Capital Inflows, Fiscal Discretion, and Exchange Rate Policy*

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Abstract

Many writers have argued for the benefits of a credible fixed exchange rate (a hard peg) as a commitment device in an open economy. But historically, fixed exchange rates have often been associated with large current account deficits and episodes of ‘over-borrowing’. This paper develops a model of capital inflows that are linked to the exchange rate regime because of endogenous fiscal policy. The key message of the paper is that a hard peg is undesirable in the absence of commitment in fiscal policy. In face of a credible fixed exchange rate, the fiscal authority subsidizes capital inflows. The economy will engage in inefficiently high international borrowing, and in welfare terms may end up worse off than under capital market autarky. To eliminate the incentive to subsidize borrowing, the monetary authority must follow a flexible exchange rate rule in which capital inflows lead to exchange rate appreciation. If fiscal policy must be financed by money creation rather than direct taxation, then a fixed exchange rate rule may cause both over-borrowing and a subsequent exchange rate crisis.

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Many writers have argued for the benefits of credible fixed exchange rates (hard pegs) in providing a nominal anchor for monetary policy in an open economy. ‘Hard pegs’ are seen as instilling a commitment in monetary policy (e.g. Calvo 2000 for emerging markets and Giavazzi and Pagano 1989 for Europe), particularly in countries with a record of high inflation. But the historical record of hard pegs is mixed. Many countries that have fixed their exchange rates have experienced very large current account deficits, and in some cases, subsequent exchange rate crises. In fact, most of the significant capital inflows into emerging market countries have taken place under fixed exchange rates. This is true of both the Latin American and East Asian economies. Figure 1 shows that for Argentina, Brazil, and Mexico, episodes of exchange rate stability have typically coincided with large and sustained current account deficits.

This paper explores the linkage between the fixed exchange rate regimes and capital inflows in environment of endogenous fiscal policy. The essential message of the paper is that the incentive for government interference in capital markets (through implicit or explicit borrowing guarantees or subsidies) will generally depend on the exchange rate policy. If there is credible commitment in both monetary and fiscal policy, then the exchange rate policy is irrelevant. But, absent commitment in fiscal policy, a credible fixed exchange rate regime (a ‘hard peg’) encourages the fiscal authority to subsidize international borrowing, even in a small economy where the cost of borrowing is fixed by world market forces. In order to avoid this excessive international borrowing, the central bank must follow a flexible exchange rate rule whereby the currency appreciates during episodes of capital inflows.

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1 The link between fixed exchange rates and capital inflows has been noted in many previous contexts. See Edwards (2000) for discussion of the exchange rate based stabilization literature. For discussion of overborrowing, see Mckinnon and Pill (1998), Burnside, Eichenbaum, and Rebelo (2001a) among others. We discuss this references more fully below.
An implication of our argument is that it is important to combine the commitment to a hard peg with limitations on fiscal policy. But this is for quite different reasons than those emphasized in standard first-generation models of currency crises. We need both a hard peg and constraints on fiscal policy not because the presence of government budget deficits threatens the sustainability of the peg, but rather because it is the hard peg itself which gives rise to bad fiscal policy. Alternatively, if constraints on fiscal policy cannot be put in place, we are best off without the hard peg.

The argument is developed a simple inter-temporal open economy model. A fiscal authority can tax or subsidize foreign borrowing. We can think of these either as explicit subsidies to domestic borrowers, or implicit guarantees that ultimately represent a liability of government. By assumption, monetary policy is determined by an independent central bank that can pre-commit to an exchange rate rule. If the fiscal authority can also pre-commit, it will never wish to interfere with international capital flows, no matter what the exchange rate policy followed by the central bank. But without pre-commitment, there is an incentive to encourage borrowing by subsidies or guarantees. The underlying distortion pushing the fiscal authority to intervene in capital markets is the unemployment rate. Wages are set in advance by monopoly suppliers of labor so that employment is inefficiently low. By subsidizing capital inflow after wages are set, the fiscal authority attempts to ameliorate this distortion.

With a fixed exchange rate rule, the fiscal authority will always wish to subsidize foreign borrowing. As a result the country will have an excessive level of external debt. In fact, in our model a fixed exchange rate leads the economy to end up in a worse welfare position than if it was under complete capital market autarky.
While a hard peg should be avoided in an environment where fiscal authorities lack credibility, there is an exchange rate rule which exactly nullifies the lack of fiscal pre-commitment. If this rule is followed by a central bank, it offsets the incentive for the fiscal authority to intervene in capital markets, allowing the economy to fully exploit the benefit from international capital flows. The key ingredient behind this rule is that the exchange rate should appreciate in response to capital inflows.

We extend the model to show that the combination of fixed exchange rates, absence of pre-commitment in fiscal policy, and a requirement that the government needs to finance its activity with money creation can generate a joint capital-market-currency crisis. The key feature of this extended model is that this joint crisis is caused solely by the initial imposition of a fixed exchange rate regime. Without an initial peg, there is no over-borrowing, and no subsequent currency collapse. In fact, without the peg, the exchange rate can be kept stable throughout.

The paper is related to a number of literatures on exchange rates and fiscal policy. Many writers have noted that exchange rate pegs used to eliminate high inflations may give rise to overvaluation and excessive current account deficits (Edwards 2000). Others have emphasized the tendency for fixed exchange rates to give rise to excessive, unhedged foreign currency borrowing (McKinnon and Pill, 2000, Burnside et al. 2001a). This in turn may give rise to ‘Fear of Floating’, as in Calvo and Reinhart (2002). From a different perspective, there is a debate about whether a credible fixed exchange rate can itself instil fiscal discipline (see Tornell and Velasco 1996). We discuss the relationship of the paper to these questions in more detail below.

The paper is organized as follows. The next section develops the basic model. Section 2 shows the results with pre-commitment. Section 3 deals with the no
commitment case. Section 4 extends the analysis to show that excessive capital inflows may generate subsequent currency crises. Section 5 discusses the relationship of the paper to the literature on exchange rate regimes and fiscal policy. Some conclusions are then offered.

1. The Model

Take a simple two-period model of an open economy\(^2\). In each period there is a single good produced by competitive firms. Consumer-workers supply labor to firms, and set wages monopolistically in advance, as in Obstfeld and Rogoff (2000).

**Firms**

Each firm has a production function given by \( Y_t = F(H_t) \), where \( F(H_t) \) is increasing, concave, and satisfies Inada conditions. We define the labor composite as

\[
H = \left( \int_0^1 H(i) \left( \frac{1}{\lambda} \right)^{\frac{1}{\lambda}} di \right)^{-\frac{1}{\lambda}},
\]

so that the firm uses differentiated labor in production, and the elasticity of substitution between types of labor is \( \lambda \). For the firm, the profit maximizing rule is:

\[
(1.1) \quad \frac{S_i}{Y_t} F'(H_t) \left[ \frac{H_i(i)}{H_t} \right]^{-\frac{1}{\lambda}} = W_i(i)
\]

so that the wage elasticity of demand for each type of labor is equal to \( \lambda \).

**Consumer-Workers**

Consumers have utility over periods 0 and 1 given by:

\[
(1.2) \quad E_{-1} U_j = E_{-1} \sum_{i=0}^1 \beta^i (U(C_j(i)) - V(H_j(i)))
\]

\(^2\) The results do not depend on the two period structure. The model could be re-framed in a dynamic setting to show the same arguments, but at the cost of analytical tractability.
where $C_t(i) \ (H_t(i))$ is consumption (employment) of household $i$ in period $t$. The functions $U(.)$ and $V(.)$ are increasing, concave, and continuously differentiable.

The household can lend or borrow (if negative) amount $B_t(i)$ at rate $r$, receives wage income where the nominal wage is $W_t$, and receives profits $\Pi_t(i)$ from ownership of the firm. Household budget constraints are then

\begin{align}
(1.3) \quad P_0 C_0(i) + P_0 B_1(i) &= W_0(i) H_0(i) + \Pi_0 - P_0 T_0 \\
(1.4) \quad P_1 C_1(i) &= (1 + r) P_1 B_1(i) + W_1(i) H_1(i) + \Pi_1 - P_1 T_1
\end{align}

where $T_t$ is a tax from the government, and $P_t$ is the price of the consumer good.

Assume that purchasing power parity (PPP) holds, and the foreign price level is normalized at unity so that $P_t = S_t$.

The first order conditions for each consumer-worker $i$, taking the demand for labor schedule (1.1) into account, are:

\begin{align}
(1.5) \quad \beta E_t U'(C_t(i)) &= \beta E_t U'(C_t(i))(1 + r) \\
(1.6) \quad E_t \left( U'(C_t) H_t(i) \frac{W_t}{S_t} - \tilde{\lambda} V'(H_t(i)) H_t(i) \right) &= 0, \quad t = 0,1.
\end{align}

where $\tilde{\lambda} = \frac{\lambda}{\lambda - 1}$. Equation (1.5) is the Euler equation for optimal consumption growth, while (1.6) implicitly determines the pre-set wage for each period\(^3\). Now assume all workers are alike, so that

\begin{align*}
W(i) &= W, \quad H(i) = H.
\end{align*}

---

\(^3\) Equation (1.6) emphasizes a central feature of the model; average real wages will be set so that the marginal product of labor exceeds the marginal rate of substitution between consumption and leisure. As in Barro and Gordon (1983), there is a real distortion that leads a benevolent policy-maker to wish to raise the level of employment. Although the formal model traces this real distortion to monopoly power in the labor market, we could alternatively think of it as arising from monopoly control of a non-traded input into production.
**Fiscal Authority**

The fiscal authority may interfere in capital markets by subsidizing international borrowing. If the world real interest rate is \( r^* \), we define the effective subsidy to foreign borrowing as \( r^* - r \), so that \( r \) represents the control variable of the fiscal authority. The fiscal authority then taxes households to finance any borrowing subsidies\(^4\). Then the fiscal authority’s budget constraint will be

\[
T_0 + \frac{T_1}{1 + r} = \frac{(r - r^*)B_1}{1 + r^*},
\]

where \( B_1 < 0 \) if the private sector are borrowers. The left hand side is the present value of tax revenue, while the right hand side is the present value of expenditure on capital subsidies. Combining (8) and the consumer budget constraint implies that the economy’s overall budget constraint must be:

\[
(1.9) \quad C_t = F(H_t) + (1 + r^*)(F(H_0) - C_0).
\]

**Central Bank**

We have not allowed for an explicit role for money in the model. But this doesn’t matter, as we can instead simply assume that the monetary authority directly chooses the exchange rate rule, as a policy tool. We assume that the monetary authority faces no credibility problem, and can commit to a period 0 exchange rate rule\(^5\). The time 0 exchange rate is assumed to follow a policy rule given by

\[
(1.10) \quad S_0 = S(r)
\]

\(^4\) While we describe these as tax financed subsidies, there is nothing in the model that rules out an alternative interpretation as lending guarantees to domestic borrowers that are implicitly financed by government. This less transparent view of the role of government bias in capital markets may be more in accord with the actual experience of emerging market economies. Since taxes are non-distortionary, there is an equivalence between the two interpretations.

\(^5\) The consequences of the lack of credibility in monetary policy have been extensively investigated before, both for open and closed economies (Barro and Gordon, 1983, Lane 1998).
Hence, the monetary authority follows a rule relating the exchange rate to the domestic real interest rate. Since in our model, capital flows are driven by the rate of return, if this is an increasing function, it implies that when the economy experiences capital outflows (inflows), the exchange rate depreciates (appreciates).

In the case of a hard peg, by definition the rule would imply that \( S'(r) = 0 \), and in addition, that \( S_1 = S_0 \). In this section, the period 1 exchange rate plays no role in the analysis, since there is no restriction on direct taxation, and after the fiscal authority has acted, there is complete monetary neutrality. In section 4 below, we investigate the implications of having an upper bound on tax collection.

**Equilibrium**

For a given value of \( r \), an equilibrium is very easy to define. In an equilibrium; a) consumer workers maximize utility subject to their budget constraints and their individual labor demand constraint, b) firms maximize profits, and c) the labor market clears. As a benchmark, assume that \( \beta(1+r^*) = 1 \). This ensures that in an equilibrium without capital controls, the current account is zero, and consumption and employment are equal in both periods.

**Determination of borrowing subsidies**

Assume that the fiscal authority is benevolent, choosing a subsidy to maximize utility of the representative household. But the authority may or may not be able to commit. With commitment, the subsidy is chosen before the wage for period 0 is set. Then the authority takes account of how its current choice of \( r \) affects both consumption and employment in both periods 0 and 1. But without commitment, it takes the nominal wage as given in period 0, and chooses a subsidy to maximize the household’s utility.
2. Fiscal policy with commitment

Under full commitment, the fiscal authority chooses \( r \) to maximize utility taking into account the consumers’ Euler equation, labor market clearing in both periods, and the economy’s external budget constraint. Table 1 illustrates these constraints. The three conditions in Table 1 implicitly determine the values of \( C_0, H_0, H_1 \).

<table>
<thead>
<tr>
<th>Table 1: Constraints facing the fiscal authority: commitment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Euler equation</td>
</tr>
<tr>
<td>( U'(C_0) = \beta E_0 U'(F(H_1)) + (1 + r^*) (F(H_0) - C_0)(1 + r) )</td>
</tr>
<tr>
<td>Labor market clearing</td>
</tr>
<tr>
<td>( F'(H_0) U'(C_0) = \tilde{\lambda} V'(H_0) ), ( F'(H_1) U'(C_1) = \tilde{\lambda} V'(H_1) )</td>
</tr>
</tbody>
</table>

Implicitly, we may write these as functions of the authority’s decision, so that \( C_0 = C_0(r) \), \( H_0 = H_0(r) \), \( H_1 = H_1(r) \), where these functions satisfy the property that \( C_0'(r) < 0 \), \( H_0'(r) > 0 \), and \( H_1'(r) < 0 \). A rise in the real interest rate reduces period 0 consumption, increases period 1 consumption, which, through adjustment in the real wage, increases period 0 employment and reduces period 1 employment. Moreover, under the assumptions made above, we must have \( C_0(r^*) = F(H_0(r^*)) = F(H_1(r^*)) \).

Note that under commitment, the fiscal authority’s problem is independent of the exchange rate rule. When the authority can pre-commit, it takes account of how the nominal wage set by workers will adjust to exchange rate.

The fiscal authority’s problem is then defined by the problem

\[
\text{(P1)} \quad \max_r \quad U(C_0(r)) - V(H_0(r)) + \beta U(C_1(r)) - \beta V(H_1(r))
\]

subject to \( C_i(r) = F(H_i(r)) + (1 + r^*)(F(H_0(r)) - C_0(r)) \).

\(^6\) Under the assumptions on the curvature of preferences and technology, an equilibrium exists.
Proposition 1

Under commitment, the optimal subsidy on foreign borrowing is zero.

Proof. Using Table 1, the first order condition for problem $P_1$ is

\[
\begin{align*}
(U'(C_0) - \beta U'(C_1)(1+r^*) \bigg) C_0'(r) & + \bigg[U'(C_0)F'(H_0) - V'(H_0)\bigg] H_0'(r) + \beta \bigg[U'(C_1)F'(H_1) - V'(H_1)\bigg] H_1'(r) = 0
\end{align*}
\]

The expression on the top line captures the effect on utility of the revision of inter-temporal consumption generated by a subsidy. A rise in $r$ will reduce consumption in period 0, so that $C_0'(r)<0$. If $r>r^*$ ($r<r^*$) it must be that $U'(C_0) = \beta U'(C_1)(1+r)$. Then, if this was the full effect on utility, it is clear that the fiscal authorities would set $r=r^*$, because they wish to reduce (increase) $r$ when $r>r^*$ ($r<r^*$). As regarding the two expressions on the second line, at the initial point $r=r^*$ and with $\beta(1+r^*)=1$, it is the case that $\beta H_1'(r^*) = -H_0'(r^*)$. Then, since when $r=r^*$, we have $C_1 = C_0$, $H_1 = H_0$, it follows that these two expressions also sum to zero when capital controls are zero.

The explanation for proposition 1 is quite straightforward. With monopoly wage setting, there is a labor market distortion in each period, due to the fact that the marginal product of labor exceeds the marginal disutility of working. That is $F'(H) > V'(H)/U'(C)$. Hence, employment is inefficiently low in each period. The fiscal authority would like to increase employment. But under pre-commitment, a borrowing subsidy will have opposite effects on employment in each period. For instance, a subsidy will reduce consumption in period 1, and increase consumption in
period 0. This will lead to a rise in employment in period 1, as wage setters will reduce their desired wage, given that the disutility of working in period 1 has fallen. But by the same token, employment in period 0 will fall. The rise in employment in period 1 increases household utility (the second expression in the above first order condition), since employment is inefficiently low to begin with. But the fall in employment in period 0 will reduce household utility, since the distortion of inefficiently low employment in period 0 is exacerbated. Under the symmetry assumptions we have made, these two effects exactly offset each other. Hence there is no benefit to the fiscal authority, acting under commitment, from subsidizing borrowing. As a result, under commitment, the fiscal authority has no incentive to interfere with international capital flows.

3. Fiscal policy without commitment

Without pre-commitment, the fiscal authority chooses the borrowing subsidy after the period 0 wage has been set. Table 2 illustrates the set of conditions facing the authority. The difference from the case with commitment is that employment in time period 0 is not directly dependent on the domestic interest rate \( r \), given that the nominal wage is predetermined. Nevertheless, employment depends on \( r \) indirectly through the exchange rate rule \( S_o(r) \). If a rise in the domestic real interest rate generates a nominal exchange rate depreciation, this increases employment in period 0, for a given nominal wage. Hence the exchange rate rule followed by the monetary authority becomes a critical determinant of the decision to subsidize borrowing.

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7 This can be shown by differentiating the economy’s budget constraint (1.9) for changes in \( r \) around \( r = r^* \), taking into account the two labor market clearing conditions in the second panel of Table 1.

8 When the initial current account is unbalanced, so that \( \beta(1 + r^*) \neq 1 \), the fiscal authority may have an incentive to levy capital taxes (or grant subsidies) even in the precommitment case. Nevertheless,
Table 2: Constraints facing the fiscal authority: no commitment

<table>
<thead>
<tr>
<th>Constraints</th>
<th>Equation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Euler equation</td>
<td>[ U'(C_0) = \beta E_0 U'(F(H_1) + (1 + r^*)(F(H_0) - C_0))(1 + r) ]</td>
</tr>
<tr>
<td>Labor market</td>
<td>[ S_0 F'(H_0) = W_0 \quad U'(C_1) F'(H_1) = \lambda V'(H_1) ]</td>
</tr>
<tr>
<td>Wage determination</td>
<td>[ E_1 \left( U'(C_0) \frac{W_0}{S_0} - \lambda V'(H_0) \right) H_0 = 0 ]</td>
</tr>
<tr>
<td>Exchange rate rule</td>
<td>[ S_0 = S(r) ]</td>
</tr>
</tbody>
</table>

From Table 2, we may define the implicit functions underlying the authority’s decision without commitment as \( C_0 = C_0(r, s(r)), H_0 = H_0(s(r)) \) and \( H_1 = H_1(r, s(r)) \), where \( s(r) = \frac{S_0(r)}{W_0} \). It is straightforward to show that these functions satisfy the conditions \( C_{0r} < 0, C_{0s} > 0, H_0'(s) > 0, H_{1r} < 0, \) and \( H_{1s} < 0 \). A period 0 real depreciation (defined as a fall in the period 0 real wage) increases employment. The increase in income directly increases period 0 consumption. But, through the income effects on labor supply, this raises the period 1 real wage, and reduces employment in time period 1.

Without commitment the fiscal authority’s problem is defined as follows

\[
(P2) \quad \max_r U(C_0(r, s)) - V(H_0(s)) + \beta U(C_1(r, s)) - \beta V(H_1(r, s))
\]

the incentives to deviate from the \( r = r^* \) case are always greater without commitment (as shown below).
subject to \( C_t(r,s) = F(H_t(r,s)) + (1 + r^*)(F(H_o(s)) - C_o(r,s)) \), and

\[
s(r) = \frac{S_o(r)}{W_o}.
\]

The choice of the fiscal authority depends critically upon the form of the exchange rate rule followed by the central bank. We first establish the following result

**Proposition 2.**

Under a fixed exchange rate the fiscal authority subsidizes international borrowing, so that \( r < r^* \).

**Proof.** A fixed exchange rate rule implies that \( s'(r) = 0 \). Then the first order condition for the fiscal authority under problem P2 is given by

\[
(3.1) \quad \left[U'(C_o) - \beta U'(C_t)(1 + r^*)\right]C_{tr} + \beta \left[ U'(C_t) F'(H_t) - V'(H_t) \right] H_{tr} = 0
\]

The first expression is the same as that in proposition 1, capturing the impact on utility of distorting the inter-temporal consumption choice. The second expression captures the effect on utility from the revision of period 1 employment following the borrowing subsidy. This expression is always negative, since from the workers optimal wage setting decision, we have \( U'(C_t) F'(H_t) = \tilde{\lambda} V'(H_t) \), with \( \tilde{\lambda} > 1 \), and \( H_{tr} < 0 \). If the sum of the two expressions is to equal zero, it must be that the first expression is positive, which can only be the case if \( r < r^* \).

Hence, under a fixed exchange rate, the fiscal authority subsidizes international borrowing. Consumers borrow at below the world real rate of interest, and the economy runs a current account deficit. The intuition behind this proposition is quite easy to see. Imagine for a moment that \( r = r^* \), so that the economy faces the world rate of interest rate, and there is zero international borrowing. Then, since the
first term in the above first-order condition is zero at \( r = r^* \), the impact on utility of a small fall in the real interest rate is

\[
-\left[ U'(C_t) F'(H_t) - V'(H_t) \right] H_{1r}.
\]

This is unambiguously positive. In contrast to the case with commitment, a small borrowing subsidy increases utility. Without commitment, the fiscal authority takes the period 0 real wage as given, under fixed exchange rates, so it cannot affect the first period level of employment. But if it reduces the domestic real interest rate slightly, this means that it will raise current consumption, and reduce future consumption. At the initial point, where \( r = r^* \), the welfare cost of this inter-temporal consumption distortion is negligible. But the reduction in period 1 consumption leads to an increase in period 1 employment. Because period 1 employment is inefficiently low to begin with, this has first order positive welfare effects. Thus the fiscal authority has an incentive to subsidize borrowing, essentially because it can increase period 1 employment without perceiving a concomitant reduction in period 0 employment. In an equilibrium, it will subsidize borrowing so much that the welfare benefits from an increase in period 1 employment are offset by the welfare costs of the inter-temporal consumption distortion. Therefore, under fixed exchange rates, the equilibrium configuration of capital controls implies that \( r < r^* \).

Welfare is lower in an equilibrium without commitment. Given that wage setters will adjust period 0 wages to account for the higher period 0 consumption, the net impact of the excess borrowing on the labor market distortion is zero, because in equilibrium, the benefit of higher employment in period 1 is offset by lower employment in period 0. But the inter-temporal consumption distortion generated by the capital subsidy leaves the home consumer worse off. In fact because we have
started from a baseline case without net borrowing, the home consumer is worse off in this equilibrium than she would be under complete capital market autarky.

A fixed exchange rate rule therefore gives rise to `over-borrowing’ in this model, in the absence of fiscal pre-commitment. Excessive borrowing takes place simply because under fixed exchange rates, optimal government policy reduces the private cost of funds below the world opportunity cost\(^9\).

It is worth noting that the important property of the exchange rate rule is the elasticity of the factor market real exchange rate \(\frac{S_0}{W_0}\) to changes in the domestic interest rate. Given that we have not defined a separate demand for money in the model so far, the level of the nominal exchange rate is irrelevant.

We now focus on the case where the monetary authority follows a more general exchange rate rule.

**Proposition 3.**

When the exchange rate rule satisfies \(s(r) = \bar{s}(r)\), such that

\[
\bar{s}’(r) = -\frac{\beta[U'(C_0)F’(H_0)-V’(H_0)]H_{i^r}}{\Delta} > 0
\]

where \(\Delta = \left[[U'(C_0)F'(H_0)-V'(H_0)]H_0’ + \beta[U'(C_0)F'(H_1)-V'(H_1)]H_{i^r}\right]^{'}\),

then the optimal borrowing subsidy is zero, and \(r = r^*\).

**Proof.** The first order condition for the fiscal authority under a general exchange rate rule is given by

\[9\] Although our model abstracts from investment, exactly the same channel would be present in an economy with endogenous capital accumulation and investment. A subsidy on current capital inflows would increase domestic investment and the future capital stock, generating a higher level out future output, in this way acting so as to minimize the underlying distortion faced by the fiscal authority.
\[
\begin{align*}
&\left[U'(C_0) - \beta U'(C_1)(1 + r^*)\right] (C_{0r} + C_{0s} s'(r)) \\
&+ \left[U'(C_0) F'(H_0) \left(\frac{1+r^*}{1+r}\right) - V'(H_0)\right] H_0 s'(r) \\
&+ \beta \left[U'(C_1) F'(H_1) - V'(H_1)\right] (H_{1r} + H_1 s'(r)) = 0
\end{align*}
\]

This extends the condition of Proposition 2 in two ways. First, an interest rate change now affects period 0 employment, if it affects the nominal exchange rate. A fall in the interest rate reduces first period employment if the exchange rate rule is increasing in the interest rate. This follows, because with a fixed money wage, a nominal exchange rate appreciation raises the real wage and reduces employment. Second however, an interest rate change increases first period consumption and second period employment through separate channels, since the rise in first period income (following the increase in output) leads to a rise in consumption in period 0 (and period 1), and a fall in employment in period 1. Note however, that if the exchange rate rule satisfies the condition given above, then the second two expressions in the above first order condition sum to zero. But then the first expression must be always zero (under the condition that \((C_{0r} + C_{0s} s'(r)) < 0\)), since we have shown above that this expression is always positive (negative) if \(r < r^* (r > r^*)\). In other words, the fiscal authority would never want to intervene in capital markets only to distort the inter-temporal consumption decision alone.

The role of the exchange rate rule (3.2) is to eliminate the incentive for the fiscal authority to intervene in international capital markets so as to increase period 1 output. If the authority reduces the domestic real interest rate below the world rate, this generates a real exchange rate appreciation (i.e. a real wage increase), which reduces period 0 employment and output. This offsets the incentive to subsidize
borrowing. In fact, the rule (3.2) restores the full commitment case, eliminating the existence of government subsidized over-borrowing.

This exchange rate rule is resonant of the recent debate on the role of the exchange rate in the process of capital inflows in emerging market economies. Many writers have argued that it is unwise for policy-makers to keep the exchange rate fixed in the presence of large capital inflows, because this runs the risk of high domestic inflation and ‘overheating’ of the domestic economy, which may precipitate subsequent crises. It is best to allow the exchange rate to appreciate as a natural brake on the domestic economy. Our results are in accord with this recommendation. In our model, because the economy experiences capital inflows (outflows) when $r < r^* (r > r^*)$, the policy prescription given by the $\delta(r)$ rule implies that the currency should appreciate in response to capital inflows. But the logic behind the need for appreciation is quite different from the standard argument. Here the argument is strategic. An appreciating exchange rate removes the incentive for the fiscal authority to stimulate a consumption boom through borrowing subsidies. It limits capital inflows, not due to the usual effects of real exchange rate appreciation, but by forcing fiscal policy to internalise the true welfare costs of intervention in capital markets.

It is clear that the rule given by (3.2) is also an optimal exchange rate rule that would be chosen by a central bank, under commitment, were it to design a rule to maximize the utility of the representative individual. If the central bank could design a rule ex ante, it would face the same objective as would the fiscal authority, if the fiscal authority were acting with commitment. In that case the central bank would choose the rule to sustain the commitment outcome.

If the exchange rate rule is not designed optimally however, there is no guarantee that it will do better than a fixed exchange rate. While the particular rule
(3.2) ensures fully open capital markets in this economy, if the response of the
exchange rate to the real interest rate is too high, then it may actually outweigh the
incentives to subsidize borrowing. Then the fiscal authority will begin to subsidize
lending (i.e. \( r > r^* \)). This will happen if the impact of a rise in \( r \) on the exchange rate
is so great that the rise in period 0 employment resulting from an exchange rate
depreciation is more important in utility terms than the fall in period 1 employment.
In this case, an equilibrium without commitment involves ‘overlending’.

4. A Currency Crisis Extension

In the model so far a fixed exchange rate policy gives rise to over-borrowing,
but does not generate an exchange rate crisis. The fixed exchange rate regime is not
itself threatened by the presence of over-borrowing. This is because of a simplifying
assumption that we’ve made; namely that the fiscal authority has unrestricted access
to lump-sum taxes. Clearly this is an unrealistic assumption – the public finances of
many emerging market economies are restricted in ways that substantially limit the
collection of direct taxes by any means. Moreover, as argued by Krugman (1998) and
Corsetti et al. (1999), the scale of implicit lending guarantees that lie behind over-
borrowing episodes may far outstrip any possibility of tax finance. Burnside,
Eichenbaum and Rebelo (2001b) argue that the large public sector liabilities
generated by capital inflows into East Asia inevitably required monetary financing.

We can extend the model to put a limit on revenues that can be raised by direct
taxation, and assume that expenditures in excess of this will force the government to
sell bonds to the central bank, as in Krugman (1979). Assume now that the central
bank can make only a temporary commitment to a fixed exchange rate. By this we
mean that it can commit to a rule in which \( S_0 \) is fixed, so that \( S'(r) = 0 \). But it
cannot necessarily ensure that \( S_1 = S_0 \). Since the fixed exchange rate again creates an
incentive for the government to subsidize domestic borrowers, part or possibly all of these subsidies must be financed by money creation, threatening the sustainability of the fixed exchange rate in the second period. The central bank’s commitment ability is only temporary, since ultimately the government budget constraint takes precedence over monetary policy.\footnote{While this is specific set of assumptions over the relative predominance of the central bank and fiscal authority, it accords quite well with the original Krugman (1979) model of speculative attacks and the large literature which followed it.}

In order to pursue the money-financing implications of the exchange rate regime we need to introduce a demand for money. This is done by extending the utility function to encompass a utility benefit of real balances. The details of the extended model are very standard, and relegated to the appendix. There, it is shown that even in the extended model, Propositions 1 and 2 apply \textit{exactly} as before. This means that the model is entirely recursive. The real side of the economy; i.e. the variables \( r, C_0, C_1 \) and \( B \), are determined as in section 3. The level of the nominal exchange rate depends on the extent of money issue, which is dependent on the limits on direct taxation. The intuitive reason that Propositions 1-2 remain unchanged is that a) the economy’s inter-temporal budget constraint is still given by (1.9), and b) from the perspective of the fiscal authority, both money creation and direct taxation are lump-sum taxes, and hence do not affect their incentives to subsidize borrowing, given the exchange rate policy followed by the central bank. Nevertheless, given an upper limit on direct taxation, the outcome of the fiscal policy game will have implications for the size of money creation, and therefore for the level of the exchange rate in period 1.

Given the equilibrium configuration of \( r, C_0, C_1 \) and \( B \), from section 3, we may describe the nominal side of the economy by the following three conditions
(4.1) \[ \frac{M_0}{S_0} = L_0(C_0, C_1, \frac{S_1}{S_0}) \]

(4.2) \[ \frac{M_1}{S_1} = L_1(C_1) \]

(4.3) \[ \frac{M_0 - M_1}{S_0} + T_p + \frac{M_1 - M_0}{(1 + r^*)S_1} = \frac{(r - r^*)B_1}{1 + r^*}. \]

Equation (4.1), we defines the implicit demand for money in period 0, where \( M_0 \) is the nominal money supply in period 0. The function \( L \) is increasing in \( C_0 \), decreasing in \( C_1 \), and decreasing in \( \frac{S_1}{S_0} \). Likewise, (4.2) defines the implicit period 1 money demand schedule. Finally, (4.3) describes the consolidated public sector budget constraint. This says that total subsidies to households (the right hand side) must be financed with money creation and direct taxes, where \( T_p \) denotes the present value of direct taxes. For given values of \( S_0 \) and \( S_1 \), equations (4.1)-(4.3) determine the three variables \( M_0, M_1, \) and \( T_p \).

If there is no constraint on the value of direct taxes, (4.1)-(4.3) are always consistent with a fixed exchange rate; i.e. with \( S_0 = S_1 \). But if we assume an upper bound on feasible tax revenue, so that \( T_p \leq \bar{T}_p \), then it may not be possible to maintain ensure that \( S_1 = S_0 \), because the money supply has to adjust to ensure that (4.3) is satisfied.

To show this, substitute (4.1) and (4.2) into (4.3), giving the condition:

(4.4) \[ L_0(C_0, C_1, \frac{S_1}{S_0})(1 - \frac{S_0}{(1 + r^*)S_1}) - \frac{M_1 - M_0}{S_0} + T_p + L_1(C_1) = \frac{(r - r^*)B_1}{1 + r^*}. \]
This equation represents the government budget constraint, combined with money market equilibrium in both periods.

Is a fixed exchange rate sustainable over both periods 0 and 1? Define $\hat{T}_p$ as the present value of direct tax revenue that satisfies (4.4) given an exchange rate $S_0$, such that $S_0'(r) = 0$, and $S_1 = S_0$ (i.e. an exchange rate rule that is independent of $r$, and the nominal level equal over both periods).

Under full fiscal pre-commitment $\hat{T}_p$ is

$$\hat{T}_p^C = \frac{M_{-1} - r^* L_0(F(H^C), F(H^C), 1) + L_1(F(H^C))}{(1 + r^*)}. $$

where a C superscript denotes the equilibrium described by proposition 1. In the absence of pre-commitment, we have (where NC denotes the equilibrium without pre-commitment)

$$\hat{T}_p^{NC} = \frac{(r - r^*) B_1}{1 + r^*} + \frac{M_{-1} - r^* L_0(F(H_0^{NC}), F(H_1^{NC}), 1) + L_1(F(H_1^{NC}))}{(1 + r^*)}. $$

Under a very weak additional assumption, we have $\hat{T}_p^C \leq \hat{T}_p^{NC}$.

**Proposition 4.**

If $\hat{T}_p^C \leq \hat{T}_p \leq \hat{T}_p^{NC}$, then an exchange rate peg is sustainable under full pre-commitment, but is not sustainable in the absence of fiscal pre-commitment.

**Proof:** If $\hat{T}_p^C \leq \hat{T}_p$, then lump sum taxes (or transfers) may be used without limitation to balance the inter-temporal government budget constraint without requiring money

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11 The condition is that

$$(r - r^*) B_1 - r^* \frac{L_0^{NC} - L_0^C}{(1 + r^*)} + \frac{L_1^{NC} - L_1^C}{1 + r^*} > 0,$$

where the notation is self-explanatory. This assumption says that the present value of the seigniorage revenue earned by the increase in demand for money in the first period arising from the increase in borrowing, net of the fall in seigniorage revenue coming from the decrease in demand for money in the second period (given the lower second period consumption in the no-commitment case), cannot be so great as to offset the increase in direct financing requirements coming from the borrowing subsidies.
finance. Then the money supply may adjust so as to keep the exchange rate fixed in the second period. But if $\hat{T}_p^{NC} > \tilde{T}_p$, then the direct tax revenue required to finance capital subsidies exceeds the upper limit on the present value of taxation. In that case, the central bank is forced to use money creation to finance the government spending requirement in excess of tax revenue, and this is inconsistent with a fixed second period exchange rate. Hence, if the government can pre-commit, there is no excess external borrowing, and the fixed exchange rate is sustainable. But if it cannot pre-commit, the economy does engage in excessive borrowing, and the fixed exchange rate regime must collapse in the second period.

Thus we have an outcome where capital subsidies are tied to fixed exchange rates, the economy over-borrows, and the fixed exchange rate regime collapses at the same time as the economy’s current account switches from deficit to surplus. Hence, we have the characteristics of a joint exchange rate and capital market crisis. Moreover, the key feature of this outcome is that the ‘crisis’ is generated solely by the fixed exchange rate rule. Without an exchange rate peg, there is no over-borrowing. In fact, without an exchange rate peg, the exchange rate can remain stable - there is no exchange rate crisis at all! But an explicit policy of pegging the exchange rate generates a fiscal policy that encourages over-borrowing. The financing of this over-borrowing then requires an abandonment of the fixed exchange rate. Paradoxically, it is the imposition of a fixed exchange rate rule itself that generates the over-borrowing, which then leads to the collapse of the fixed exchange rate. Thus, in a novel sense, the fixed exchange rate policy sows the seeds of its own demise12.

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12 It should be noted that our currency crisis here is based on a ‘first-generation’ underpinning, focusing only on the effects of fiscal deficits. There are many aspects of the experience of currency crises that are not captured by our model. For instance, the problems of financial fragility (see Chang and
5. Discussion

These results are related to a large literature that draws a link between pegged exchange rates, fiscal imbalances, and excessive current account deficits. One traditional argument is that pegged exchange rates foster excessive real appreciation and trade deficits in face of domestic inflation. Many Latin American countries used an exchange rate peg as part of a disinflation strategy. The argument for exchange rate pegs was based on the belief that they offered more monetary credibility than managed floating exchange rate regimes. A similar argument for the credibility of exchange rate pegs in the case of European economies was made in Giavazzi and Pagano (1989). In the Latin American experiences, however, inertia in domestic inflation gradually led to an overvalued real exchange rate. Combined with lax fiscal policy, this led to a large and unsustainable current account deficits, eventually precipitating a crisis (see Edwards 2000).

To explain the Asian crisis of 1997-98, where neither overvaluation or fiscal imbalances played a large role, writers began to argue that the mix of fixed exchange rates and implicit government guarantees on private borrowing generated a ‘moral hazard’, leading to the growth of un-hedged dollar denominated debt (see McKinnon and Pill, (2000), Burnside et al (2001b), Krugman (1998), Corsetti et al (1999)). In this view, when private borrowers in emerging market economies believe that the public sector will absorb any losses, they effectively take the exchange rate peg as permanent, and fail to hedge against possible depreciation. This leads to inefficiently large borrowing and a subsequent crisis.

Velasco 2001), or currency mismatch (Aghion et al 2001) are clearly important features of a complete
A related literature views the causation running in the other direction – from balance sheet positions to exchange rate pegs. Calvo and Reinhart (2002) document the reluctance of many emerging market countries to allow exchange rate flexibility, thus exhibiting ‘Fear of Floating’. They and others (Aghion et al. 2001, Chamon et al. 2001) argue that, in the presence of weak domestic financial sector and large foreign currency denominated liabilities, exchange rate depreciation may play a perverse role, eliminating the standard argument for flexible exchange rates as a stabilization mechanism. Finally, Chang and Velasco (2005) develop a model where the linkage between pegged exchange rates and foreign currency borrowing both ways. In their model, the expectation of a fixed exchange rate can give rise to large foreign currency liabilities, which then lead monetary authorities to maintain a pegged exchange rate and thus validate expectations.

Our paper contrasts with this literature in a number of ways. First, since we deal with an environment where PPP holds continually, so there cannot be any real exchange rate overvaluation. While our extended model of section 4 does offer a direct causal link from an exchange rate peg to a future exchange rate crisis, this occurs not because of the direct impacts of fiscal deficits on the current account, but due to the effect of capital subsidies on private borrowing. As in the moral hazard literature, our model also implies that a combination of fixed exchange rates and government subsidies to private borrowing leads to an excessive current account deficit and may lead to currency crises. However, the currency denomination of borrowing is irrelevant in our model, and in contrast to the previous literature, in our theory of currency and financial crises in emerging markets.

13 Their model also allows for another equilibrium whereby if agents anticipate flexible exchange rates, they insure themselves against exchange rate volatility through capital markets, and the monetary authorities then choose to float the exchange rate.

14 This is because a) we have continual PPP, so that neither monetary or fiscal policy can affect the real exchange rate, b) monetary policy is based on a rule, rather than discretion, and c) we do not
paper the subsidies represent an ex-post optimal fiscal response to an existing
distortion. Finally, unlike Chang and Velasco (2005), we do not endogenize the
exchange rate regime choice itself. Rather our aim is to highlight a key link between
the exchange rate regime and the incentive structure facing fiscal policy.

We have focused on a particular strategic environment whereby the monetary
authority can fully commit to an exchange rate peg, but the fiscal authority cannot
commit to an optimal rule. How realistic is this assumption? In fact, a traditional
argument in favour of exchange rate pegs was that they enhanced not just monetary
credibility but also improved fiscal discipline (see Tornell and Velasco 1996). The
argument is that substantial fiscal imbalances must lead to losses of foreign exchange
reserves and/or eventual monetization of debt, which are inconsistent with the long
run maintenance of the peg. But the evidence on fiscal discipline and exchange rate
 pegs is quite mixed. In emerging market economies Hamann (2001) finds no link
between fixed exchange rates and reductions in fiscal imbalances. Likewise there is
little evidence that the ERM led to improved fiscal discipline in European economies
(Wyploz, 1997). Indeed, Tornell and Velasco (1996) argue that theoretically, a
flexible exchange rate may provide more fiscal discipline. Hence, the assumption of
full commitment in monetary policy, but lack of commitment in fiscal policy, may
represent quite a realistic perspective. One could also argue that the widely observed
growth of central bank independence, combined with growing fiscal imbalances
underwrites this assumption.

More generally, our paper relates to the substantial literature on monetary-
fiscal interactions and the debate on rules versus discretion. Dixit and Lambertini
(2001) develop a model in which monetary commitment is negated by fiscal

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incorporate financial fragility or balance sheet effects at the corporate level, which would introduce a
discretion. While in a very different framework, our results argue that monetary commitment (or at least commitment to an exchange rate peg) is undesirable in face of fiscal discretion.

6. Conclusions

There have been many papers written on currency and capital market crises in emerging market countries. The previous section showed that elements of our analysis have been stressed in many other papers; e.g. the subsidization of capital inflows, over-borrowing, the role of fixed exchange rates, and the fiscal foundations of currency crises. The key differentiating feature of our paper is to tie all these pieces together in a way that reveals a simple message – a fixed exchange rate can cause excessive borrowing and subsequent currency crises. This occurs because fixed exchange rates encourage bad fiscal policy choices. So the essential conclusion of the paper is similar that of other commentators – a hard peg should be accompanied by coordination between monetary and fiscal authorities. On the other hand, our analysis also suggests that an appropriate exchange rate rule, allowing capital inflows to be matched by appreciation, can in itself improve the performance of fiscal policy.

Of course, an immediate implication of the paper is that a hard peg is not necessarily optimal policy in itself. But as discussed in Section 5, there are many reasons (not explicitly incorporated in the model) for emerging market countries reluctance to allow exchange rate flexibility. Nevertheless, even allowing for these, it is important to understand the broader strategic context in which both monetary and fiscal policy are chosen.

\[^{15}\text{Canzoneri et. al. argue that fiscal discipline is also a requirement of a viable currency union.}\]
Appendix

To obtain equations (4.1)-(4.3), assume that the home resident has the utility function in each period given by

\[ U(C_t(i)) + G\left(\frac{M_t}{P_t}\right) - V(H_t(i)), \quad t = 0, 1, \]

where \( G(.) \) is increasing, concave, and continuously differentiable, and \( M_t \) represents nominal money balances. Household budget constraints are now amended to encompass money holdings:

(A.1) \[ P_0 C_0(i) + M_0(i) - M_{-1}(i) + P_0 B_t(i) = W_0(i) H_0(i) + \Pi_0 - P_0 T_0 \]

(A.2) \[ P_1 C_1(i) + M_1(i) = (1 + r) P_0 B_t(i) + W_1(i) H_1(i) + \Pi_1 + M_0(i) - P_1 T_1 \]

Now households are taxed both directly through lump sum taxes \( T_0 \) and \( T_1 \) and indirectly through central bank money issue. Initial money holdings are \( M_{-1}(i) \). The optimality conditions for consumer \( i \) are as in (1.5) and (1.6), with the addition of the conditions determining money demand in periods 0 and 1. These are described as

(A.3) \[ G'(\frac{M_0(i)}{P_0}) = U'(C_0(i)) \left( 1 - \frac{P_0}{P_1 (1 + r)} \right) \]

(A.4) \[ G'(\frac{M_1(i)}{P_1}) = U'(C_1(i)) \]

Conditions (A.3) and (A.4) implicitly give the demand for money schedules of household \( i \). Again, we assume that all households are alike, and drop the \( i \) notation hereafter.

The fiscal authority receives income in the first period from the central bank’s money creation; \( M_0 - M_{-1} \), and from savings of consumers \( P_0 B_1 \) (which may be negative). With this, it purchases foreign bonds. In the second period it receives
income from its holdings of foreign bonds, money creation, and with this finances payments to households. Thus, the two budget constraints are:

\[ P_0 B^*_g l_1 = M_0 - M_{-1} + P_0 B_1 + P_0 T_0 \]
\[ P_0 B_1 (1 + r) = M_1 - M_0 + (1 + r^*) P_0 B^*_g l_1 + P_1 T_1. \]

Again, given PPP, we have \( P_0 = S_0, \ P_1 = S_1 \). Putting these together, we have

\[ (A.5) \]
\[ \frac{M_0 - M_{-1}}{S_0} + T_0 + \frac{M_1 - M_0}{(1 + r^*) S_1} + \frac{T_1}{(1 + r^*)} = \frac{(r - r^*) B_1}{1 + r^*}. \]

Thus, total subsidies to households (the right hand side) must be financed with money creation and direct taxes.

Assume that the fiscal authority is concerned with household utility net of the utility of real balances. Now combining (A.1), (A.2), and (A.5), it is straightforward to see that the economy’s inter-temporal budget constraint is still given by (1.9). This has an immediate implication; Propositions 1 and 2 still hold as before. The reason that Proposition 1 holds is immediate. If the fiscal authority acts with commitment, it ignores the price level implications of its subsidy choice, because from a welfare perspective, it is irrelevant whether subsidies are financed with direct taxes or money issue. Proposition 2 holds because the fiscal authority’s problem is still defined exactly as in Table 2, because it cannot affect the real exchange rate \( \frac{S_0}{W_0} \), and again it is irrelevant to its optimal decision whether its subsidies are financed by direct taxation or money issue.

From (A.3), (A.4), and (A.5), we can obtain equations (4.1)-(4.3).
References


Figure 1
Mexico

Figure 1