IMF Working Paper

WP/97/133

INTERNATIONAL MONETARY FUND

Research Department

Fiscal Policy and the Predictability of Exchange Rate Collapse

Prepared by Betty C. Daniel

Authorized for distribution by Donald Mathieson [1]

October 1997

Abstract

It is well known that the long-run viability of a fixed exchange rate regime imposes constraints on monetary policy. This paper shows that, in a model with forward-looking agents, short-run viability imposes a fiscal constraint. When policy change, which destroys long-run viability, also violates the fiscal constraint, collapse is instantaneous. Delayed predictable collapse requires satisfaction of the fiscal constraint.

JEL Classification Numbers: F31, F33, F41, F42

Keywords: Exchange rate collapse, intertemporal budget constraints, fiscal policy, monetary policy

Author's E-Mail Address: b.daniel@albany.edu

[1]This research was begun while the author was visiting the University of Pennsylvania on an NSF Visiting Professorship for Women, # GER94-50140. This paper was written while the author was a Visiting Scholar at the International Monetary Fund. Financial support from all three organizations is gratefully acknowledged. The author wishes to thank Pierre-Richard Agénor, Robert Flood, Dale Henderson, and other IMF seminar participants for very helpful comments. This paper will be published externally.

CONTENTS

Page

SUMMARY

This paper addresses the predictability of exchange rate crises. Empirically, it is difficult to attribute some recent exchange regime collapses to a preceding period of unsustainable government policies. Many have argued that the Mexican collapse in December 1994 and the crisis in the exchange rate mechanism of the European Monetary System in August 1993 took the markets by surprise. Fundamentals were not obviously inconsistent with fixed rates, which suggests that exchange rate collapse might not require a period of nonsustainable policy accompanied by declining reserves. This experience has led many to suggest self-fulfilling crises as an alternative explanation. This paper presents a third view. It shows that instantaneous collapse can be the result of a policy that increases the government's reliance on seigniorage revenues.

Consider the following. The government increases transfer payments to agents by increasing monetary growth, such that the present value of transfer payments increases. An agent's intertemporal budget constraint implies that the present value of consumption depends on initial real wealth, plus the present value of income plus transfers less the present value of expenditures on real money balances. Under the assumption of a logarithmic model in which money enters the utility function, expenditures on real money balances are proportional to consumption. Therefore, the increase in the present-value of transfers increases the present value of desired consumption. This creates excess world demand for goods, which drives up the domestic price and the exchange rate. Domestic real money balances fall with an increase in the domestic price level until the fall in domestic real wealth equals the increase in the present value of monetary transfers. Therefore, equilibrium requires exchange rate collapse. The policy drives the shadow floating exchange rate above the fixed spot rate, irrespective of the quantity of reserves, and forces exchange rate collapse.

I. INTRODUCTION

Are exchange rate crises predictable? In the standard monetary model, relatively expansionary domestic credit creation leads to a predictable and unsustainable decline in a country's foreign exchange reserves. Using the exhaustible resource model of Salant and Henderson (1978) and Salant (1983), Krugman (1979) showed that the reserve decline would end with a discrete predictable attack on reserves, reducing them to some minimum level, and forcing a collapse of the fixed rate. Krugman's model has been extended to incorporate uncertainty about the reserve floor and about policy, such that the timing of collapse is subject to uncertainty, but the basic feature that collapse is predictable, given current government policy of relatively expansionary domestic credit creation, is essential to the model.

Empirically, it is difficult to attribute some recent exchange regime collapses to a preceding period of unsustainable government policies. Many have argued that the Mexican collapse in December 1994 and the ERM crisis in August 1993 took the markets by surprise. Fundamentals were not obviously inconsistent with a regime of fixed rates. This suggests that exchange rate collapse might not require a period of nonsustainable policy accompanied by declining reserves, and has led many to suggest self-fulfilling crises as an alternative explanation. (Obstfeld 1986, 1994; Eichengreen and Wyplosz 1992; Sachs, Tornell and Velasco, 1996). This paper presents a third view. It demonstrates that in a model with forward-looking agents, the feasibility of a delayed predictable collapse imposes a constraint on fiscal policy.[2] When this constraint is not met, relatively expansionary domestic monetary policy cannot coexist with a fixed exchange rate even temporarily. Therefore, exchange rate crises could be precipitated by a "news" event which triggers a change in expectations about satisfaction of the fiscal constraint. Once such an event has occurred, collapse is instantaneous, irrespective of the amount of reserves.

To understand this result, consider an increase in the rate of domestic credit creation given to domestic agents as lump-sum transfers. The expansionary monetary policy implies that the fixed rate is not viable in the long run. This paper shows that its short-run viability depends on the effect of the policy on the present value of government transfers. If they increase, then the present discounted value of disposable income for forward-looking agents increases, leading them to attempt to increase present-value and current consumption.[3] However, present-value consumption cannot increase in equilibrium because output is fixed, fixing the present discounted value of the country's resources. The attempt to increase consumption must drive

---

[2]Buiter (1989) recognized that a viable gold standard imposes monetary and fiscal constraints.

[3]When interest equals time preference, as it does continuously in the small-open-economy model, current and present-value consumption move in the same direction. The agent does not want to increase current consumption in the absence of an increase in present-value consumption.

up the price level, reducing the real value of the agent's domestic money balances, such that he is content with the initial values for both current and present-value consumption. The increase in the domestic price level is possible only with exchange rate collapse. Using Flood and Garber's (1984) terminology, the increase in the present-discounted value of transfers increases the shadow floating rate relative to the fixed rate. This leads agents to attack to reap the implied speculative profits. The fixed rate cannot survive even temporarily. Predictable delayed collapse requires that the policy change leading to eventual collapse not affect the current present value of government transfers.

This paper develops these ideas using a small open economy with forward-looking agents. Section 2 presents the model. Section 3 contains a description of the initial equilibrium and considers policy change and the restrictions for a delayed predictable collapse. Section 4 provides conclusions.

II. Small Country Model

A. General Assumptions

The domestic country is assumed to be small in world markets, allowing it to take foreign variables as constant. To keep the model simple, both purchasing power parity and interest rate parity are assumed, yielding, respectively:

$$P = SP^*$$

$$i = i^* + \frac{\dot{S}}{S} \qquad \textbf{(1)}$$

where P is the domestic price level, S is the spot exchange rate, defined as the domestic price of foreign currency, i is the nominal interest rate, and an asterisk (*) denotes a foreign variable. For convenience, the foreign rate of inflation and money growth are assumed to be zero, and the foreign price level is normalized at unity. Additionally, the foreign interest rate is assumed to equal the rate of time preference of the representative domestic agent (θ), assuring the existence of a steady state equilibrium.

B. Monetary and Fiscal Policy

With the simplification of no banking system, the money supply *(M)* is determined by the sum of domestic credit *(D)* and interest-bearing foreign exchange reserves *(SF)*. Therefore, money and monetary growth are given, respectively, by:

$$M = D + \bar{S}F$$

$$\dot{M} = \dot{D} + \bar{S}\dot{F}, \tag{2}$$

where a dot ($\dot{}$) denotes a time derivative. The overbar on S denotes the fixed exchange rate. The authorities also intervene in the foreign exchange market in the event of a discrete speculative attack on reserves, allowing money to change discretely according to:

$$\Delta M = \bar{S}\Delta F.$$

Fiscal policy is defined very simply. The government (consolidated monetary and fiscal authority) obtains revenue from domestic credit creation ($\dot{D}$) and from interest earnings on assets (θSF).[4] It transfers these revenues to the public in a lump-sum manner according to:

$$S\tau = \dot{D} + \theta SF, \tag{3}$$

where τ is the real value of transfers.

Combining equations (2) and (3) yields an expression for the government's budget constraint:

$$\dot{F} = \theta F + \mu\frac{M}{S} - \tau, \tag{4}$$

where $\mu = \frac{\dot{M}}{M}$, the nominal rate of money growth. The government accumulates foreign exchange reserves as transfers fall short of interest on existing government assets and seigniorage revenues. Under the assumption that monetary growth in the rest of the world is zero ($\mu^* = 0$), fixed exchange rates imply that domestic monetary growth is zero ($\mu = 0$). Equation (4), therefore, determines the change in foreign exchange reserves. Under flexible rates, μ is given by the value which sets $\dot{F} = 0$ in equation (4).[5]

---

[4]For simplicity, the government is assumed to issue no government debt to private agents. However, in a world in which private bonds and government debt are perfect substitutes, all results would be identical.

[5]This policy, together with a floor on reserves, assures solvency for the government: $\lim_{t\to\infty} F_t e^{-\theta t} = 0$

C. Money Market Equilibrium with Forward-looking Agents

Consider, now, private sector behavior. Assume that the small open economy is populated by representative agents with identical logarithmic utility functions containing consumption and real money balances. A representative agent faces a budget constraint whereby the real value of the agent's wealth (a), which consists of real bonds (b) and the real value of nominal money balances $\left(\frac{M}{S}\right)$, accumulates over time as the agent receives interest on wealth, transfers from the government (τ), and endowments (y), and falls with expenditures on consumption (c) and real money balances $\left(i\frac{M}{S}\right)$ according to:

$$\dot{a} = \theta a + y + \tau - \left(c + i\frac{M}{S}\right),$$

where i is the nominal interest rate.

Assuming that the future stream of endowments is constant and that the domestic rate of time preference equals the world real interest rate, maximization of utility subject to the budget constraint and to the "no Ponzi game" constraint, given by $\lim_{t\to\infty} a_t e^{-\theta t} = 0$ yields consumption demand and real money demand equations according to:

$$c = (1 - \gamma)\left[\theta\left(\frac{M}{S} + b + \psi\right) + y\right], \tag{5}$$

$$i\frac{M}{S} = \frac{\gamma}{1-\gamma}c. \tag{6}$$

Consumption's share in total expenditures is given by $1 - \gamma$, and ψ is the present discounted value of government transfer payments. Total expenditure on consumption and real money balances $\left(c + i\frac{M}{S}\right)$ is proportional to total wealth, defined as financial wealth $\left(\frac{M}{S} + b\right)$ plus the present discounted value of disposable income $\left(\frac{y}{\theta} + \psi\right)$. Additionally, expenditures on money $\left(i\frac{M}{S}\right)$ are proportional to expenditures on consumption. Since interest equals time preference, consumption is constant over time.

Using (5) and (1) in (6) yields the money market equilibrium equation as a function of the exchange rate and its rate of change.

$$\left(\theta + \frac{\dot{S}}{S}\right)\frac{M}{S} = \gamma\left[\theta\left(\frac{M}{S} + b + \psi\right) + y\right]. \tag{7}$$

This equation and equation (4) are the fundamental equations of the model. Monetary equilibrium differs from that in the standard model in two ways. First, the scale variable, determining money demand, contains forward looking variables. The expression $\frac{y}{\theta} + \psi$ denotes the present value of future income and transfers. Second, the government's budget constraint, equation (4), implies that τ, ψ, and μ cannot be chosen independently. It is shown below that the effect of expansionary domestic credit creation on the short-run viability of the fixed exchange rate depends on the implications of the policy for the present discounted value of government transfers. If the policy increases present value transfers, then it must cause instantaneous exchange rate collapse. If the policy increases current transfers only, leaving present value transfers unchanged, then it can generate delayed collapse.

III. Policy and Exchange Rate Collapse

A. Initial Equilibrium

To determine the criteria necessary for delayed predictable collapse, it is first necessary to establish an initial equilibrium in which the fixed rate is viable indefinitely. From this initial equilibrium, policy change and its implications for the survival of the fixed rate regime can be analyzed.

This section defines initial values and the corresponding values of the policy variables, such that fixed and flexible rate equilibria are both viable. Assume that $\mu_0 = \mu^* = \dot{F}_0 = 0$, such that transfers are constant at the value given by $\tau_0 = \theta F_0$. Setting the rate of change of the exchange rate equal to zero in equation (7), and solving yields an expression for the equilibrium fixed exchange rate:

$$\bar{S} = \frac{\theta(1 - \gamma)M_0}{\gamma(\theta b_0 + y + \tau_0)} = \frac{\theta(1 - \gamma)M_0}{\gamma(\theta(b_0 + F_0) + y)}, \tag{8}$$

where an overbar is used to denote the value of the exchange rate in the fixed rate regime. The fixed exchange rate is assumed to be set at this value.

To assure that this fixed rate equilibrium is viable, it is necessary to solve for the value the exchange rate would take on, conditional on speculative attack and a switch to a floating exchange rate regime. Flood and Garber (1984) label this the shadow floating exchange rate. Viability requires the absence of speculative profits from attack and therefore requires that the shadow floating rate never exceed the fixed rate.

To solve for the shadow floating rate, it is necessary to specify a reserve commitment by the central bank. Assume that the central bank is willing to lose a maximum of $\bar{S}\delta_t$ foreign exchange reserves at time t. Once this quantity is gone, they abandon the fixed rate. Additionally, assume that the impact of the foreign exchange reserve loss on the money supply is not sterilized.[6] Therefore, with exchange rate collapse, the government loses $\bar{S}\delta_0$ foreign exchange reserves, and the money supply decreases by $\bar{S}\delta_0$. Domestic agents increase their holdings of real bonds by δ_0 as they swap real bonds for real money balances. The shadow floating rate values of stock variables are denoted by tildes (˜). At time 0, they are given by:

$$\tilde{F}_0 = F_0 - \delta$$

$$\tilde{b}_0 = b_0 + \delta$$

$$\tilde{m}_0 = \frac{M_0 - \bar{S}\delta_0}{\tilde{S}_0} = \frac{\bar{S}}{\tilde{S}_0}(m_0 - \delta)\,.$$

The shadow flexible exchange rate is that rate which sets $\frac{\dot{S}}{S} = \tilde{\mu}$, where $\tilde{\mu}$ is given by the value of μ which sets $\dot{F} = 0$ in equation (4), allowing the discrete adjustment of asset stocks through the foreign exchange market. Its value is given by:

$$\tilde{\mu} = \frac{\tau + \theta\tilde{F}}{\tilde{m}} = \frac{\theta\delta_0}{m_0 - \delta_0}\,.$$

Substituting $\tilde{\mu}$ into equation (7), it can be shown that $\tilde{S}_0 = \bar{S}$. Additionally, since foreign exchange reserves are not changing in the equilibrium defined above, the shadow floating rate in the future continues to equal the spot rate.

---

[6]The consequences of relaxing this assumption are considered at the end of the paper.

Since the shadow floating rate equals the spot rate now and in the future, profits from a speculative attack are zero, and the flexible rate equilibrium is viable indefinitely. Note, however, that if agents do attack and the government loses some foreign exchange reserves, then money growth must be higher to replace the government's lost interest revenues on foreign exchange reserves, yielding a self-fulfilling exchange rate crisis.[7] This is a problem of multiple equilibria and is considered at the end of the paper. For now, assume that speculative attack does not occur, and focus on the fixed rate equilibrium.

B. Domestic Credit Expansion and Instantaneous Collapse

From the initial equilibrium, described above, in which there is no expectation of exchange rate collapse, consider a policy change leading to an increase in the rate of domestic credit creation. Specifically, assume that at time 0, the domestic government permanently increases transfers to agents, such that $\tau = \tau_0 + \Delta\tau = \theta F_0 + \Delta\tau$, and finances this with an increase in domestic credit creation according to equation (3).

Consider, first, money market equilibrium under fixed exchange rates. From equation (8):

$$\bar{S} = \frac{\theta(1-\gamma)M_0}{\gamma(\theta b_0 + y + \tau_0)} = \frac{\theta(1-\gamma)(M_0 + \Delta M)}{\gamma(\theta(b_0 + \Delta b) + y + \tau_0 + \Delta\tau)} .$$

The increase in transfers increases the present discounted value of disposable income, thereby increasing real money demand. If the exchange rate is to remain fixed, agents must make a discrete swap of real bonds for money, as the authorities peg the exchange rate. The increase in the value of transfer payments creates declining foreign exchange reserves from equation (4), as in Krugman (1979) and Flood and Garber (1984). However, for this fixed rate to be a viable equilibrium, it must be the case that the shadow floating rate not exceed the value of the fixed rate. Otherwise, agents will attack forcing abandonment of the fixed rate.

Now, compute the shadow flexible exchange rate. Under floating rates $\frac{\dot{S}}{S} = \mu$, such that from equation (4), $\tilde{\mu}_0 \tilde{m}_0 = \Delta\tau + \theta\delta_0$. After substitution and manipulation of the exchange rate equation, the shadow floating rate relative to the fixed rate can be expressed as:

---

[7] Obstfeld (1986, 1994) discusses the possibility of a self-fulfilling crisis, conditional on a change in policy with collapse. Others have also suggested the possibility of multiple equilibria to explain instances of collapse which take the markets by surprise.

$$\frac{\tilde{S}_0}{\bar{S}} = \frac{\gamma[\theta(b_0+F_0)+y]-(1-\gamma)\theta\delta_0}{\gamma[\theta(b_0+F_0)+y]-(1-\gamma)(\theta\delta_0+\Delta\tau)} > 1,$$

for reasonable magnitudes of δ.[8] Therefore, the shadow floating rate is above the fixed rate irrespective of the magnitude of reserve loss. Speculators will attack the fixed rate regime, the instant of the policy change, to reap the implied profits.

It is useful to think about the intuition behind this result. Return to the fundamental equation given by (7). The policy decision is to increase transfer payments to the public and finance this with seigniorage revenue, created by a corresponding rise in the rate of domestic credit creation. This policy change increases the present-discounted value of disposable income, increasing the representative agent's perception of his wealth. The increase in wealth raises an agent's desired current and future consumption.[9] But present-value consumption cannot increase since the present value of consumption resources is unchanged. The attempt to increase current consumption must force a price level increase in equilibrium. This reduces the real value of his nominal assets such that he is content with the initial values for current and future consumption.[10] With the foreign price level fixed, the only way the domestic price level can rise is with exchange rate collapse.

To understand the result in a different way, use equation (4) to substitute for the flexible rate value of $\left(\theta + \frac{\dot{S}}{S}\right)\frac{M}{S}$ to yield:

$$\tau_0 + \Delta\tau - \theta\left(F - \frac{M}{S}\right) = \gamma\left[\theta\left(\frac{M}{S} + b\right) + \tau_0 + \Delta\tau\right].$$

---

[8]With a speculative attack agents lose $\bar{S}\delta$ nominal money balances. Therefore, $\delta < \frac{M_0}{\bar{S}} = \frac{\gamma[\theta(b_0+F_0)+y]}{\theta(1-\gamma)}$, so that the numerator is positive. The denominator is smaller and positive since the exchange rate cannot be negative.

[9]It is possible, when utility is not logarithmic, for the increased wealth to create an equal increase in present-value expenditures on money and no increase in desired consumption. This yields different results. See Daniel (1997).

[10]Note that increased current consumption and an implied current account deficit cannot be an optimal path. With current consumption up, and present-value consumption unchanged due to the resource constraint, then future consumption would have to fall. With interest equal to time preference, the agent has no reason to plan for a decrease in future consumption.

Note that the two groups of financial assets $\left[\left(F - \frac{M}{S}\right);\left(\frac{M}{S} + b\right)\right]$ are unaffected by the magnitude of reserve loss. Expenditure on real money balances, given by the left-hand side, is not affected by reserve loss because any reduction in reserves feeds into larger money growth necessary to achieve the target seigniorage revenues. Domestic real wealth is not affected by an exchange of equal values. Therefore, if the equation holds initially with $\Delta\tau = 0$, then it cannot hold with $\Delta\tau > 0$ at an unchanged exchange rate. From equation (7), the exchange rate must increase.

In summary, when a policy change toward expansionary domestic credit creation increases the present value of government transfers, exchange rate collapse is instantaneous. This suggests that a criteria for the short run viability of fixed exchange rate is that the present value of government transfers not rise. The next section demonstrates the validity of this hypothesis.

C. Domestic Credit Expansion and Delayed Collapse

Now, consider the alternative policy of setting $\dot{D} = \rho D$ and letting τ be determined by equation (4). In the initial equilibrium, $\rho = \dot{D} = 0$, and the initial fixed exchange rate is given by equation (8). Note that under this policy, the present discounted value of transfers is conditional on the exchange rate regime. Therefore, to compute the shadow floating exchange rate, it is first necessary to compute the present value of transfers, conditional on exchange rate collapse.

From equation (3), the present value of transfers, conditional on collapse at time zero, becomes:

$$\tilde{\Psi}_0 = \int_0^\infty \tilde{\tau}_t e^{-\theta t} dt = F_0 - \delta_0 + \int_0^\infty \frac{1}{S_t} \dot{D}_t e^{-\theta t} dt .$$

where $\mu = \rho = \frac{\dot{S}}{S}$ such that:

$$S_t = \tilde{S}_0 e^{\rho t}$$

and

$$\dot{D}_t = \rho D_0 e^{\rho t} .$$

Substituting and integrating yields:

$$\tilde{\psi}_0 = F_0 - \delta_0 + \frac{\rho D_0}{\theta \tilde{S}_0}.$$

This simplifies further to $\tilde{\psi}_0 = \frac{\rho D_0}{\theta \tilde{S}_0}$, under the conventional assumption that the reserve floor is zero, such that the authorities abandon the fixed rate when reserves are exhausted $(F_0 = \delta_0)$. Assuming a zero reserve floor and using equation (7) to solve for the shadow floating exchange rate at time zero yields:

$$\tilde{S}_0 - \bar{S} = \frac{(1-\gamma)[\rho D_0 - \theta \bar{S} F_0]}{\gamma[\theta(b_0 + F_0) + y]} \lesseqgtr 0.$$

The shadow floating rate can be below, equal to, or above the fixed rate, as in Flood and Garber (1984). Additionally, higher reserves imply a lower shadow floating rate, suggesting that a government can maintain a fixed rate as long as it has sufficient reserves.

To understand why this result differs from the previous one in which expansionary domestic policy required instantaneous exchange rate collapse, independent of the level of reserves, it is necessary to consider the effect of this policy on the present value of transfers. When the policy variable is the rate of expansion of domestic credit, with the transfers determined endogenously from the government's budget constraint, the present value of transfers does not necessarily increase.[11] The relationship of the shadow floating rate to the fixed rate is determined by the relationship of the present value of transfers, conditional on collapse at time zero and evaluated at the fixed exchange rate $\left(\frac{\rho D_0}{\theta \bar{S}}\right)$, to the initial value of transfers, given by F_0. If the present value of transfers, conditional on collapse, does not rise, the shadow floating rate is below the spot rate, and delayed collapse is possible. Collapse today would imply the loss of so many reserves relative to the increase in the present value of seigniorage that the present value of transfers would actually fall. A postponed collapse allows a smaller reserve loss on the day of collapse and higher present value seigniorage revenue, reducing the fall in the present value of transfers.

---

[11]For the policy exercise in the previous section, the policy variable is the level of transfers, implying that the present value of transfers increased irrespective of the initial level of reserves.

When delayed collapse is possible, its timing is computed to equate the shadow floating rate at the time of collapse (*T*) with the fixed rate, as in Flood and Garber (1984). Therefore, collapse occurs when:

$$\theta\bar{S}F_T = \rho D_T$$

where from equations (3) and (4), $F_t = F_0 + \frac{D_0}{\bar{S}}(1 - e^{\rho t})$ for $t \leq T$. Substituting, yields an expression which determines the date of collapse (T) as:

$$\frac{\theta}{\rho + \theta}\frac{M_0}{D_0} = e^{\rho T}. \tag{9}$$

As in other work, the time to collapse is increasing in reserves,[12] and decreasing in the rate of growth of domestic credit *(ρ)*.

Delayed collapse is possible only when the increase in the rate of growth of domestic credit creation leaves the present value of transfers, conditional on collapse at time *T*, unaffected. To see this, compute the present value of transfers at time 0, conditional on collapse at time *T* as:

$$\psi_{0,T} = \int_0^T \left(\theta F_t + \frac{\rho D_t}{\bar{S}} \right) e^{-\theta t} dt + \int_T^\infty \frac{\rho D_t}{S_t} e^{-\theta t} dt = \frac{M_0}{\bar{S}}\left(1 - e^{-\theta T}\right) + \frac{D_0}{\bar{S}}\left(\frac{\rho + \theta}{\theta} e^{(\rho - \theta)T} - 1 \right).$$

Substituting for $e^{\rho T}$ from equation (9), yields: $\psi_{0,T} = F_0$. The present value of transfers is constant at its initial level of F_0, conditional on collapse at time *T*.

Therefore, for a policy of expansionary domestic credit creation to be consistent with a fixed exchange rate, even temporarily, the policy change must leave the fiscal constraint satisfied. In particular, the present value of government transfers must not deviate from its initial equilibrium level. Otherwise, when agents perceive their wealth has increased, the attempt to increase consumption, with the intention of increasing present-value consumption, when the present value of resources is unchanged, must depreciate the exchange rate immediately, reducing the real value of domestic monetary assets. The level of reserves matters only if it

---

[12] $\left(\frac{M_0}{D_0}\right)$ is increasing in reserves.

plays a role in determining whether the policy change increases the present value of transfers.[13]

Using the government's intertemporal budget constraint, which constrains the present value of transfers to equal the present value of seigniorage revenues plus initial debt, it is possible to provide a more general interpretation of the fiscal constraint.[14] Note that an increase in the present value of transfers implies an increase in the present value of seigniorage revenues.[15] Therefore, avoidance of instantaneous collapse constrains the government from increasing the present value of seigniorage revenues.

D. Sterilization and Exchange Rate Collapse

Finally, it is interesting to consider the implications of sterilizing the effect of reserve changes on the money supply. Flood, Garber, and Kramer (1996) and Flood and Marion (1996) claim that it is important to recognize that governments do sterilize. To allow sterilization, it is necessary to introduce a government bond, held by the public, into the model. Assume that the government issues real bonds b^g to private agents and that these are perfect substitutes for foreign real bonds and pay the same interest rate. Any reduction (increase) in the monetary base due to a loss (gain) of foreign exchange reserves is instantaneously offset by an open market purchase (sale) of government bonds to keep the money supply constant. Government non-monetary debt $(b^g - F)$ is constant under a policy of sterilization. It is well known that, with complete sterilization, if the exchange rate is not viable in the long run, then it is not viable in the short-run either. Expansionary domestic credit creation must cause immediate exchange rate collapse, independent of fiscal policy.[16]

However, it is also possible to show that sterilization can eliminate the possibility of multiple equilibria for the case where the fixed rate is viable in the long-run. Consider the case where

---

[13]It is interesting to note that the policy in this section replicates the essentials of policy in Flood and Garber (1984), where the scale variable is constant and where policy is control of the rate of domestic credit creation. Satisfaction of the fiscal constraint assures that the scale variable is constant, conditional on collapse at time T.

[14]To derive this, integrate equation (4), subject to the assumption that $\lim_{T\to\infty} F_T e^{-\theta t} = 0$

[15]In a two-country model, policy change must leave the present value of seigniorage revenues, relative to the agent's non-monetary wealth (bonds plus present-value disposable income), unchanged. See Daniel (1997).

[16]Flood, Garber, and Kramer (1996) and Flood and Marion (1996) are able to change this result by introducing imperfect substitutability of bonds.

the policy choice variable is the level of transfers. Here, multiple equilibria can arise because a speculative attack reduces the government's interest-bearing reserves. To maintain transfers at their target level, domestic credit creation and money growth must increase. A policy of sterilizing the effects of these speculative attacks on the money supply would replace foreign exchange reserves with reduced government debt, eliminating the need for higher monetary growth and eliminating self-fulfilling crises. To summarize, if the fixed rate is viable in the long run, and the authorities sterilize the results of speculative attacks, then the fixed rate is viable in the short run. Sterilization assures that multiple equilibria vanish.

IV. Conclusion

It is well-known that the long-run viability of a fixed exchange rate regime imposes constraints on policy. This paper shows that in the absence of long-run viability, short-run viability imposes an additional constraint. Only when this fiscal constraint is satisfied, is delayed predictable collapse possible. When the fiscal constraint is violated, collapse must occur instantaneously.

In the model presented here, a policy change toward expansionary domestic credit creation is consistent with delayed predictable exchange rate collapse as in Krugman (1979), Flood and Garber (1984), and others, only if it is not accompanied by an increase in the present value of government transfers. Therefore, the fiscal constraint necessary for temporary viability of the fixed exchange rate regime is that the present value of government transfers must not rise. From the government's intertemporal budget constraint, this is equivalent to the requirement that the present value of seigniorage revenue must not rise.

With an increase in present-value transfers, agents perceive that their wealth has increased, and the attempt to increase consumption must cause an equilibrium increase in the price level. Given purchasing power parity, the only way the domestic price level can rise is with exchange rate collapse. Hence, the shadow floating rate rises above the fixed rate whenever policy change increases the present value of government transfer payments. Collapse is instantaneous, unexpected, and accompanied by exchange rate depreciation.

This model provides an alternative to the self-fulfilling crisis explanation for episodes of exchange rate collapse, which appear to take the markets by surprise. In these models, plans by the monetary to change policy, conditional on collapse, can generate collapse in a system with sound fixed rate fundamentals. In the model presented here, beliefs about fundamentals can generate collapse. Any event, which changes expectations about future policy in such a way that the fiscal constraint is violated, can trigger collapse. This is a fundamentals explanation of exchange rate crises in the sense that collapse is triggered when agents believe that fundamentals violate the forward-looking fiscal constraint. Fundamentals need not be misaligned for a sustained period of time, or become misaligned, when reserves are low, to generate a collapse. Policy change, which violates the fiscal constraint, must generate instantaneous collapse, even when reserves are high.

The policy implications of these results reinforce the already prevalent notion that current monetary policy alone is not sufficient to peg the exchange rate. A successful peg requires that the fiscal authority have in place current policy and credible plans for future policy such that the fiscal constraint is met. From an initial position of a viable peg, this prohibits the domestic country from engaging in fiscal change which will increase the present value of seigniorage revenues. A country's plans for future taxes, transfers and money growth must be consistent with this present-value constraint. Otherwise, the promise by the monetary authority to buy and sell currency at a fixed price is not sufficient to peg the exchange rate.

References

Agénor, Pierre-Richard, Jagdeep S. Bhandari, and Robert P. Flood, 1992, "Speculative Attacks and Models of Balance of Payments Crises," *Staff Papers*, International Monetary Fund, Vol. 39 (June), pp. 357-394.

Buiter, Willem H., 1989, "A Viable Gold Standard Requires Flexible Monetary and Fiscal Policy," *Review of Economic Studies*, (January), pp. 101-118.

Daniel, Betty C., 1997, "Seigniorage, Fiscal Constraints, and the Viability of a Fixed Exchange Rage Regime," Manuscript: State University of New York – Albany.

Eichengreen, Barry and Charles Wyploz, 1993, "The Unstable EMS," *Brookings Papers on Economic Activity*, Vol. 1, pp. 51-144.

Flood, Robert P. and Peter M. Garber , 1984, "Collapsing Exchange Rate Regimes: Some Linear Examples," *Journal of International Economics*, Vol. 17 (August), pp. 1-13.

Flood, Robert, Peter M. Garber and Charles Kramer, 1996, "Collapsing Exchange Rate Regimes: Another Linear Example," *Journal of International Economics*, Vol. 41 (November), pp. 223-224.

Flood, Robert and Nancy Marion, 1996, "Speculative Attacks: Fundamentals and Self-Fulfilling Prophesies," NBER Working Paper No. 5789 (Cambridge, MA: National Bureau of Economic Research).

Krugman, Paul, 1979, "A Model of Balance of Payments Crises," *Journal of Money, Credit, and Banking*, Vol. 11 (August), pp. 311-325.

Obstfeld, Maurice, 1986b, "Rational and Self-Fulfilling Balance of Payments Crises," *American Economic Review*, Vol. 76 (March), pp. 72-81.

Obstfeld, Maurice, 1994, "The Logic of Currency Crises," NBER Working Paper No. 4640 (Cambridge, MA: National Bureau of Economic Research).

Sachs, Jeffrey, Aaron Tornell and Andres Velasco, 1996, "The Mexican Peso Crisis: Sudden Death or Death Foretold?" *Journal of International Economics*, Vol. 41 (November), pp. 265-284.

Salant, Stephen W., and Dale W. Henderson, 1978, "Market Anticipations of Government Policies and the Price of Gold," *Journal of Political Economy*, Vol. 86 (August), pp. 627-48.

Salant, Stephen W., 1983, "The Vulnerability of Price Stabilization Schemes to Speculative Attack," *Journal of Political Economy*, Vol. 91 (February), pp. 1-38.