Market Sentiment 
and Macroeconomic Fluctuations 
under Pegged Exchange Rates

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Abstract
This paper models changes in “market sentiment” as a temporary increase in the premium faced by domestic private borrowers on world capital markets. The effects of this shock are studied in an intertemporal optimizing framework of a fixed exchange rate economy, where firms’ demand for working capital is financed by bank credit. Depending on the (perceived) length of this shock, the model is capable of predicting a rise in domestic interest rates, capital outflows and a drop in official reserves, a reduction in bank deposits and the supply of credit, a fall in private consumption, a contraction in output, and an increase in unemployment. These predictions are consistent with observed facts associated with several recent episodes of turbulence on international financial markets.

JEL Classification Numbers: E44, F32, F34

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1 Introduction

Crises in individual countries have shown a growing tendency in recent years to translate into turbulence in international financial markets and severe economic downturns across borders. For instance, following the Mexican peso crisis of December 1994, and the sharp rise in borrowing spreads on world capital markets, a full-blown economic crisis developed in Argentina. Similarly, the Thai baht crisis of July 1997 led to both financial and economic turmoil in Korea, Malaysia, and Indonesia. All of these countries experienced dramatic falls in private sector credit and output, sharp increases in real interest rates and unemployment, banking sector problems, large capital outflows, which eventually forced them to abandon their pegged exchange rate systems. The collapse of Argentina’s currency board in early 2002 also had adverse effects on a number of countries, including Brazil and Turkey, as a result of the sharp increase in the cost of borrowing that these countries faced on world capital markets.\(^1\) Although the adverse effects have been short-lived in many cases, their have entailed large economic costs.

The mechanisms through which “contagious” external shocks are transmitted to other countries has generated considerable interest in recent years. The recent literature has emphasized both real (or trade) and financial channels—particularly the sensitivity of portfolio capital flows to abrupt changes in market sentiment (unrelated to fundamentals) or herding behavior.\(^2\) This paper studies the macroeconomic effects of temporary external shocks in an intertemporal optimizing model of a small open developing economy operating a pegged exchange rate regime and facing imperfect world capital markets. Specifically, domestic individual borrowers are assumed to face an upward-
sloping supply curve of credit, with a premium that depends positively on the individual’s level of foreign borrowing and a set of exogenous factors, which capture “market sentiment.” In contrast to models emphasizing “country risk” (as for instance in Aizenman (1989)), domestic agents are assumed to internalize the effect of their borrowing decisions on the marginal cost of funds that they face. In this setting, a change in “market sentiment” is modeled as a transitory increase in the exogenous component of the premium faced by domestic borrowers on world capital markets. The real and monetary effects of this shock are analyzed by modeling portfolio decisions (namely, the allocation of financial wealth between bank deposits, cash balances, and foreign-currency liabilities), real wage behavior, and the link between bank credit and the supply side through firms’ demand for working capital—a key feature of the financial system in many developing countries.3

The remainder of the paper proceeds as follows. The model is presented in Section II, and its dynamic form is derived in Section III. Section IV characterizes the adjustment process to a transitory change in “market sentiment”, defined as a temporary increase in the autonomous component of the premium faced by domestic borrowers on world financial markets. Section V considers some extensions of the analysis and offers some final remarks.

2 The Framework

Consider a small open economy in which perfect foresight prevails and five types of agents operate: households, producers, commercial banks, the government, and the central bank. The exchange rate is depreciated at a predetermined rate by the central bank. The price of the good is fixed on world markets, and

3Indeed, in many cases, banks account for a sizable fraction of the financing needs of firms (see Agénor (2003, Chapter 4)). Studies in which the link between firms’ working capital needs and bank credit is explicitly considered include Edwards and Végh (1997), Greenwald and Stiglitz (1993), and Isard et al. (1996).
purchasing power parity holds continuously.

2.1 Producers

Firms must finance their working capital needs prior to the sale of output. They have no direct access to world capital markets, and borrow only from commercial banks. Working capital needs are here assumed to consist solely of labor costs. Total production costs faced by the representative firm are thus equal to the wage bill plus the interest payments made on bank loans needed to pay labor in advance.

Formally, the maximization problem faced by the representative firm can be written as

$$\max_y \{y - wn - i_L l\},$$

(1)

where $y$ denotes output, $w$ the real wage, $n$ the quantity of labor employed, $i_L$ the nominal (contractual) lending rate charged by commercial banks, and $l$ the real amount of loans obtained from commercial banks.

The output-employment relationship takes the form

$$n = y^\beta, \quad \beta > 1$$

(2)

whereas the firm’s financial constraint is given by

$$l \geq wn.$$ 

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4For simplicity, it is assumed that there is no domestic substitute for bank loans, so that firms cannot issue equities or bonds (claims on their capital stock) to finance their working capital needs. Note also that, given that the model is cast in continuous time, arguing that these needs must be financed “prior to the sale of output” cannot be taken literally.

5Except otherwise indicated, partial derivatives are denoted by corresponding subscripts, whereas the total derivative of a function of a single argument is denoted by a prime. A sign over a variable refers to the sign of the corresponding partial derivative, and $\dot{x} \equiv dx/dt$. Time subscripts are omitted for simplicity. A ‘‘’ is used to denote steady-state values.
Constraint (3) will be assumed to be continuously binding, because the only reason for firms to demand loans is to finance labor costs.

Maximizing equation (1) subject to (2) and (3) yields

$$y^* \equiv \left[ \frac{1}{\beta} w(1 + i_L) \right]^{1/(\beta - 1)},$$

which shows that output supply is inversely related to the effective cost of labor, $w(1 + i_L)$. Substituting equation (4) in (2) yields labor demand as

$$n^d = n^d[w(1 + i_L)], \quad n^{dr} < 0.$$

Using equations (3) and (5), the firm’s demand for credit is given by

$$l^d = wn^d = l^d(\bar{w}, i_L).$$

which shows that, in general, an increase in the real wage has an ambiguous effect on the demand for credit. On the one hand, it raises directly labor costs; on the other, it lowers the demand for labor. If the elasticity of the demand for labor is sufficiently large in absolute terms, the net effect will be negative.\(^6\) This is the case assumed in what follows.

Real wages are set according to

$$w = w(w^+_m, U),$$

which shows that wages are positively related to workers’ reservation wage, $w_m$ (or, more generally, the opportunity cost of effort), and negatively to the unemployment rate, $U$. A wage-setting equation like (7) can be derived from a variety of efficiency-wage models—as in the case, for instance, in which firms face turnover costs and the quit rate tends to rise when labor market conditions become more favorable (see Agénor (2001)). Alternatively, (7)\(^6\)By definition, $dl^d / dw = \tilde{n}^d + \bar{w}(\partial n^d / \partial \omega)$. Multiplying both sides by $\bar{w} / \bar{l}^d = \bar{n}^d$ yields the elasticity $\eta_{l^d / w} = 1 + \eta_{n^d / w}$, which therefore requires $|\eta_{n^d / w}| > 1$ for $dl^d / dw$ to be negative.
may also be derived from a setting in which a utility-maximizing trade union operates, and the relative weight attached to employment (as opposed to wages) in the union’s objective function increases with the level of unemployment (see Agénor (1999)). Regardless of the exact rationale, the “level” effect of unemployment on real wages (as opposed to a Phillips-curve type relationship between the rate of change of nominal wages and unemployment) has been supported by much of the recent evidence on wage formation in developing countries.

With labor supply fixed at $n^*$, the unemployment rate is a direct, negative function of labor demand $n^d$, so that:

$$w = w(n^d), \quad w' > 0.$$  

Solving this equation for $n^d$ and equating the result to (5) yields

$$w = \omega(i_L), \quad \omega' < 0,$$  

which relates the real wage negatively to the bank lending rate.

In the above setting, an increase in the lending rate has conflicting effects on effective labor costs per worker, $w(1 + i_L)$. On the one hand, it increases directly effective unit labor costs, which tends to reduce output and labor demand. On the other, by reducing labor demand, it raises unemployment and lowers wages, which tends to reduce effective unit labor costs. In what follows it is assumed that the sensitivity of wages to unemployment is not too high, so that the direct effect dominates. Thus, substituting (8) in equations (4) and (6) yields

$$l^d = l^d(i_L), \quad y^s = y^s(i_L), \quad l^d, y^s < 0.$$  

Firms do not invest and transfer all their profits, $\Pi$, to their owners, domestic households:

$$\Pi = y^s - w n^d - i_L l^d,$$
that is, using (6):

$$\Pi = y^s - (1 + i_L)l^d. \tag{10}$$

The financial counterpart to firms’ bank credit is assumed to consist of domestic cash held outside the banking system ($z_f = l^d$).

### 2.2 Households

Households supply labor inelastically, consume the domestic good, and hold two categories of financial assets in their portfolios: domestic cash balances, which bear no interest, and domestic-currency deposits with the banking system. They borrow only from foreign lenders.\(^7\)

The representative household maximizes discounted lifetime utility, given by

$$\int_0^\infty \left[ \frac{c^{1-\eta}}{1-\eta} + \ln z_h \right] e^{-\rho t} dt, \quad \rho, \eta > 0, \eta \neq 1 \tag{11}$$

where $\rho$ denotes the rate of time preference (assumed constant), $c$ consumption expenditure, $\sigma = 1/\eta$ the intertemporal elasticity of substitution in consumption, and $z_h$ real cash balances.\(^8\)

Nominal wealth of the representative household, $A$, is defined as

$$A = Z_h + D - EL^*,$$

where $E$ is the nominal exchange rate, $Z_h = EZ_h$, $D$ is the nominal value of deposits with the banking system, and $L^*$ is the real (foreign-currency) value of loans received from foreign lenders. Given that the world price of the good is normalized to unity, and that purchasing power parity holds continuously,\(^7\)

\(^7\)The assumption that households do not borrow from domestic banks is consistent with the evidence suggesting that in many developing countries, the share of private credit allocated to households is often small and subject to quantity rationing.

\(^8\)A more general specification would be to enter both cash and bank deposits in the instantaneous utility function, by assuming that both types of assets generate (imperfectly substitutable) liquidity services. This would, however, complicate the analysis without adding much in terms of substance.
the domestic price level and the nominal exchange rate are one and the same, and real wealth can be written as

\[ a = z_h + d - L^*, \]  

(12)

where \( d = D/E \). For simplicity, foreign loans are assumed to have an infinite maturity.

The flow budget constraint is given by

\[ \dot{a} = wn^d + \Pi + i_d d - c - \tau - (i^* + \theta)L^* - (z_h + d)\varepsilon, \]  

(13)

where \( wn^d \) is wage income, \( \Pi \) profits received from firms (as defined in (10)), \( \tau \) the real value of lump-sum taxes, \( i_d \) the deposit interest rate, and \( \varepsilon \) the constant, nominal rate of devaluation.\(^9\) The term \(-(z_h + d)\varepsilon\) accounts for capital losses on domestic financial assets resulting from inflation. The cost of borrowing on world capital markets \( i^* + \theta \) consists of an exogenous, risk-free interest rate \( i^* \) and a premium \( \theta \), which is defined as

\[ \theta = \theta(L^*, \alpha), \]  

(14)

where \( \alpha \) is a shift factor. Although \( \alpha \) may in general capture various household characteristics other than the level of borrowing (such as the composition of the household, or its age distribution), here it will be taken to reflect “market sentiment” or “mood” toward the country in question—in effect, a country-specific factor that reflects foreign lenders’ idiosyncratic perceptions of the country’s creditworthiness. The premium is positively related to both \( L^* \) and \( \alpha \).\(^{10}\) The assumption that domestic private agents are able to borrow

\(^9\)As discussed below, banks have zero profits and therefore do not transfer any income to households.

\(^{10}\)As discussed in Appendix A, it is also plausible to assume that the premium is convex in \( L^* \) (so that \( \theta_{L^*} > 0 \)), that the cross-derivative \( \theta_{L^*\alpha} \) is positive, and that for \( L^* \) sufficiently high a binding borrowing constraint is eventually reached. In what follows it is assumed that the economy operates on the upward-sloping portion of the supply curve of funds, rather than at any absolute borrowing ceiling, and that \( \theta \) is continuously differentiable in that range.
more on world capital markets only at a higher rate of interest captures the existence of individual default risk. As in the literature on sovereign debt—see for instance Eaton and Fernandez (1995)—the domestic agent’s ability to borrow is restricted by his or her capacity to repay (which depends on uncertain income flows) and the enforceability of international contracts.\footnote{See Agénor (1997) for a more detailed discussion. The assumption that the (household-specific) premium depends positively on the agent’s level of debt—rather than the economy’s total debt—leads naturally to the assumption that agents internalize the effect of their borrowing decisions on $\theta$, as discussed below.}

Households treat $w, n^d, \Pi, i_d, i^*, \varepsilon$ and $\tau$ as given, internalize the effect of their portfolio decisions on the marginal cost of borrowing, and maximize (11) subject to (12), (13) and (14) by choosing a sequence \{\textit{c, z, d, L}$^\ast$\}_t=0. Let $r_d = i_d - \varepsilon$ be the real domestic deposit rate. The optimality conditions are given by:

\begin{equation}
\frac{c^\eta}{z_h} = i_d \Rightarrow z_h = z_h(c, r_d + \varepsilon),
\end{equation}

\begin{equation}
r_d = i^* + \theta + L^*\theta_{L^*},
\end{equation}

\begin{equation}
\dot{c}/c = \sigma(r_d - \rho),
\end{equation}

together with the transversality condition $\lim_{t \to \infty} (e^{-\rho t} a) = 0$.

Equations (15) and (17) are standard conditions in optimizing models of this type. (15) relates the demand for cash positively to consumption and negatively to the bank deposit rate. It is derived by equating the marginal rate of substitution between consumption and real cash balances to the opportunity cost of holding cash, the nominal deposit rate. Equation (17) is the Euler equation, which shows that total consumption rises or falls depending on whether the real deposit rate (which measures the rate of return on saving) exceeds or falls below the rate of time preference.
Equation (16) is the interest rate parity condition that holds under the assumption of imperfect world capital markets. It equates the marginal cost of borrowing abroad and the marginal rate of return on domestic assets. In turn, the marginal cost of borrowing is given by the effective cost of borrowing, \( i^* + \theta \), plus the devaluation rate and the increase in the cost of servicing the existing stock of foreign loans induced by the marginal increase in the premium (itself resulting from the marginal increase in borrowing), \( L^* \theta L^* \).

The arbitrage condition (16) determines implicitly the demand for foreign loans. Taking a linear approximation to \( \theta \) (so that \( \theta L^* \) is independent of \( L^* \)) yields

\[
L^* = \left( r_d - i^* - \theta \alpha \right) / \gamma,
\]

where \( \gamma = 2\theta L^* > 0 \). Equation (18) shows that the optimal level of foreign borrowing is positively related to the difference between the real domestic deposit rate and the exogenous component of the cost of borrowing on world capital markets, given by the sum of the safe interest rate and the autonomous component of the premium.

Using equations (12), (15) and (18), the demand for bank deposits can be derived as

\[
d = a + L^* - z_h = \Phi(c, r_d, \hat{a}; \hat{a}),
\]

where

\[
\Phi_c = -z_{hc}, \quad \Phi_{r_d} = \gamma^{-1} - z_{hr_d}, \quad \Phi_a = 1, \quad \Phi_\alpha = -\theta / \gamma.
\]

Equation (19) indicates that the demand for bank deposits depends positively on the domestic deposit rate and net financial wealth, and negatively on consumption and the autonomous component of the premium.
2.3 Commercial banks

Assets of commercial banks consist of credit extended to domestic firms, \( l^s \), and reserves held at the central bank, \( RR \); for simplicity, banks hold no excess reserves. Bank liabilities consist of deposits held by households. In real terms, the balance sheet of commercial banks can therefore be written as

\[
d = l^s + RR.
\]  
(20)

Reserves held at the central bank do not pay interest and are determined by

\[
RR = \mu d, \quad 0 < \mu < 1.
\]  
(21)

where \( \mu \) is the coefficient of reserve requirements.

The actual level of deposits held by the private sector is demand determined and, from equations (20) and (21), the supply of credit is given by

\[
l^s = (1 - \mu)d.
\]  
(22)

From (19) and (22), the supply of credit can be written as

\[
l^s = l^s(\tilde{c}, r_d, \tilde{a}; \tilde{\alpha}),
\]  
(23)

where \( l^s_x = (1 - \mu)\Phi_x \), with \( x = c, i_d, a, \alpha \).

Banks costlessly intermediate between depositors and borrowers so that the nominal deposit rate differs from the nominal lending rate only by the amount of the distortion induced by the required reserve ratio:

\[
i_L = i_d/(1 - \mu).
\]

This implies that, in real terms, the wedge between deposit and lending rates is given by

\[
r_d = (1 - \mu)r_L - \mu \varepsilon.
\]  
(24)
2.4 Central bank and the Government

The central bank pursues a policy of unsterilized intervention to defend the peg. It therefore ensures the costless conversion of domestic currency holdings into foreign currency at the prevailing exchange rate. It does not extend any credit to the economy, and its balance sheet is thus given by

\[ R^* = z + RR, \]

(25)

where \( z \equiv z_f + z_h \) denotes total cash balances held by private agents and \( R^* \) the central bank’s net stock of foreign assets, measured in foreign currency terms—which is here also equal to the supply of base money. Interest received by the central bank on its holdings of foreign assets, \( i^* R^* \), is assumed to be transferred in its entirety to the government.

The government consumes the domestic good, in quantity \( g \). Its resources consist of transfers from the central bank, lump-sum taxes levied on households, and the inflation tax on cash balances. The budget constraint of the government is thus

\[ g - \tau = i^* R^* + \varepsilon(z + RR). \]

(26)

Assuming that the government maintains a balanced budget by adjusting lump-sum taxes yields, using (25) and (26),

\[ \tau = g - (i^* + \varepsilon)R^*. \]

(27)

2.5 Equilibrium of the credit market

To close the model requires specifying the equilibrium conditions of the currency and credit markets. By Walras’ Law, these two conditions are not independent. The focus can therefore be on a single market, which is here taken to be the credit market.

Using (9) and (23), the equilibrium condition of the credit market is given by

\[ l^c(c, r_d, a; \alpha) = l^d(r_L + \varepsilon). \]

(28)
Using (24) to eliminate $r_d$ in the above equation, the equilibrium bank lending rate is given by

$$r_L = r_L(c, a; \alpha),$$

(29)

where $\partial r_L/\partial x = -\Omega^{-1}\Phi_x$, with $x = c, a, \alpha$, and

$$\Omega = (1 - \mu)\Phi_{rd} - \frac{l^d}{1 - \mu} > 0.$$

Equation (29) shows that the equilibrium real lending rate depends positively on consumption and the autonomous component of the premium, and negatively on the household’s net financial wealth. An increase in $\alpha$, for instance, lowers bank deposits and reduces the supply of credit, requiring an increase in domestic interest rates to maintain equilibrium of the credit market.

Substituting (24) and (29) in (19), the household’s demand for bank deposits can be written as

$$d = d(c, a; \alpha),$$

(30)

where

$$d_x = [1 - (1 - \mu)\Phi_{rd}/\Omega]\Phi_x,$$

with $x = c, a, \alpha,$

and $(1 - \mu)\Phi_{rd}/\Omega$ is less than unity, so that $\text{sg}(d_x) = \text{sg}(\Phi_x)$.

3 Dynamic Structure and Steady State

To characterize the dynamic structure of the model, the first step is to note that from equation (25), $z_h = R^* - z_f - RR$. This result implies that, noting that $z_f = l$, and using (21) and (22):

$$z_h = R^* - (1 - \mu)d - \mu d = R^* - d.$$  

(31)

Substituting this expression for $z_h$ in equation (12) yields

$$D^* = -a = L^* - R^*,$$

(32)
which shows that, because the central bank does not accumulate assets and the government maintains a continuously balanced budget, the private sector’s net real financial liabilities, $-a$, are equal to the economy’s net stock of foreign debt measured in foreign-currency terms, $D^*$.

Because $\dot{D}^* = -\dot{a}$, using (13) yields

$$\dot{D}^* = c + \tau + (i^* + \varepsilon + \theta)L^* - (wn^d + \Pi) - i_d d - \varepsilon D^*.$$

Substituting the government budget constraint (27) in this expression yields

$$\dot{D}^* = c + g + i^* D^* + \theta L^* - (wn^d + \Pi) - i_d d.$$

From (10), $wn^d + \Pi = y_s - i_L l$, and from the banks’ zero-profit condition, $i_d d - i_L l = 0$; the above expression can therefore be rewritten as

$$\dot{D}^* = c + g + i^* D^* + \theta(L^*, \omega) L^* - y_s,$$

which represents the consolidated flow budget constraint of the economy.\textsuperscript{12}

Equations (18), (24), and (29) yield

$$L^* = [(1 - \mu) r_L(c, D^*; \omega) - \mu \varepsilon - i^* - \theta \omega \alpha] / \gamma,$$

which can be written as

$$L^* = \lambda(c, D^*; \omega),$$

where

$$\lambda_x = \gamma^{-1}[(1 - \mu) \partial r_L / \partial x] = -(1 - \mu) \Phi_x / \gamma \Omega,$$

with $x = c, D^*$.

\textsuperscript{12}Integrating equation (33) yields the economy’s intertemporal budget constraint

$$D^*_0 = \int_0^\infty (y^s - c - g - \theta L^*) e^{-\int_0^t \omega dt} dt + \lim_{t \to \infty} D^* e^{-\int_0^t \omega dt}.$$

The economy must eventually repay all its debt to foreign creditors, so the second term on the left-hand side in the above expression must be zero. Thus, the current level of debt must be equal to the discounted stream of the excess of future production over domestic absorption plus premium-related interest payments on private foreign borrowing.
\[ \lambda_\alpha = \gamma^{-1}[(1 - \mu)\partial r_L / \partial \alpha - \theta_\alpha] = -\gamma^{-1}[(1 - \mu)(\frac{\theta_\alpha}{\gamma \Omega}) - \theta_\alpha], \]

so that,
\[ \lambda_\alpha = \frac{\theta_\alpha}{\gamma \Omega} \{ (1 - \mu)z_{hr_d} + \frac{l^d}{1 - \mu} \}. \]

Equation (34) shows, in particular, that the net effect of an increase in \( \alpha \) is a reduction in the demand for foreign loans, despite its indirect, positive effect on domestic interest rates (operating through the supply and demand of loans on the credit market).

Equations (17), (24), (29), (30), (33) and (34) describe the evolution of the economy along any perfect foresight equilibrium path. These equations can be summarized as follows:

\[ L^* = \lambda(c, D^*; \alpha), \quad d = d(c, D^*; \alpha), \quad (35) \]

\[ \dot{c}/c = \sigma[(1 - \mu)r_L(c, D^*; \alpha) - \mu\varepsilon - \rho], \quad (36) \]

\[ \dot{D}^* = c + g + i^*D^* + \theta[\lambda(\cdot), \alpha]\lambda(\cdot) - y^*[r_L(c, D^*; \alpha) + \varepsilon], \quad (37) \]

with \( d_{D^*} = -d_a < 0 \), and equation (27) determining residually lump-sum taxes.

Equations (36) and (37) form a first-order differential equation system in consumption \( c \), which may jump in response to new information, and net external debt \( D^* \), which can change only gradually. In the neighborhood of the steady state, this system can be written as

\[ \dot{c} = G(\dot{c}, \dot{D}^*; \dot{\alpha}), \quad (38) \]

\[ \dot{D}^* = \Psi(\dot{c}, \dot{D}^*; \dot{\alpha}) + g, \quad (39) \]

where \( G_x = \sigma(1 - \mu)(\partial r_L / \partial x)c, \) for \( x = c, D^*, \alpha, \) and
\[ \Psi_c = 1 + (\bar{\theta} + \bar{L}^*\theta_{L^*})\lambda_c - y^*s \frac{\partial r_L}{\partial c}, \quad \Psi_{D^*} = i^* + (\bar{\theta} + \bar{L}^*\theta_{L^*})\lambda_{D^*} - y^*s \frac{\partial r_L}{\partial D^*}, \]
\[ \Psi_\alpha = \bar{L}^\ast \theta_\alpha + (\bar{\theta} + \bar{L}^\ast \theta_L \lambda_\alpha - y^{\ast} \frac{\partial r_L}{\partial \alpha}. \]

Equation (39) shows that, in general, the net effect of an increase in the autonomous component of the premium on the current account deficit is ambiguous. This net effect can be decomposed into:

- A **portfolio effect**, which results from the fact that the increase in \( \alpha \) lowers directly (at the initial level of the premium) the demand for foreign loans by domestic households. This is measured by the term \( \tilde{\theta}\lambda_\alpha \), and tends to reduce the current account deficit and the rate of accumulation of foreign indebtedness.

- A **composite income effect**, which operates through two channels. First, an increase in \( \alpha \) raises directly the premium, and increases interest payments on the existing stock of foreign debt. This is measured by the term \( \bar{L}^\ast \theta_\alpha \), which worsens the current account deficit. Second, the direct reduction in private foreign borrowing induced by the rise in \( \alpha \) lowers also the premium, at the initial level of debt. This is measured by the term \( \bar{L}^\ast \theta_L \lambda_\alpha \), which tends to reduce the current account deficit. Thus, the composite income effect has an ambiguous effect on the current account.

- A **supply-side effect**, which is due to the fact that the increase in \( \alpha \) raises the lending rate (by reducing the supply of bank deposits and thus the supply of credit), thereby lowering output. This effect is captured by the term \( -y^{\ast t}(\partial r_L/\partial \alpha) \), and tends to increase the current account deficit.

The fact that the composite income effect is ambiguous, and that the portfolio and supply-side effects operate in opposite directions, implies that the net effect of a change in \( \alpha \) on the premium-related debt service payments by the private sector, \( \theta L^\ast \), cannot be determined a priori. In what follows, it
will be assumed that the sum of all three effects is such that the current account deteriorates, that is, $\Psi_\alpha > 0$. As shown in Appendix B (available upon request), a sufficient (although not necessary) condition for this inequality to hold is that the elasticity of the external premium with respect to $\alpha$, $\eta_{\theta/\alpha}$, be greater (in absolute terms) than the elasticity of the demand for foreign loans by households with respect to $\alpha$, $\eta_{L^*/\alpha}$. In turn, this condition ensures that an increase in $\alpha$ raises premium-related debt service payments by households $(\partial(\theta L^*)/\partial \alpha > 0)$, or equivalently that the sum of the portfolio and income effects is positive.

Linearizing equations (38) and (39) around the initial steady state gives

$$
\begin{bmatrix}
\dot{c} \\
\dot{D}^*
\end{bmatrix}
= 
\begin{bmatrix}
G_c & G_{D^*} \\
\Psi_c & \Psi_{D^*}
\end{bmatrix}
\begin{bmatrix}
c - \tilde{c} \\
D^* - \tilde{D}^*
\end{bmatrix}. 
$$

(40)

Saddlepath stability requires one unstable (positive) root. To ensure that this condition holds, the determinant of the matrix of coefficients in (40) must be negative: $G_c \Psi_{D^*} - G_{D^*} \Psi_c < 0$. This condition is interpreted graphically below.

A key feature of the above model is the assumption that the central bank does not engage in sterilized intervention. As a result, although net external debt evolves only gradually over time, both official reserves and private foreign borrowing may shift discretely in response to changes in domestic or foreign interest rates. Discrete changes in private borrowing must nevertheless be accompanied by an offsetting movement (at the official exchange rate) in the stock of foreign reserves held by the central bank, in order to leave net external debt $D^*$ constant on impact.

The steady-state solution is obtained by setting $\dot{c} = \dot{D}^* = 0$. From equation (36), the real deposit rate must be equal to the rate of time preference:

$$
\tilde{r}_d = \tilde{i}_d - \varepsilon = \rho.
$$

(41)

Substituting this result in (18) yields

$$
\tilde{L}^* = (\rho - \tilde{i}^* - \theta_\alpha \alpha)/\gamma,
$$

(42)
which indicates that the steady-state level of private foreign borrowing is positive as long as \( \rho > i^* + \theta \alpha \), that is, as long as the rate of time preference of domestic households exceeds the effective cost of foreign borrowing.

Equations (24) and (41) yield

\[
\bar{r}_L = \frac{\rho + \mu \varepsilon}{1 - \mu},
\]

which implies, using (9):

\[
\bar{l} = l^d(\frac{\rho + \varepsilon}{1 - \mu}), \quad \bar{y} = y^*(\frac{\rho + \varepsilon}{1 - \mu}),
\]

which show that in this setting—taking labor supply and other determinants of the wage-setting equation (7) as exogenous—the supply of output and firms’ demand for credit are invariant to shocks other than changes in the rate of time preference, the devaluation rate, or the reserve requirement ratio.

From equation (37), the current account must be in equilibrium, so the trade surplus must equal the deficit in the services account:

\[
\bar{y} - \bar{c} - g = i^* \bar{D}^* + \bar{\theta} \bar{L}^*.
\]

Finally, from (15) and (41), real cash balances held by households are given by

\[
\bar{z}_h = z_h(\bar{c}, \rho + \varepsilon).
\]

The steady-state equilibrium of the model is depicted in Figure 1. The locus \([\bar{D}^* = 0]\) gives the combinations of \(c\) and \(D^*\) for which net external debt (measured in foreign-currency terms) remains constant, whereas the locus \([\bar{c} = 0]\) depicts the combinations of \(c\) and \(D^*\) for which consumption does not change over time. Points above the \([\bar{D}^* = 0]\) curve correspond to situations of current account deficits (with the stock of debt increasing), whereas points below the curve represent surpluses (and the level of debt is falling). Points located to the left of the \([\bar{c} = 0]\) curve represent situations in which the domestic real deposit rate is lower than the rate of time preference, and
consumption is falling. Conversely, points located to the right of the $\dot{c} = 0$ curve represent situations in which consumption is rising. Saddlepath stability requires that the $\dot{c} = 0$ curve be steeper than the $\dot{D}^* = 0$ curve. The saddlepath $SS$ has a negative slope (as formally established in Appendix B) and defines the only convergent path to the steady-state equilibrium (obtained at point $E$).

4 Change in Market Sentiment

As argued earlier, a contagious shock can be modeled in the above setting as a temporary increase in the autonomous component of the premium that domestic private borrowers face on world capital markets, that is, an increase in $\alpha$, which captures a sudden change (unrelated to fundamentals) in market sentiment about the economy’s prospects. Specifically, it is assumed that $\alpha$ increases at $t = 0$ but returns to its initial value at a future date $T$.

To understand the dynamics associated with a temporary increase in $\alpha$, consider first the long-run effects associated with a permanent shock. As can be inferred directly from equation (42), net private borrowing on world capital markets falls. The nominal deposit rate remains constant at $\rho + \varepsilon$, implying that the lending rate (given in (43)) is also constant. From (44), output therefore does not change, and neither does the demand for credit by firms. The supply of credit (from (28)) and bank deposits (from (22)) are also unaffected.

Despite the reduction in private foreign indebtedness, the increase in the premium results in a rise in interest payments abroad and thus a deterioration of the services account. Maintaining current account equilibrium therefore requires an improvement in the trade balance. And because output does not change, consumption must fall. From (46), households’ real cash balances therefore also fall. But because the demand for credit by domestic firms—and thus firms’ holdings of cash—remain constant, the fall in households’
holdings of domestic currency must be accompanied by a reduction in official reserves. The overall effect on the economy’s net external debt (the difference between private foreign debt and foreign assets held by the central bank) is nevertheless negative. Graphically, as illustrated in Figure 1, both the $c = 0$ locus and the $\hat{D}^* = 0$ locus shift to the left. Point $E'$ is the equilibrium position at which the economy would settle if the increase in $\alpha$ were permanent, with a lower level of consumption and lower external debt.

On impact, foreign borrowing by the private sector also falls. The discrete reduction in private foreign borrowing is accompanied by an offsetting reduction in official reserves, because the economy’s total debt can change only gradually. The reduction in the central bank’s net foreign assets reduces the supply of base money. But at the initial level of consumption and interest rates (that is, at the initial level of cash balances held by households), the reduction in private foreign borrowing induces households to decrease their demand for bank deposits. In turn, the reduction in deposits lowers the supply of credit, thereby requiring an increase in the domestic lending rate (which reduces firms’ demand for loans) to maintain equilibrium of the credit market. The increase in real interest rates creates an incentive for the household to shift consumption toward the future, so that consumption falls on impact. Output also falls on impact, because the increase in the lending rate translates into a rise—despite a reduction in wages—in the effective price of labor. The reduction in output and labor demand on impact raises unemployment.

As shown in Appendix B, although the reduction in net foreign indebtedness lowers debt service payments at the risk-free rate, the services account always deteriorates—thereby ensuring that in the long run the trade balance improves and consumption falls, as indicated above.

As shown in Appendix B, the fall in consumption (by reducing the demand for cash balances) tends to increase the demand for bank deposits, which in turn puts downward pressure on the domestic lending rate. If the degree of intertemporal substitution is not too high—a reasonable assumption in light of the evidence, as discussed by Agénor and Montiel (1999)—the impact effect on consumption will be limited and the demand for bank deposits will unambiguously fall. The reduction in the supply of loans will therefore
Note that here, because the household is a net debtor in the initial steady state, wealth and intertemporal effects operate in the same direction. On the one hand, the increase in the premium encourages households to save more (and consume less) today, because the cost of foreign borrowing has risen (the intertemporal substitution effect). On the other, the increase in the cost of borrowing leads households to expect a net increase in debt service (despite the reduction in the demand for foreign loans) in the long run, thereby reducing permanent income, lowering private expenditure and increasing saving today (the wealth effect). Consumption falls as a result of both effects.\(^{15}\)

Whether the trade balance (which, in the initial equilibrium, is characterized by a surplus equal to net interest income payments on the economy’s external debt) improves or not depends on how much consumption falls relative to output. At the same time, although private foreign borrowing falls, the net effect of an increase in \(\alpha\) on the services account is a rise in interest payments by the household to foreign creditors (as assumed earlier) and therefore an increase in the deficit of the services account.\(^{16}\) With a permanent shock, the net effect is a current account surplus on impact \((\dot{D^*} < 0)\), which implies that the reduction in consumption is not only large enough to generate an improvement in the trade balance, but that the trade surplus so generated is sufficiently large to outweigh the effect of the deterioration in the services account on the current account balance. Graphically, consumption would jump downward from \(E\) to \(G\), located on the new saddlepath.

With a temporary shock, however, although consumption always falls on impact, the net effect on the current account is ambiguous and depends on the duration of the shock, \(T\). The dynamics of a temporary shock are also illustrated in Figure 1. Consider first the case in which the period of

\(^{15}\)See Agénor (1998) for a further discussion.

\(^{16}\)Recall that the economy’s stock of foreign debt does not change on impact; thus, the increase in debt service refers only to the premium-related component.
time $T$ during which the autonomous component of the premium increases is sufficiently large. Given that the shock is temporary, the optimal “smoothing response” is such that consumption falls initially (from $E$ to a point such as $A$) by less than it would if the shock was permanent. As in the case of a permanent shock, despite the deterioration in the services account and the fall in output, the reduction in consumption is large enough to ensure that the economy generates trade and current account surpluses on impact ($\dot{D}^* < 0$). During the first phase of the transition period, consumption begins to rise (toward $S'S''$) after the initial downward jump, the current account remains in surplus, and the economy reduces its net external debt. However, as time goes by, the expected future reversal of the shock becomes gradually more important in consumption decisions, and agents at some point during the transition begin to reduce the rate of change of expenditure. Formally, this occurs at the point in which the path of the system crosses the $[\dot{D}^* = 0]$ curve corresponding to the long-run equilibrium $E'$, that is, at $B$, where the current account is in equilibrium. After that point, consumption continues to rise, and the current account moves into deficit ($\dot{D}^* > 0$). The initial saddlepath $SS$ corresponding to the original equilibrium position is reached exactly at $T$ (point $C$). After that point, consumption begins falling, and the current account continues to deteriorate (and external debt to increase), until the economy returns to its original equilibrium position at $E$.

During the first phase of the transition period, with consumption increasing and net external debt falling, bank deposits are increasing, credit supply is rising, and the bank lending rate is falling.\footnote{The ensuing discussion assumes that the degree of intertemporal substitution, and thus the initial impact of the shock on consumption, is not too large (see Appendix B).} Foreign borrowing by the private sector is therefore falling, so that the economy is registering net capital outflows. Domestic cash balances are rising, as well as official reserves held by the central bank. In the second phase of the transition (between $B$ and $C$), with consumption rising and the stock of debt increasing, the domestic
lending rate is also rising, and private foreign borrowing begins to increase. At period $T$ when the shock is reversed, consumption begins to fall and net external debt continues to increase. At the same time, the bank lending rate falls discretely, whereas private foreign borrowing jumps up. Real cash balances, official reserves, and bank deposits also jump upward, so that the economy’s net foreign debt remains constant. As can be inferred from (30), bank deposits increase at $T$ despite a drop in the deposit rate; the reason is that the jump in foreign borrowing (a capital inflow) is matched by an increase in both real cash balances (as a result of the reduction in the opportunity cost of money) and deposits in the banking system. Again, this portfolio reallocation occurs instantly, so as to leave the net foreign debt level of the economy constant at $T$.\(^{18}\) The path of output mirrors the adjustment path of the lending rate. Figure 2 illustrates the adjustment path of the main variables of the economy.

Consider now the case in which the length of time $T$ during which the premium increases is relatively short. In contrast to the previous case, a temporary rise in $\alpha$ will be accompanied by an initial deficit in the current account—induced by a deterioration in the trade balance (resulting itself from a fall in output and limited adjustment in consumption) and a deterioration in the services account. This deficit will persist as long as the shock lasts, followed by a subsequent improvement (in line with consumption) toward the original steady state. This adjustment path corresponds to $EA'B'E$ in the figure. Intuitively, a fairly short temporary shock generates little incentives for private agents to engage in intertemporal substitution; as a result, initial consumption does not adjust by much and, because output falls, there is a tendency for the trade balance to deteriorate—thereby compounding the adverse effect of the increase in the exogenous component of the premium on the services account.

\(^{18}\)Note also that the increase in $R^*$, which matches the increase in $L^*$, results from higher cash holdings not only by households, but also by firms (the supply of credit expands as a result of an increase in bank deposits). Equivalently, from (31) $R_T^* = z_{h,T} + d_T$. 

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5 Summary and Conclusions

This paper has used an intertemporal optimizing framework to examine the macroeconomic effects of changes in “market sentiment,” that is, changes in market perceptions about the economic prospects of a country that are unrelated to the behavior of its fundamentals. A key building block of the model is the assumption that firms’ must borrow to finance their working capital needs (essentially, labor costs) prior to the sale of output. A transitory change in “market sentiment” is then modeled as a temporary increase in the autonomous component of the premium that domestic private borrowers must pay (above the “safe” lending rate) on world capital markets.

The short-run dynamics associated with this type of shocks were shown to depend in important ways on the short-run linkage between the financial sector and the supply side, the degree of intertemporal substitution in consumption, and the duration of the shock. Under the assumptions that the degree of intertemporal substitution is not too large, and that the shock is perceived to be of a sufficiently long duration, the model predicts an increase in domestic interest rates, a reduction in foreign borrowing (or, equivalently, an increase in net capital outflows), a sharp drop in official reserves and the monetary base, a reduction in bank credit, a contraction in output, an increase in unemployment, a fall in consumption, and an improvement in external accounts. These predictions of the model are consistent with the evidence available for developing countries during recent periods of turbulence on world financial markets.

The model could be extended in several directions. One possible avenue would be to endogenizing financial intermediation spreads (that is, the lending-deposit spread), by accounting more explicitly for domestic credit market imperfections. The framework used in Appendix A (based on Agénor and Aizenman (1998)) to explain the “external” premium could be used to determine domestic spreads as well; In such a setting, they would then depend also on a markup that compensates for the expected cost of contract
enforcement and state verification, and for the expected revenue lost in adverse states of nature. Another direction is to introduce net worth effects on the determination of financial intermediation spreads, by explicitly accounting for firms’ borrowing and decisions to accumulate physical capital. To the extent that net worth (as measured for instance by the difference between the stock of capital and the level of foreign borrowing) acts as a measure of (effective) collateral in case of default, it would affect the propensity to lend. Changes in market sentiment, by altering borrowing decisions, would therefore affect the economy through another channel. These extensions would, however, increase the complexity of the present framework and numerical simulation methods may be required to analyze its transitional dynamics.
Appendix A
Default Risk and the Premium

This Appendix presents a simple model, along the lines of Agénor and Aizenman (1998), that characterizes the relationship between the premium and the world interest rate that individual domestic borrowers face on world capital markets. In this model, domestic agents face random shocks to their income or, more generally, their repayment capacity. Such shocks make future (end-of-period) repayments on the debt contracted today (at the beginning of the period) uncertain, and leads foreign lenders to charge a premium—which is such that the expected yield of the loan is greater than (and, in equilibrium, equal) to the yield that would be obtained if they were to lend at the safe interest rate.

Formally, suppose that lenders on world capital markets provide loans to domestic agents at the beginning of the period, and face the risk of default on these loans at the end of the period. They may also be unable to obtain full legal remedies for breach of contract in the borrower’s country. Lenders are perfect competitors and risk-neutral.

Let $L^*_h$ denote (beginning-of-period) borrowing by agent $h$. The agent’s end-of-period income, in gross terms, is given by

$$g(L^*_h)(1 + v_h), \quad g' \geq 0, \quad g'' \leq 0,$$

where $v_h$ is an idiosyncratic shock with zero mean and a density function $f(v)$, defined over the interval $(-v_m, v_m)$, with $v_m < 1$. $g(L^*_h)$ is the expected value of the agent’s resources, which is assumed to depend positively on the level of debt. The function is also assumed to have a concave shape and can be thought of as a production function.

If agent $h$ chooses to default on part or all of his or her debt (after the realization of the shock $v_h$), the foreign lender is assumed to be capable of
securing (through appropriate legal actions) a fraction $0 \leq \kappa < 1$ of the realized value of the agent’s resources. Thus, agent $h$ will choose to default if and only if

$$\kappa g(L_h^*)(1 + v_h) < (1 + i_h^*)L_h^*, \quad (A1)$$

where $i_h^*$ is the contractual interest rate. The term on the left-hand side in the above expression is the agent’s repayment following the decision to default, whereas the term on the right-hand side is the contractual repayment. Let $v_{\text{max}}$ denote the highest value of the shock $v_h$ associated with (partial) default. This value is implicitly given by

$$\kappa g(L_h^*)(1 + v_{\text{max}}) = (1 + i_h^*)L_h^*. \quad (A2)$$

If default never occurs—as is the case if the condition $\kappa g(L_h^*)(1 + v_h) > (1 + i_h^*)L_h^*$ holds—$v_{\text{max}}$ is set at the lower end of the support ($v_{\text{max}} = -v_m$).

In case of default, the lender’s net revenue is equal to the agent’s actual repayment, minus the state verification and contract enforcement cost, $C_h$:19

$$\kappa g(L_h^*)(1 + v_h) - C_h. \quad (A3)$$

Because lenders are assumed to be risk-neutral and competitive, the contractual interest rate charged on loans to agent $h$ is determined by the condition that expected gross repayment from $h$ (evaluated over the range of variation of $\varepsilon_h$) be equal to the gross revenue that could be obtained by lending at the safe interest rate, $i^*$. From equations (A1) and (A3), this condition can be written as

$$(1 + i^*)L^* = \int_{v_m}^{v_{\text{max}}} [(1 + i_h^*)L_h^*] f(v_h)dv_h + \int_{-v_{\text{max}}}^{v_{\text{max}}} [\kappa g(L_h^*)(1 + v_h) - C_h] f(v_h)dv_h \quad (A4)$$

19 The cost $C_h$ is a lump-sum cost, incurred by lenders in order to identify the idiosyncratic shock $v_h$ (after it is realized) and to enforce repayment in “bad” states of nature. The analysis would be more involved it was assumed that some costs are paid after obtaining information about $v_h$. In that case, lenders would refrain from forcing debt repayment when the realized value of the shock $v_h$ is below an “enforcement threshold.”
Using (A2) and (A4), the agent $h$-specific lending rate is given by

$$i_h^* = i^* + \frac{\int_{\nu_m}^{\nu_{\max}} [\kappa g(L^*)(\nu_{\max} - \nu_h)] f(\nu_h) d\nu_h}{L^*} + \frac{C_h \int_{-\nu_m}^{\nu_{\max}} f(\nu_h) d\nu_h}{L^*}. \quad (A5)$$

The agent-specific contractual lending rate exceeds therefore the safe world of interest rate by the sum of two terms. The first is the expected revenue lost due to partial default in bad states of nature. The second term measures expected state verification and contract enforcement costs.

Using (A4), agent $h$'s net expected income can be written as

$$\kappa g(L^*_h) - (1 + Ei^*_h)L^*_h, \quad (A6)$$

where $Ei^*_h$ is the expected interest rate faced by the individual, which is given by

$$1 + Ei^*_h = 1 + i^* + \frac{\Pr(d/h)C_h}{L^*_h}, \quad (A7)$$

where $\Pr(d/h) = \int_{-\nu_m}^{\nu_{\max}} f(\nu_h) d\nu_h$ denotes agent $h$'s probability of (partial) default. Hence, in the absence of default risk ($\Pr(d/h) = 0$), in equilibrium the ex post lending rate will be equal to the risk-free interest rate ($i^*_h = i^*$). In general, however, lenders will typically impose a premium, so that $Ei^*_h > i^*$.

The above equation determines implicitly the supply of credit facing the individual on world capital markets. It can be established that the supply of credit is perfectly elastic over an initial portion (with the individual facing the safe rate $i^*$), rises for a level of $L^*$ that is low enough, and is completely inelastic when the individual reaches a borrowing constraint.20

A useful example is the case in which the idiosyncratic shock $\varepsilon_h$ follows a uniform distribution, so that $f(\nu_h) = 1/2\nu_m$, and $\Pr(\nu_h > x) = (\nu_m - x)/2\nu_m$. In that case, it can be established that

20In general, the supply curve of funds may be backward-bending, due to the conflicting effects of higher interest rates on expected repayment (see Agénon and Aizenman (1998), and Aizenman, Gavin, and Hausmann (2000)). In the paper, it is assumed that the economy operate on the efficient portion of the supply curve of funds. The credit ceiling is defined by the point where the supply of funds becomes inelastic. Further, it can be shown that the credit ceiling depends negatively on the verification cost, $C_h$, and positively on the bargaining power coefficient, $\kappa$. 

28
\[ \Pr(d/h) = \frac{(v_{\text{max}} + v_m)}{2v_m}, \quad (A8) \]

and that the agent-specific lending rate is given by

\[ i^*_h = i^* + \frac{\kappa g(L^*_h)}{L^*_h} v_m \Pr(d/h)^2 + \frac{\Pr(d/h)C_h}{L^*_h}, \quad (A9) \]

Combining equations (A7) and (A8), it can be inferred that, for an internal solution on the upward-sloping portion of the supply curve of credit facing agent \( h \):

\[ \text{Ei}^*_h = q(L^*_h; \kappa, v_m). \]

Thus, along the positive portion of the credit supply function, the \textit{ex ante} interest rate faced by agent \( h \) rises with the individual’s level of borrowing. Also, the greater the proportion of the individual’s wealth that the foreign lender can confiscate in case of default, or the lower the state verification cost, the lower the interest rate.

The paper focuses on an economy composed of a multitude of agents, characterized by idiosyncratic uncertainty. Hence, for the aggregate budget constraint, the expected interest rate may be viewed as equivalent to the realized (or actual) rate.
References


Figure 1
Temporary Deterioration in Market Sentiment
Figure 2
Adjustment Path to a Temporary Deterioration in Market Sentiment

\[
(\rho + \mu \epsilon)/(1 - \mu)
\]

\[
(\rho - \bar{r} - \theta \alpha)/\gamma
\]

\[
y^s[(\rho + \epsilon)/(1 - \mu)]
\]
Appendix B

This Appendix derives the signs of $\Psi_\alpha$ and the impact and steady-state effects of a shock to $\alpha$. Throughout this discussion, it is assumed for simplicity that $\varepsilon = 0$.

As shown in the text,

$$\Psi_\alpha = \tilde{L}_\alpha \theta_{\alpha} + \left( \tilde{\theta} + \tilde{L}_\alpha \theta_{L*} \right) \lambda_\alpha - y'' \frac{\partial r_L}{\partial \alpha}.$$

Given that $y'' < 0$ and $\partial r_L/\partial \alpha > 0$, the last term is positive. Thus, a sufficient (although not necessary) condition for $\Psi_\alpha > 0$ is

$$\frac{\partial (\theta L*)}{\partial \alpha} = \tilde{L}_\alpha \theta_{\alpha} + \left( \tilde{\theta} + \tilde{L}_\alpha \theta_{L*} \right) L^*_\alpha > 0,$$

where $L^*_\alpha = \lambda_\alpha$. The term on the right-hand side, multiplied by $\alpha/\tilde{\theta} \tilde{L}^*$, can be written as

$$\frac{\alpha \theta_{\alpha}}{\tilde{\theta}} + \left( \frac{\alpha L^*_\alpha}{\tilde{L}^*} \right) \left( 1 + \frac{\tilde{L}_\alpha \theta_{L*}}{\tilde{\theta}} \right) > 0.$$ 

Let $\eta_{z/x} = |(dz/z)/(dx/x)|$ denote (the absolute value of) the elasticity of $z$ with respect to $x$. The above condition can be written as

$$\eta_{\theta/\alpha} + \eta_{L^*/\alpha} (1 + \eta_{\theta/L^*}) > 0,$$

where $\eta_{\theta/\alpha} = \alpha \theta_{\alpha}/\tilde{\theta} > 0$, $\eta_{L^*/\alpha} < 0$, and $\eta_{\theta/L^*} > 0$. By definition, $\eta_{\theta/L^*} \eta_{L^*/\alpha} = \eta_{\theta/\alpha}$. Thus, the above expression is equivalent to

$$2 \eta_{\theta/\alpha} + \eta_{L^*/\alpha} > 0,$$

which is always satisfied if

$$|\eta_{\theta/\alpha}| > |\eta_{L^*/\alpha}|.$$  \hspace{1cm} (B1)

To establish the impact and steady-state effects of an increase in $\alpha$, note that the saddlepath of the economy is given by

$$c - \tilde{c} = \kappa(D^* - \tilde{D}^*),$$  \hspace{1cm} (B2)

where $\kappa \equiv (\nu - \Psi_D)/\Psi_c = G_D/(\nu - G_c) < 0$ and $\nu$ denotes the negative root of the system.
As assumed in the text, \( \Psi_\alpha > 0 \). From (40):

\[
d\tilde{c}/d\alpha = (\Psi_\alpha G_{D^*} - \Psi_{D^*}G_\alpha)/\Sigma,
\]

(B3)

\[
d\tilde{D}^*/d\alpha = (\Psi_c G_\alpha - G_c \Psi_\alpha)/\Sigma,
\]

(B4)

where \( \Sigma = G_c \Psi_{D^*} - G_{D^*} \Psi_c < 0 \). For \( d\tilde{c}/d\alpha < 0 \), it must be that

\[
\Psi_\alpha/\Psi_{D^*} > G_\alpha/G_{D^*} = (\partial r_L/\partial \alpha)/(\partial r_L/\partial D^*) = \theta_\alpha/\gamma.
\]

Equivalently, given the definitions of \( \Psi_\alpha \) and \( \Psi_{D^*} \):

\[
\tilde{L}^* \theta_\alpha + (\tilde{\theta} + \tilde{L}^* \theta_{L^*}) \lambda_\alpha - y^s \partial r_L/\partial \alpha > \frac{\theta_\alpha}{\gamma} \left[ i^* + (\tilde{\theta} + L^* \theta_{L^*}) \lambda_{D^*} - y^s \partial r_L / \partial D^* \right],
\]

or

\[
\tilde{L}^* \theta_\alpha > \frac{\theta_\alpha}{\gamma} \left[ i^* + (\tilde{\theta} + \tilde{L}^* \theta_{L^*}) - y^s (\partial r_L / \partial D^* - \gamma/\beta) \right].
\]

It can be verified that \( \partial r_L / \partial D^* = \gamma/\beta \). We thus have

\[
\gamma \tilde{L}^* > i^* + (\tilde{\theta} + L^* \theta_{L^*}).
\]

Because \( \gamma = 2\theta_{L^*} \), the above expression can be written as \( L^* \theta_{L^*} > i^* + \tilde{\theta} \), that is \( \eta_{\theta/L^*} > (i^* + \tilde{\theta})/\tilde{\theta} \), or \( \eta_{L^*/\theta} < \tilde{\theta}/(i^* + \tilde{\theta}) \). But because \( \eta_{L^*/\theta} = \eta_{L^*/\alpha} \cdot \eta_{\alpha/\theta} \), and because \( \eta_{\alpha/\theta} = \eta_{\theta/\alpha}^{-1} \), the above condition becomes

\[
\eta_{L^*/\theta} = \frac{\eta_{L^*/\alpha}}{\eta_{\theta/\alpha}} < \frac{\tilde{\theta}}{i^* + \tilde{\theta}}.
\]

Because \( \eta_{L^*/\alpha} < 0 \), we also have \( \eta_{L^*/\alpha}/\eta_{\theta/\alpha} < 0 \); the above inequality therefore always holds and \( d\tilde{c}/d\alpha < 0 \).
For $d\tilde{D}^*/d\alpha < 0$, it must be that

$$\Psi_c/\Psi_\alpha > G_c/G_\alpha = (\partial r_L/\partial c)/(\partial r_L/\partial \alpha) = \Phi_c/\Phi_\alpha = z_{hc}\gamma/\theta_\alpha,$$

that is, given the definitions of $\Psi_c$ and $\Psi_\alpha$:

$$1 + (\tilde{\theta} + \tilde{L}^*\theta_{L^*})\lambda_c - y^\flat\frac{\partial r_L}{\partial c} > z_{hc} \frac{\gamma}{\theta_\alpha} \left\{ \tilde{L}^*\theta_\alpha + (\tilde{\theta} + \tilde{L}^*\theta_{L^*})\lambda_\alpha - y^\flat\frac{\partial r_L}{\partial \alpha} \right\}.$$

From the definitions in the text, $\partial r_L/\partial \alpha = \theta_\alpha$. Thus

$$1 + (\tilde{\theta} + \tilde{L}^*\theta_{L^*})\lambda_c > z_{hc} \frac{\gamma}{\theta_\alpha} \left\{ \tilde{L}^*\theta_\alpha + (\tilde{\theta} + \tilde{L}^*\theta_{L^*})\lambda_\alpha \right\} + y^\flat\left\{ \frac{\partial r_L}{\partial c} - \frac{z_{hc}}{\Omega} \right\}.$$

It can be verified that $\partial r_L/\partial c = z_{hc}/\Omega$, so that

$$\theta_\alpha \left\{ 1 + (\tilde{\theta} + \tilde{L}^*\theta_{L^*})\lambda_c \right\} > z_{hc} \gamma \left\{ \tilde{L}^*\theta_\alpha + (\tilde{\theta} + \tilde{L}^*\theta_{L^*})\lambda_\alpha \right\}.$$

Because $\lambda_c = (1 - \mu)z_{hc}\beta$, given the definition of $\lambda_\alpha$ given above, this expression can be simplified to

$$1 > z_{hc} \gamma \left( \tilde{L}^* - (\tilde{\theta} + \tilde{L}^*\theta_{L^*}) \right),$$

or, with $\gamma = 2\theta_{L^*}$:

$$1 > \frac{z_{hc}}{\Omega} \tilde{\theta} \left( \frac{\tilde{L}^*\theta_{L^*}}{\tilde{\theta}} - 1 \right) = z_{hc} \tilde{\theta} (\eta_{L^*/\theta} - 1).$$

As shown above, $\eta_{L^*/\theta} < 0$. The right-hand side of the above equation is thus negative, the inequality always holds, and $d\tilde{D}^*/d\alpha < 0$.

We also have

$$dL^*/d\alpha = -\theta_\alpha/\gamma < 0, \quad dz_h/d\alpha = z_{hc}(d\tilde{c}/d\alpha) < 0,$$

$$d\tilde{\eta}_L/d\alpha = d\tilde{\eta}_L/d\alpha = 0, \quad d\tilde{g}/d\alpha = d\tilde{L}_f^*/d\alpha = 0.$$

The effect on bank deposits is given by

$$d\tilde{d}/d\alpha = d_c \left( \frac{d\tilde{c}}{d\alpha} \right) + d_{D^*} \left( \frac{d\tilde{D}^*}{d\alpha} \right) + d_\alpha,$$
so that, because \( \tilde{D}^* = \tilde{L}^* - \tilde{R}^* \):

\[
d\tilde{d}/d\alpha = (d_c - d_{D^*}z_{hc})(\frac{d\tilde{c}}{d\alpha}) + (\theta_\alpha/\gamma) + d_\alpha,
\]

or, because \( d_\alpha = -\theta_\alpha/\gamma \), \( d_c = -z_{hc} \), and \( d_{D^*} = -1 \) (so that \( d_c - d_{D^*}z_{hc} = 0 \)):

\[
d\tilde{d}/d\alpha = d\tilde{c} / d\alpha = 0.
\]

Because \( d\tilde{z}_f/d\alpha = d\tilde{d}^f/d\alpha = 0 \),

\[
d\tilde{z}/d\alpha = d\tilde{z}_h/d\alpha = z_{hc}(d\tilde{c}/d\alpha) < 0.
\]

From (31), \( \tilde{R}^* = \tilde{z}_h + \tilde{d} \). Given that \( d\tilde{d}/d\alpha = 0 \),

\[
d\tilde{R}^*/d\alpha = d\tilde{z}_h/d\alpha < 0.
\]

The impact on the services account, \( i^*\tilde{D}^* + \tilde{\theta}\tilde{L}^* \), is given by

\[
i^*\frac{d\tilde{D}^*}{d\alpha} + \frac{d(\tilde{\theta}\tilde{L}^*)}{d\alpha} = (i^* + \tilde{\theta})\frac{d\tilde{L}^*}{d\alpha} + \tilde{L}^*\theta_\alpha - i^*\frac{d\tilde{R}^*}{d\alpha}, \tag{B5}
\]

which can be shown to be positive.

The impact effect of an increase in \( \alpha \) on consumption is given by, using equations (B2) and (B4), and noting that \( dD^*_0/d\alpha = 0 \):

\[
\frac{dc_0}{d\alpha} = \frac{d\tilde{c}}{d\alpha} - \kappa\frac{d\tilde{D}^*}{d\alpha} = -\frac{\nu G_\alpha}{\Sigma} + \frac{\Psi_\alpha(G_{D^*} + \kappa G_c)}{\Sigma}
\]

or equivalently, because \( G_{D^*} + \kappa G_c = \kappa\nu \):

\[
\frac{dc_0}{d\alpha} = -\frac{\nu(G_\alpha - \kappa\Psi_\alpha)}{\Sigma} < 0, \tag{B6}
\]

and consumption falls on impact. The effect on the lending rate is

\[
\frac{dr_L(0)}{d\alpha} = (\frac{\partial r_L}{\partial c})(\frac{dc_0}{d\alpha}) + \frac{\partial r_L}{\partial \alpha}, \tag{B7}
\]

which is ambiguous because \( dc_0/d\alpha < 0 \). If \( \sigma \) is sufficiently small, or if the shock to \( \alpha \) is of a sufficiently short duration (so that the drop in initial consumption is limited), the lending rate will rise on impact. The effect on bank deposits is

\[
\frac{dd_0}{d\alpha} = d_c\frac{dc_0}{d\alpha} + d_\alpha, \tag{B8}
\]
which is also ambiguous. Again, if the degree of intertemporal substitution is not too high, or if the shock to $\alpha$ is of a sufficiently short duration, bank deposits will fall.

The supply of credit and output fall on impact, if the lending rate rises on impact. For private foreign borrowing,

$$
\frac{dL^*_0}{d\alpha} = \gamma^{-1} \left[ (1 - \mu) \frac{dr_L(0)}{d\alpha} - \theta_\alpha \right] = \lambda_c \left( \frac{dc_0}{d\alpha} \right) + \lambda_\alpha, \quad (B9)
$$

so that, because $\lambda_c > 0$ and $\lambda_\alpha < 0$, and consumption falls on impact, private foreign borrowing also falls unambiguously.

Because $dD^*_0/d\alpha = 0$,

$$
dR^*_0/d\alpha = dL^*_0/d\alpha < 0. \quad (B10)
$$

From equation (15):

$$
\frac{dz_h(0)}{d\alpha} = z_{hc} \left( \frac{dc_0}{d\alpha} \right) + (1 - \mu) z_{hr_d} \frac{dr_L(0)}{d\alpha},
$$

or, using (B7):

$$
\frac{dz_h(0)}{d\alpha} = \left\{ z_{hc} + (1 - \mu) z_{hr_d} \frac{\partial r_L}{\partial c} \right\} \left( \frac{dc_0}{d\alpha} \right) + (1 - \mu) z_{hr_d} \frac{\partial r_L(0)}{d\alpha}. \quad (B11)
$$

From the definition of $\partial r_L/\partial c$, it can be established that

$$
z_{hc} + (1 - \mu) z_{hr_d} \frac{\partial r_L}{\partial c} = z_{hc} \left\{ 1 + \frac{(1 - \mu) z_{hr_d}}{\Omega} \right\},
$$

with

$$
1 + \frac{(1 - \mu) z_{hr_d}}{\Omega} = \gamma^{-1} - \frac{\nu_\theta}{1 - \mu} > 0.
$$

Because the partial effect $\partial r_L(0)/\partial \alpha$ is always positive, and $z_{hr_d} < 0$, the second term on the right-hand side of (B11) is negative. Thus, given the above result, the first term is also negative and $dz_h(0)/d\alpha < 0$.

When the shock to $\alpha$ is considered temporary, the general solution of system (40) can be written as

for $0 \leq t \leq T$:

$$
c = \tilde{c}_{t\leq T} + \kappa_1 C_1 e^{\nu_1 t} + \kappa_2 C_2 e^{\nu_2 t}, \quad (B12)
$$
\begin{align}
D^* &= \tilde{D}^*_{t \leq T} + C_1 e^{\nu_1 t} + C_2 e^{\nu_2 t}, \quad (B13) \\
\text{for } t \geq T: \\
&\begin{align*}
c &= \tilde{c}_0 + \kappa_1 C'_1 e^{\nu_1 t} + \kappa_2 C'_2 e^{\nu_2 t}, & (B14) \\
D^* &= \tilde{D}^*_0 + C'_1 e^{\nu_1 t} + C'_2 e^{\nu_2 t}, & (B15)
\end{align*}
\end{align}

where \( \nu_1(= \nu) \) denotes the negative root \( \nu_2 \) the positive root of the system (with \(|\nu_1| < \nu_2\)), and \( \kappa_h = G_{D^*}/(\nu_h - G_c), \ h = 1, 2 \). The four arbitrary constants \( C_1, C_2, C'_1 \) and \( C'_2 \) are determined under the assumptions that a) \( C'_2 = 0 \) (for the transversality condition to hold); b) \( D^* \) evolves continuously from its initial given value \( \tilde{D}^*_0 = D^*_0 \), so that \( D^*_0 = \tilde{D}^*_0_{t \leq T} + C_1 + C_2 \); and c) the time paths for \( c \) and \( D^* \) are continuous for \( t > 0 \). In particular, at time \( t = T \), the solutions for (B13) and (B15); and (B12) and (B14) must coincide, yielding two more equations which, together with the above condition on \( D^*_0 \), uniquely determine the solution for \( C_1, C_2, \) and \( C'_2 \). The solutions are given by:

For \( 0 \leq t \leq T \):
\begin{align*}
c &= \tilde{c}_t - \chi \Delta \kappa_1 (D^*_0 - \tilde{D}^*_0_{t \leq T}) e^{\nu_1 t} + \chi \nu_1 G_F (D^*_0 - \tilde{D}^*_0_{t \leq T}) e^{\nu_2 (t - T)}, \\
D^* &= \tilde{D}^*_0_{t \leq T} - \chi \Delta (D^*_0 - \tilde{D}^*_0_{t \leq T}) e^{\nu_1 t} + \chi \nu_1 (\nu_2 - G_c) (D^*_0 - \tilde{D}^*_0_{t \leq T}) e^{\nu_2 (t - T)},
\end{align*}

and for \( t \geq T \):
\begin{align*}
c &= \tilde{c}_0 + \kappa_1 (D^* - D^*_0), \\
D^* &= D^*_0 - \chi (D^*_0 - \tilde{D}^*_0_{t \leq T}) e^{\nu_1 t} \left\{ \Delta - \nu_2 (\nu_1 - G_c) e^{-\nu_1 T} \right\},
\end{align*}

where \( \chi = 1/G_c(\nu_2 - \nu_1), \ \Delta = -\chi + \nu_1 (\nu_2 - G_c) e^{-\nu_2 T}. \)