \delta)](\tilde{m} + \tilde{b})} > 0.
\]

\(^8\)The absence of such an intergenerational redistribution, due to the consideration of
Consider the short-run dynamics after an unexpected permanent rise in $\tilde{E}$ occurs. Fig. 1 can be used to describe the comparative dynamics. The initial equilibrium is at $A_0$ and the new one at $A_1$. As the saddle-path shifts downward after the unexpected devaluation occurs, consumption suddenly falls.\(^9\)

The unexpected drop in the real money supply, due to the reduction in the stock of domestic credit in real terms, abruptly causes an excess demand for money (only attenuated by the fall in the real money demand, deriving from the downward jump of consumption). In order to eliminate the pressures on the exchange-rate, the central bank must buy foreign bonds and issue money until the money market equilibrium is restored. Consequently, the stock of foreign reserves jumps up. Since foreign assets are predetermined at their initial value, the rise in foreign reserves results in a fall of consumer foreign bond holdings.

The consumption drop causes a current account surplus because consumption falls below the level of domestic income and therefore the trade balance improves.

Once the new saddle-path has been reached, the system moves monotonically from $A_{01}$ to $A_1$ with an accumulation of foreign assets and a rise in infinitely-lived agents, is responsible for the devaluation neutrality in the Obstfeld (1981) analysis.

\(^9\)In Fig. 1, the $c=0$ locus is moved downward on the right, while the $f=0$ schedule remains unaltered. This implies that the new long-run equilibrium $A_1$ stays along the $f=0$ schedule.

\(^{10}\)The vertical translation of the saddle-path, i.e. the impact multiplier of consumption, is: $\frac{d\tilde{c}(0)}{d\tilde{c}} = \frac{\eta_1}{\rho} > 0$. 

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consumption and real money balances above the pre-shock level.

3.2 A sustained increase in the rate of devaluation

An increase in $\varepsilon$ exerts no long-run effects on consumption and the stock of claims on foreigners. The rise in the inflation rate brings real money balances down; this fall in $\bar{m}$ is entirely determined by a decline in the stock of foreign reserves. Moreover, as $\bar{f}$ stays unaltered, a change in the mix of external assets takes place: the fall of $\bar{f}$ is exactly compensated by a rise in $\bar{b}$. Therefore, in the present experiment money superneutrality holds, despite the fact that in general money is non-superneutral in finite-lived setups.\textsuperscript{11}

As consumption and foreign assets do not move in the long-run, an unanticipated permanent rise in $\varepsilon$ has no dynamic consequences on the economy. On impact, only a jump fall in foreign reserves and hence a jump re-shuffle in the foreign asset composition take place.

The mechanics of the increase in $\varepsilon$ are as follows. The rise in the opportunity cost of holding money, by driving the real money demand down, generates an excess supply of money. The central bank officially intervenes in the currency market by selling foreign bonds and shrinking the money supply; a loss of foreign reserves takes place. There are no effects on nonhuman wealth and consumption, as government revenues, and hence transfer payments, remain invariant because the rise in seigniorage is exactly compensated for the inflation tax. See Stockman (1981), and Marini and Van der Ploeg (1988).

\textsuperscript{11}In fact, within OLG models, a rise in long-run inflation generates the ”Tobin effect”, i.e. a positive effect on saving, wealth and capital formation, when consumers are lump-sum compensated for the inflation tax. See Stockman (1981), and Marini and Van der Ploeg (1988).
pensated by the decline in foreign reserves. Therefore, the redistributive mechanism across age-heterogeneous generations seen before is not at work now.

4 Conclusion

In this paper, we have investigated the consequences of currency devaluations, in levels and rates, within a life-cycle small open economy, operating under a managed-float exchange-rate regime and free international capital mobility.

Our findings on the exchange-rate policies under perfect capital mobility are in striking contrast with what is found by Obstfeld (1981) and others, who instead consider infinite-lived small open economies having intertemporally dependent preferences. We firstly discover that a once-and-for-all devaluation is non-neutral for wealth formation and the external balance; as in the case of international capital immobility considered by Calvo (1981), this type of devaluation improves the current account, since, on impact, consumption is driven down. Secondly, we find that an increase in the rate of devaluation is neutral for saving, the current account balance and nonhuman wealth; only real money balances and the composition of foreign assets change.

These results are to be ascribed to the fact that, only when a devaluation shift changes lump-sum transfers, does an OLG demographic setup with no bequests imply an intergenerational redistribution of resources that alter aggregate saving, consumption and the external balance. This consideration is further strengthened by observing that if the government budget were balanced through the endogenous adjustment of government spending,
both types of devaluations would be neutral for wealth accumulation and the current account balance.
APPENDIX

Microeconomics of the consumer-side

This Appendix provides the microeconomic derivation of the aggregate behavior of consumers, namely equations (1) of the paper.

Assuming that the individual utility is logarithmic in consumption, \( c_i \), and real money balances, \( m_i \), at each instant \( t \) a consumer born at time \( s \leq t \) solves the following problem

\[
\max_{t} \int_{t}^{\infty} \left[ \alpha \ln c_i(s, j) + (1 - \alpha) \ln m_i(s, j) \right] \exp[-(\theta + \delta)(j - t)] dj \quad (A.1)
\]

subject to the instantaneous budget constraint

\[
\frac{d}{dt} w_i(s, t) = (\rho + \theta) w_i(s, t) + y_i + \tau_i(s, t) - (\rho + \varepsilon) m_i(s, t) - c_i(s, t), \quad (A.2)
\]

and the solvency condition precluding Ponzi schemes

\[
\lim_{j \to \infty} w_i(j, t) \exp[-(\rho + \theta)(j - t)] = 0, \quad (A.3)
\]

where \( w_i(s, t) \) and \( \tau_i(s, t) \) denote nonhuman wealth and lump-sum transfers of a consumer born at time \( s \); \( \theta \) is the mortality rate (exogenous), \( \delta \) the rate of time preference (exogenous), \( \rho \) the world interest rate (exogenous), \( y_i \) the fixed individual nonasset income, and \( \alpha \) a positive preference parameter.

The optimality conditions for the individual problem (A.1)-(A.3) are
\[ c_i(s, t) = \alpha(\theta + \delta)[w_i(s, t) + h_i(s, t)] \]

\[ m_i(s, t) = \frac{(1 - \alpha)c_i(s, t)}{\alpha(\rho + \varepsilon)} \]

\[ \frac{d}{dt}c_i(s, t) = (\rho - \delta)c_i(s, t), \]

where \( h_i(s, t) \) is the consumer’s human wealth, given by

\[ h_i(s, t) = \int_t^\infty [y_i + \tau_i(s, t)] \exp[-(\rho + \theta)(j - t)]dj. \]

Aggregating over all the cohorts and omitting the time index, the demand-side of the model can be expressed as

\[ c = \alpha(\theta + \delta)(w + h) \quad \text{(A.4a)} \]

\[ m = \frac{(1 - \alpha)c}{\alpha(\rho + \varepsilon)} \quad \text{(A.4b)} \]

\[ \dot{h} = (\rho + \theta)h - y - \tau \quad \text{(A.4c)} \]

\[ w = \rho w + y + \tau - (\rho + \varepsilon)m - c, \quad \text{(A.4d)} \]

where the small letters denote the aggregate variables of the corresponding individual variables with subscript \( i \); each aggregate variable is defined as

\[ x = x(t) = \int_{-\infty}^t x_i(s, t)\theta \exp[\theta(s - t)]ds, \]
where $x_i(s,t)$ indicates a generic individual variable.

Using equations (A.4), the Blanchard-Yaari equation of motion for consumption can be obtained:

$$\dot{c} = (\rho - \delta)c - \alpha \theta(\theta + \delta)w.$$  \hspace{1cm} (A.4a')

Thus, as indicated in Section 2 of the paper, the aggregate behavior of consumers is described by (A.4a’), (A.4b) and (A.4d), once the definition $w = m + b$ is employed.
References


Figure 1. Comparative dynamics