A Third Generation Model of Financial Crises*

Andrés Velasco

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Abstract

What are the causes of the recent spate of financial and currency crises in so-called emerging markets? If the model of this paper is correct, one such cause is a shift in expectations, which suddenly turn pessimistic. With imperfect financial markets and large amounts of dollar debt, such pessimism can become self-fulfilling, causing a fall in investment, a sharp real depreciation, and a deterioration in creditworthiness. What is the right fiscal and monetary response to an incipient shift of this kind? When it comes to monetary policy, the model here suggests a tightening is called for. In this regard orthodoxy may have got things right. But where fiscal policy is concerned, the model calls for an expansion, even if the government is constrained in international debt markets. More importantly, the model shows that either policy has a chance to work if and only if initial conditions are not too bad: when dollar debts are too high and/or exports are too low, there is little macroeconomic policy can do. This argues for putting more attention on prudential policy (avoiding overborrowing) and microeconomic reform (expanding the supply of exports).

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1 Introduction

International financial markets have given modelers much material to work with in the last decade. Not long ago, the prevailing view was that currency crises were the inevitable outcome of money-financed fiscal imbalances coupled with fixed exchange rates. Too much money creation would cause reserves to fall, eventually undoing the peg. But this "first generation" of models of crisis, pioneered by Krugman (1979), has fallen out of fashion because in many actual crises –Asia is the most glaring example– the crucial fiscal disequilibria seemed to be absent. Moreover, in some cases, including much of Europe in the early 1990s, currency crises occurred even though central banks had more than enough resources to prevent them. Obstfeld (1994, 1996) put forward a "second generation" view, in which central banks may decide to abandon the defense of an exchange rate peg when the social costs of doing so, in terms of unemployment and domestic recession, became too large. This change of perspective implied, in particular, that crises may be driven by self fulfilling expectations, since the costs of defending an exchange peg may themselves depend on anticipations that the peg will be maintained. However, Obstfeld's emphasis on mounting unemployment and domestic recession, while appropriate for the ERM 1992 crisis, was at odds with the crises of Mexico in 1994 and East Asia in 1997. Asian countries, in particular, were growing quickly until shortly before the currency meltdown.

Instead of fiscal imbalances or weakness in real activity, the most striking common feature of recent crises in emerging markets was a sudden and large reversal in *private* capital flows, which pushed many a local bank and corporation into bankruptcy. This has led to a "third generation" of crisis models, which assigns a key role to financial structure. Papers in this line Krugman (1999, 2000), Aghion, Baccheta and Banerjee (1999, 2000), Chang and Velasco (1999, 2000) and Céspedes, Chang and Velasco (2000, 2001). Details differ, but these papers have in common several building blocks:

- *International illiquidity*: because of various market imperfections domestic agents cannot borrow as much as they want at the world rate of interest, even if they are perfectly solvent in the usual sense. This affects the way they adjust to shocks, forcing them to rely on scarce collateral or (in some versions) liquidate existing investments in order to meet liquidity needs.

- *Dollarization of liabilities*: domestic agents earn domestic currency yet have no choice but to borrow in foreign currency. This means that nominal devaluations (or with sticky prices and wages, real devaluations) can impair their ability to service old debt and, by reducing net worth and collateral, also impair their ability to secure new debt.

- *The transfer problem*: external shocks, such as a fall in export demand, may require large real devaluations. In turn, these required changes in relative prices may exacerbate the above-mentioned financial problems.

This combination of factors causes, in some cases, the domestic effects of external shocks to be magnified and made persistent. In others, it opens the door to multiple equilibria, so that the mere expectation of a large devaluation causes one to occur; in turn, the devaluation damages financial health enough to justify the initially pessimistic expectations. For this to be true sudden depreciations may turn out to be contractionary, not expansionary as in the Mundell-Fleming model.

This paper sets out a minimal yet rigorous “third generation” model: a general equilibrium formulation built up from microfoundations, which nonetheless has a closed-form solution that lends itself to a simple graphical representation reminiscent of the classic IS-LM-BP paradigm. For situations of sufficiently weak initial fundamentals (high inherited dollar debts, low exports), there can be two equilibria: one with healthy firms, high investment and a strong real exchange rate, and one with collapsing net worth, no investment and a depreciated real exchange rate. The shift from one to the other can occur because of shifts in animal spirits, which then become self-fulfilling.

I put this model to work in assessing whether monetary and fiscal policies can be used to avoid financial and currency crises. This was perhaps the most contentious aspect of the debate after the 1997-98 Asian meltdown. The IMF and Wall Street called for the usual medicine of monetary and fiscal tightening. Critics objected, arguing that there was no fiscal disequilibrium, so it was unclear why austerity was needed. Worse, the policies did not seem to work, failing to prevent the sharp depreciation of the exchange rate while sending almost every economy in the region spinning head first into recession.

The debate was often acrimonious. The IMF’s Stanley Fischer contended that stopping the depreciation was priority number one. Confidence, a reversal of capital flows and growth would follow. Enthusiasts of this policy pointed to the 1995 example of Mexico. Rudi Dornbusch (1998) *dixit*:

> Mexico fully implemented a stark US-IMF program of tight money

> to stabilize the currency and restore confidence. Starting in a near-meltdown situation, confidence returned and within a year the country was on the second leg of a V-shaped recovery. The IMF is unqualifiedly right in its insistence on high rates as the front end of stabilization.

On the other side Joe Stiglitz, then of the World Bank, argued (Stiglitz and Furman, 1998):

> In East Asia... aggregate demand and supply were initially roughly in balance. Not surprisingly, raising interest rates had significant adverse macroeconomic effects. These large macroeconomic effects, combined with high indebtedness, led to a large increase in the probability of bankruptcy, lowering expected returns and thus making investments less attractive in these countries.

These quotes suggest that policy clearly has a role to play, and that the job is simply to decide whether a tightening or an expansion is called for. But if crises are self-fulfilling events, as in much of the recent literature – and also in this paper– and not caused by exogenous shocks or policymakers' mistakes, what is policy to do? One possibility is to design policy to move the economy to a situation in which the "bad" equilibrium can no longer occur. That is the goal I set in the paper, asking whether this goal is attainable. I find that:

- Monetary and fiscal policy can do the job only if initial conditions are not too bad: if the debt/export ratio is past a certain threshold, there is no feasible combination of money and government spending that can rule out the bad equilibrium.
- A *monetary tightening* is called for. This contraction is costly in that it reduces output, but that is precisely what is needed: making domestically produced goods relatively scarce raises their relative price (the real exchange rate appreciates), strengthening balance sheets and preventing a collapse in investment.
- But when it comes to fiscal policy, an *expansion of government spending* is what the doctor ordered. This time the relative price of domestic goods is raised by an increase in demand, which again has beneficial financial effects.

- Adopting a policy of *fixed nominal exchange rates* is of little help. Almost exactly the same conditions on the initial debt/export ratio that give rise to multiplicity under flexible rates also give rise to multiplicity under fixed rates. The only difference is under a sustained peg the collapse comes via a fall in current output, rather than a real depreciation.

The paper is structured as follows. The next section lays out the basic model, and the following one solves it, ascertaining conditions under which self-fulfilling panics are possible. Section 4 analyzes whether and when policy is useful in avoiding crises, while Section 5 concludes.

2 The Model

The model has two periods, current and future; two goods, foreign and domestic; and two kinds of people, capitalists and workers. Workers only consume. Capitalist own capital which they lend to firms, and also consume. They finance investment in excess of their own net worth by borrowing from foreigners. The key aspect of the model is that such borrowing is constrained by the need to put up collateral. In its treatment of borrowing constraints the model resembles the work by Krugman (1999) and Aghion, Baccheta and Banerjee (2000), though the precise specification of collateral is forward-looking rather than backward-looking as in those two papers. The model also borrows liberally from Céspedes, Chang and Velasco (2000), a paper with a different financial imperfection but whose modeling of labor and goods markets is very close to that found here.

2.1 Domestic Production

Both domestic firms and consumers demand a CES aggregate of home output, given by

$$Y_t = \left[\int_0^1 (Y_{jt})^{1-\theta}\, dj\right]^{\frac{1}{1-\theta}},\ \theta > 1 \tag{1}$$

where Y_{jt} denotes home output of good j in period t and $\theta^{-1} > 1$ is the elasticity of substitution among individual home goods. The minimum cost of a unit of Y_t is given by

$$P_t \equiv \left[\int_0^1 P_{jt}^{\frac{\theta-1}{\theta}} dj\right]^{\frac{\theta}{\theta-1}} \tag{2}$$

This specification implies that for each home good there is a demand function of the form

$$Y_{jt} = Y_t \left(\frac{P_{jt}}{P_t}\right)^{-\frac{1}{\theta}} \tag{3}$$

Production of home goods is carried out by monopolistically competitive firms, indexed by j. Each firm has access to the Cobb-Douglas technology

$$Y_{jt} = K_{jt}^{\alpha} L_{jt}^{1-\alpha},\ 0 < \alpha < 1 \tag{4}$$

where K_{jt} denotes capital input and L_{jt} denotes labor input. Assume, as in Blanchard and Kiyotaki (1985) and Obstfeld and Rogoff (2000), that workers' labor services are heterogeneous. As a consequence, the input L_{jt} is a CES aggregate of the services of the different workers in the economy:

$$L_{jt} = \left[\int_0^1 L_{ijt}{}^{1-\sigma} di\right]^{\frac{1}{1-\sigma}} \tag{5}$$

where workers are indexed by i in the unit interval, L_{ijt} denotes the services purchased from worker i by firm j, and $\sigma^{-1} > 1$ is the elasticity of substitution among different labor types. The minimum cost of a unit of L_t is given by

$$W_t = \left[\int_0^1 W_{it}{}^{\frac{\sigma-1}{\sigma}} di\right]^{\frac{\sigma}{\sigma-1}} \tag{6}$$

which can be taken to be the aggregate wage.

In every period, the jth firm's problem is to maximize profits, given by

$$\Pi_{jt} = P_{jt} Y_{jt} - \int_0^1 W_{ijt} L_{ijt}\ di - R_t K_{jt} \tag{7}$$

where R_t is the return to capital, and profits are expressed in terms of the domestic currency (henceforth called *peso*). Maximization takes place subject to 3, 4, 5 and W_{ijt}, worker i's wage rate when employed by firm j.

The solution to this problem is standard. Cost minimization yields the demand for worker i's labor:

$$L_{ijt} = \left(\frac{W_{it}}{W_t}\right)^{-\frac{1}{\sigma}} L_{jt} \tag{8}$$

where

$$L_{jt} = \frac{\int_0^1 W_{ijt} L_{ijt} \, di}{W_t} \tag{9}$$

In addition we have first order conditions

$$\alpha \left(\frac{Y_t}{K_t} \right) = \left(\frac{1}{1-\theta} \right) \left(\frac{R_t}{P_t} \right) \tag{10}$$

$$(1-\alpha) \left(\frac{Y_t}{L_t} \right) = \left(\frac{1}{1-\theta} \right) \left(\frac{W_t}{P_t} \right) \tag{11}$$

where I have assumed a symmetric equilibrium and therefore suppressed the subscript j. Notice that the LHS of 10 (11) is the marginal product of labor (capital), which is set equal to the markup $(1-\theta)^{-1}$ over the real product wage (rental rate). Finally, using these expressions in the profit function 7 and imposing symmetry (so that again subscripts j are eliminated) one finds

$$\frac{\Pi_t}{P_t} = \theta Y_t \tag{12}$$

In what follows I assume, in order to minimize algebraic complexity, that workers are the sole owners of firms. Under this assumption, the total return to capitalists is simply given by a rearrangement of 10. Notice this holds whether prices and/or wages are sticky or not, and for any level of output. The total return to workers is simply the remainder of output:

$$\left(\frac{W_t}{P_t} \right) L_t + \frac{\Pi_t}{P_t} = Y_t \left[1 - \alpha \left(1 - \theta \right) \right] \tag{13}$$

2.2 Workers

Labor services are imperfect substitutes of each other but workers are identical otherwise. Worker i 's preferences are given by

$$\sum_{t=0}^{1} \left\{ \log C_{it} - \xi \left(\frac{1}{\upsilon} \right) L_{it}^{\upsilon} \right\} \beta^t \tag{14}$$

where $\upsilon > 0$ is the elasticity of labor supply and ζ is a constant included for convenience.[1] This preference specification is chosen because it yields, as we shall see, a simple solution for equilibrium employment under flexible wages.

[1] The constant is $\zeta = (1-\sigma) \left[1 - \delta - \alpha (1-\theta) \right] (1-\alpha)^{-1}$, where δ is the ratio of government spending to output in the initial steady state. See the section below on the government for details.

The consumption quantity C_{it} is a Cobb-Douglas aggregate of home and imported goods, with shares γ and $1-\gamma$ respectively. Assume that the imported good has a fixed price, normalized to one, in terms of a foreign currency, which we shall refer to as the *dollar*. Moreover, imports are freely traded and that the Law of One Price holds, so that the *peso* price of imports is equal to the *nominal exchange rate* of S_t pesos per dollar. The nominal exchange will be assumed to float unless specifically indicated. With this specification, the minimum cost of one unit of consumption is given by

$$Q_t = P_t^{\gamma} S_t^{1-\gamma} \tag{15}$$

To make things simple, assume that workers cannot borrow or lend abroad, but do hold domestic money. They do this because of a cash-in-advance constraint which requires them to hold pesos in order to buy consumption and pay taxes

$$M_{it} \geq Q_t C_{it} + P_t G_t \tag{16}$$

where $P_t G_t$ is the peso value of per capita taxes levied to finance total real government expenditure G (recall that there is mass one of workers). This constraint will hold with equality as long as the expected cost of holding money is positive, which I assume from now on.

Workers' wages constitute their only source of earned income. Worker i's problem is then to maximize 14 subject to the demand for his labor services 8, and his budget constraint

$$M_{it+1} - M_{it} = W_t L_{it} + \Pi_t + T_t - P_t G_t - Q_t C_{it} \tag{17}$$

where T_t per capita monetary transfers from the government.

Again, the solution to this problem is standard. Purchasing consumption at minimum cost requires that the ratio of the marginal utilities of consuming imported and domestic goods be equal to their relative price $\frac{S_t}{P_t} \equiv E_t$, where we can think of E_t as the *real exchange rate*. The optimal real wage is set to equate the marginal disutility of labor to its marginal return and is

$$L_t = 1 \tag{18}$$

in symmetric equilibrium.

2.3 Capitalists

Capitalists are the key players in they model: they finance investment partly with foreign loans, and foreign borrowing is subject to frictions. They consume in the closing period only and, in true capitalist style, they consume only imports. Their objective is to maximize the utility from such consumption, which boils down to maximizing the amount consumed.

To describe the capitalists' behavior, it is best to distinguish explicitly between the initial and final periods. I adopt the convention that no subscript indicates an initial period variable, while a subscript 1 indicates a final period variable. At the beginning of time, capitalists have some *net worth* N, expressed in units of the domestic good, and have access to a world capital market where the *safe* interest rate for dollars borrowed is given by ρ. Capitalists invest in capital for the next period, subject to the budget constraint

$$I = N + EF_1 \tag{19}$$

where F_1 denotes the amount borrowed abroad to be repaid next period, and I is investment made in the initial period involving capital to be used in the closing period. Notice that capital is made up of domestic goods only.

At the beginning of each period, capitalists collect the income from capital (equal to $\alpha(1-\theta)Y_t$) and repay foreign debt. As a consequence, their initial net worth is

$$N = \alpha(1-\theta)Y - (1+\rho)EF \tag{20}$$

where F is inherited foreign debt. The size of this debt will play a crucial role. Note that –holding real income constant– a real devaluation, defined as an increase in E, will have a negative impact on net worth. This will be a key aspect in our analysis. The formulation here is the real-economy counterpart of the problem of "dollarization" of liabilities stressed by Calvo (1999, 2000) and others. Because domestic capitalists' productive assets and liabilities consist of different goods, changes in relative prices affect their net worth and hence their creditworthiness.

If they are not financially constrained and can borrow as much as they want, capitalists maximize their next-period consumption by choosing an amount of investment such that the percentage return to capital is equal to the domestic goods' expected cost of borrowing, so that

$$\frac{\alpha(1-\theta)Y_1}{I} = (1+\rho)\left(\frac{E_1}{E}\right) \tag{21}$$

But financial constraints may not let them do that. In the closing period capitalists receive the total return on their investment, $\alpha(1-\theta)Y_1$. A crucial assumption is that, because of limitations of sovereignty, court jurisdiction and the like, lenders can seize at most a portion $\mu < 1$ of this return in case of non-payment. Hence, they will not lend at the initial time an amount generating obligations larger than the resulting collateral:[2]

$$(1+\rho)\,E_1F_1 \leq \mu\alpha\,(1-\theta)\,Y_1. \tag{22}$$

This can also be written as

$$EF_1 \leq \varepsilon\mu\,(I+K)\,. \tag{23}$$

The coefficient ε is given by

$$\varepsilon = \left(\frac{\bar{I}+K}{I+K}\right)^{1-\alpha}, \tag{24}$$

where K is the quantity of initial capital and $\bar{I}$ is the level of investment chosen when the capitalists are unconstrained –hence, $\bar{I}$ solves 21, recalling that $Y_1 = (I+K)^{\alpha}$. Of course, ε is not a constant, so that treating it as such involves a linear approximation. But notice that $\varepsilon > 1$ for $0 \leq I \leq \bar{I}$, which is the relevant range.

The fact that borrowing is constrained can lead investment to be constrained. Combining 19 and 23 we have

$$I \leq \left(\frac{1}{1-\lambda}\right) N + \left(\frac{\lambda}{1-\lambda}\right) K \tag{25}$$

where $\lambda = \varepsilon\mu$. I shall assume from now on that $\lambda < 1$, which is equivalent to assuming that the law-enforcement technology is sufficiently weak, so that μ is small enough. With that assumption, 25 shows that investment carried forward to the next period can be no larger than a multiple of initial net worth plus a multiple of initial capital. If financial constraint 25 is binding, then it determines investment.

[2] Notice this formulation implies that, after being used for production in the terminal period, total installed capital $K+I$ cannot be used for anything else, and hence has no market or collateral value.

2.4 The government

The government simply sets monetary transfers equal to earned seigniorage:

$$P_t T_t = M_{t+1} - M_t \tag{26}$$

where $M_t = \int_0^1 M_{it} di$ is aggregate money supply. Note also that, because there is mass one of agents, T_t is both the aggregate and the per capita transfer.

The government also spends G_t per period on home goods. Unless otherwise indicated, I will assume that in both periods this expenditure is a constant proportion of domestic output:

$$G_t = \delta Y_t, \; 0 < \delta < 1. \tag{27}$$

Recall the government finances this expenditure by taxing workers directly. The reason to keep the financing of real expenditure independent of the inflation tax revenue is to separate the fiscal and monetary policy exercises I will carry out below. Otherwise, a fiscal expansion financed with inflation tax revenue would be a fiscal and a monetary shock at once.

2.5 Market clearing

Market clearing for home goods requires that domestic output be equal to demand. As we have seen, domestic consumption of home goods is a fraction γ of the value of total consumption. In addition, the home good may be sold to foreigners. Since one wants to allow for shocks to foreign demand, I simply assume that the value of home exports in dollars is exogenous and given by some fixed X.[3]

This implies that the market for home goods will clear when

$$Y_t = I_t + G_t + \gamma \frac{Q_t}{P_t} C_t + E_t X \tag{28}$$

Next I consolidate the public and private sectors by combining budget constraints 17 and 26, using 12:

[3] This is similar to Krugman (1999), and can be justified by positing that the foreign elasticity of substitution in consumption is one, but that foreigners expenditure share in domestic goods is negligible.

$$G_t + \frac{Q_t}{P_t} C_t = \frac{W_t}{P_t} L_t + \frac{\Pi_t}{P_t} = Y_t \left[1 - \alpha \left(1 - \theta\right)\right] \tag{29}$$

where the second equality comes from using 13. That completes the description of the model.

3 Equilibria with and without crises

In this section I solve the model, showing how it can be reduced to an extremely simple system of equations that resembles the classic IS-LM-BP analysis. Then I investigate under what conditions self-fulfilling financial and exchange rate crises can occur.

3.1 Solving the model

Combining 28 and 29, evaluated for the initial period, we have

$$\left[1 - \gamma + \gamma\alpha \left(1 - \theta\right)\right] Y = I + \left(1 - \gamma\right) G + EX \tag{30}$$

This is the IS schedule.

In the final period, naturally, no investment takes place. Using 28 and 29 along with 27 one therefore has

$$\beta Y_1 = E_1 X_1 \tag{31}$$

where $\beta = (1 - \gamma)(1 - \delta) + \gamma\alpha(1 - \theta)$ is a positive constant. Combining this last expression with arbitrage equation 21 yields

$$I = \frac{\alpha \left(1 - \theta\right)}{\beta} \frac{EX_1}{1 + \rho} \tag{32}$$

I term this the BP schedule, by analogy to the IS-LM-BP scheme of Mundell-Fleming fame: it gives the combinations of investment and the real exchange rate that set the balance of payments in equilibrium.

Next, using 25 and 20 one arrives at

$$\left(1 - \lambda\right) I \leq \alpha \left(1 - \theta\right) Y - \left(1 + \rho\right) EF + \lambda K \tag{33}$$

I term this the FC schedule.

Finally, combining cash-in-advance constraint 16 and 29, both in the first period, we get

$$\frac{M}{P} = [1 - \alpha (1 - \theta)] Y \tag{34}$$

This is the very simple LM schedule.

Together, 30, 34, and either 32 and 33 form a system of three equations and four unknowns: I, E, P and Y. With flexible wages and prices, I, E and P are endogenous and output Y is determined by the production function, with initial capital given by history and labor supply at its equilibrium level of one. With nominal stickiness in the initial period, I, E and Y are endogenous and P is predetermined. In either case, X, X_1 and M are exogenous, and inherited foreign debt F and capital K are given by history.

As in Obstfeld and Rogoff (2000) and Céspedes, Chang and Velasco (2000), I assume that nominal stickiness, if and when it is present, can occur in the initial period only. This means that, once the level of investment is determined in that period, all closing-period variables are determined in a standard neoclassical way. In particular, output is given by the chosen level of capital and labor supplied equal to one. For this level of output, and an exogenous level of exports, 31 gives the equilibrium real exchange rate. Other endogenous variables can similarly be pinned down by using the relevant equations.

3.2 When is the equilibrium unique?

Consider first a flex-price equilibrium in which we can treat Y as exogenous. Given that, at least in this section, I assume $G = \delta Y$, the IS schedule 30 can be written as

$$\beta Y = I + EX \tag{35}$$

This schedule slopes down in E, I space: a real devaluation increases the home-good value of exports, calling for a reduction in investment.

The FC schedule in 33 also slopes down in E, I space: a real devaluation reduces the current value of collateral and current net worth, thereby cutting investment if the constraint binds.

Finally, the BP schedule in 32 is upward-sloping in E, I space because higher investment today means higher output tomorrow, which according to 31 means a more depreciated real exchange rate tomorrow. In turn, by arbitrage, this means a more depreciated real exchange rate (a higher E) today.

Examining 33 and 35 one sees that for the IS to be steeper (more negative) it is necessary that

$$\frac{(1+\rho)\,F}{X} > 1-\lambda \tag{36}$$

That is, it must be an economy where the service of accumulated foreign debt is larger than a fraction of current exports. In the jargon of Washington and Wall Street, the country must have a high debt/export ratio.

Expressions 33 and 35 also reveal that the IS cuts the vertical axis above the FC curve if

$$\frac{(1+\rho)\,F}{X} > \frac{\alpha\,(1-\theta)}{\beta} + \frac{\lambda}{\beta}\frac{K}{Y} \tag{37}$$

There are several configurations, depending on whether IS is steeper and has a larger intercept that FC. I assume from now on that $\frac{\alpha(1-\theta)}{\beta} = 1 - \frac{(1-\gamma)[1-\alpha(1-\theta)-\delta]}{(1-\delta)(1-\gamma)+\gamma\alpha(1-\theta)} < 1-\lambda$, which is basically tantamount to assuming that λ is small but not too small. Focus next on two polar cases.[4]

The first to consider is the "low debt case" shown in figure 1. Neither 36 nor 37 are satisfied, so that the FC is steeper (more negative) and has the lower intercept than the IS. There are two subcases, depending on where the BP schedule lies. If that schedule is steep (as in BP') –implying, among other things, that future export prospects X_1 are weak, so that a depreciated real exchange rate today does not translate itself into much higher current investment– then because BP' intersects IS below FC, the financial constraint is still not binding. The equilibrium is at point A. But if the BP is flatter (as in BP"), because future export prospects are better than in the previous case, we have can have a different story. Because BP intersects IS below FC, the financial constraint is binding. This means that investment and the real exchange rate are determined by the intersection of the IS and FC curves (at point B), and BP is irrelevant. Given a rosy set of world conditions (high expected X_1), local capitalists would like to invest more, but they cannot.

Turn next to the "high debt" case depicted in figure 2. Here both **??** and 37 are satisfied, so that the IS is steeper and cuts the vertical axis below the FC. The first one involves low future exports and therefore BP'. In that

[4]This is not an exhaustive taxonomy. There are some intermediate cases of little or no relevance for the analysis of crises.

case point A is the unique equilibrium. The economy is bankrupt, with no investment as the only possible outcome. Again there are two subcases. The second subcase obtains when future exports are high, so that BP' is the relevant schedule. Now two equilibria are possible, and so are self-fulfilling collapses. If the financial constraint is not binding, equilibrium is at point A. If it is, the equilibrium is at point C. Point B is unstable. At A the economy is at an interior equilibrium with financially healthy firms, positive net worth and investment, and a strong currency. At C the exchange rate has depreciated sharply, firms are bankrupt and consequently investment is zero.

The mechanism that takes the economy from the "good" to the "bad" equilibrium is, as usual, self-fulfilling pessimism. Starting at A, investors who anticipate a big real devaluation choose not to invest, because the return on their investment would be worth little in terms of the foreign goods they need to repay external debt. The fall in investment makes home goods relatively plentiful, leading to a collapse in their relative price. This real depreciation closes the circle, destroying net worth, bankrupting local capitalists and confirming the fears that prevented investment to begin with.

4 Is Policy Useful in Avoiding Crises?

Suppose we define a crisis as a sudden shift from a "good" to a "bad" equilibrium: from point A to point C in figure 3. Can policy do anything about it? Consider monetary policy first, then fiscal policy, then fixed exchange rates.

4.1 Monetary Policy

To analyze the role of money one has to add two twists to the analysis so far. The first, of course, is to introduce nominal stickiness. To render output demand-determined, assume both wages and prices are pre-set in the initial period, but fully flexible in the second period. This means, given the simple LM schedule in 34, that for given prices, increases in nominal money lead to proportional increases in initial-period output. This means that we can use our earlier graphical apparatus to analyze the effects of monetary policy, shifting curves in response to movements in Y, which in turn are caused by changes in the money supply.

A second task is to separate monetary from fiscal policy. Our assumption that real government expenditure G is proportional to output Y is no longer tenable, because if changes in money cause output to change, this would automatically change fiscal policy as well. I therefore assume that we start from a position in which $\bar{G} = \delta \bar{Y}$, where $\bar{Y}$ is the flex-price level of output. But thereafter, if expectations change and/or monetary policy changes, government spending remains at this level in the initial period. In the final period, on the other hand, the economy returns to the rule $G_1 = \delta Y_1$, where Y_1 is now the flexible-price future level of output, given whatever investment decisions may have been taken in the initial period.

Focus now on what monetary policy might be able to do. In figure 3, the schedules labeled IS and FC give rise to possible equilibria at points A and C. Suppose a crisis of confidence, driven by pessimistic animal spirits, threatens to take the economy from A to C. Ruling out that outcome involves moving to a configuration such as that given by curves IS' and FC', so that the IS' schedule cuts the vertical axis below the FC' schedule. In that case IS' comes to lie everywhere below FC', so that the financial constraint cannot be binding. The only feasible equilibrium is now at point D.

More technically, the shock to expectations that causes the incipient move from A to C is assumed to be a zero-probability event. Therefore, any change in monetary (or, below, fiscal) policy in response to the run is also a zero-probability event. This ensures that money shocks are always unanticipated, and therefore have real effects. It also assumes away any credibility problems associated with monetary policy.[5]

Moving the IS curve down involves contracting the money supply, so that output falls and its relative price rises (E goes down) for every level of investment. It is easy to check that, as Y falls, the IS moves down more quickly than the FC. With government spending constant, the IS intercept (see 30) changes by $\frac{[\beta+\delta(1-\gamma)]\Delta Y}{X}$, while the FC intercept changes by $\frac{\alpha(1-\theta)\Delta Y}{(1+\rho)F}$. Given that we are in the high debt situation, so that $\frac{(1+\rho)F}{X} > \frac{\alpha(1-\theta)}{\beta} + \frac{\lambda}{\beta}\frac{K}{Y}$, it must also be the case that $\frac{(1+\rho)F}{X} > \frac{\alpha(1-\theta)}{\beta+\delta(1-\gamma)}$, so the required result obtains.

But if government expenditure remains constant (in terms of units of the domestic good), output cannot fall so much that private consumption becomes negative. Notice that the level of output that ensures the intercept

[5] Credibility is of course a huge issue in the design of discretionary monetary policies under flexible exchange rates. But is has been discussed so extensively elsewhere that I hope I can afford to neglect it here.

of IS is no larger than the intercept of FC is the solution to

$$\frac{[\beta + \delta(1-\gamma)]\,Y - (1-\gamma)\,\bar{G}}{X} \leq \frac{\alpha(1-\theta)\,Y + \lambda K}{(1+\rho)\,F} \tag{38}$$

which in turn means that the share of government spending in output must satisfy

$$\frac{\bar{G}}{Y} \geq 1 - \alpha(1-\theta)\left(\frac{1-\eta\gamma}{\eta-\eta\gamma}\right) - \frac{\lambda}{\eta(1-\gamma)}\frac{K}{Y} \tag{39}$$

where $\eta = \frac{(1+\rho)F}{X}$ is the debt ratio. For the policy to work this share must be no larger than $1-\alpha(1-\theta)$, which is the share of output available for private and public consumption.[6] Using 39, the overall requirement is

$$1 - \alpha(1-\theta)\left(\frac{1-\eta\gamma}{\eta-\eta\gamma}\right) - \frac{\lambda}{\eta(1-\gamma)}\frac{K}{Y} \leq \frac{\bar{G}}{Y} \leq 1 - \alpha(1-\theta)\,. \tag{40}$$

In turn, for this interval to be non empty it must be the case that

$$\frac{(1+\rho)\,F}{X} < 1 + \frac{\lambda}{\alpha(1-\theta)}\frac{K}{Y} \tag{41}$$

In words, the debt/export ratio cannot be too large. Notice also that as output falls the RHS of 41 grows, so the larger the monetary contraction, the less likely this condition will be satisfied.

Summarizing: ruling out the bad equilibrium requires contracting output, so that the real exchange rate appreciates for every level of investment. But with government spending constant, the required cut in output must still leave some room for private consumption. This is achievable if and only if the debt ratio is below a given threshold. Hence, monetary policy cannot do the job if initial conditions are too adverse.

4.2 Fiscal policy

The name of the game again is to move the relevant schedules so that the bad equilibrium is no longer feasible. Notice from 30 that the IS intercept changes by $-\frac{(1-\gamma)\Delta G}{X}$, holding Y constant (as one must, given that now the money supply is constant). Hence, under a fiscal expansion the IS curve shifts down while the FC schedule stays put. This would seem to help in

[6] In other words, if $\frac{\bar{G}}{Y} > 1-\alpha(1-\theta)$, worker's consumption would have to be negative.

preventing a bad equilibrium from obtaining, if only the IS can move down far enough (to IS') so that its vertical intercept is at least as low as that of the FC. This is case depicted in Figure 4.

The intuition is clear: since the private consumption sector's marginal propensity to spend on domestic goods is $\gamma < 1$, while the government's is 1, shifting resources to the government and carrying out an expansionary fiscal policy raises relative demand for domestic goods, increasing their relative price (appreciating the real exchange rate) for every level of investment.

But again we have to make sure that the required increase in government spending leave some room for private consumption. As in the case of monetary policy, the condition that makes sure the intercepts have the required relative size is 38, now evaluated at $\bar{Y}$. Is there a level of $\bar{G}$, holding $\bar{Y}$ constant, which a) satisfies 38 and b) ensures that $\frac{\bar{G}}{\bar{Y}} < 1 - \alpha(1-\theta)$, so that there is something for workers to eat?

The required analysis is exactly the same as in the previous section, except that output is now constant at $\bar{Y}$, so that the policy works exclusively by switching expenditure.. The condition on the debt ratio that must now be satisfied to ensure that the policy is feasible is 41 evaluated at $\bar{Y}$:

$$\frac{(1+\rho)F}{X} < 1 + \frac{\lambda}{\alpha(1-\theta)}\frac{K}{\bar{Y}} \tag{42}$$

A successful fiscal policy has a better chance of being feasible, since the RHS of 42 is now a constant, that is independent of the fiscal stance. The reason for the difference is that a fiscal contraction moves the IS curve while leaving the FC put, while a monetary contraction moves both schedules: a cut in money reduces output, and therefore the size of the return earned by capitalists. This makes monetary policy less effective, and therefore less likely to be able to rule out the bad equilibrium.

So far I have studied the effects of changing the money supply and government spending in isolation. What about some mix of contractionary monetary and expansionary policies? That can be readily studied as well. The arguments given above for the constraints on Y, holding $\bar{G}$ constant, and on G, holding $\bar{Y}$ constant, also hold for any combination of Y and G. Condition 41 would still have to be satisfied for that policy mix to be successful.

4.3 Fixed exchange rates

If flexible exchange rates prove so troublesome in this context, someone might argue, why not just fix the exchange rate? The fact that monetary policy –the means for ensuring a peg– does not always work here might should make one suspicious of such an alternative. But, given the prevalence of fixed rates in many countries until recently, it is an approach to be explored in more detail.

With fixed nominal exchange rates and sticky prices and wages, one can think of the real exchange rate as fixed at some level $\bar{E}$. This in turn renders output Y endogenous. Hence, the IS and FC (or BP) schedules become a system of two equations in two unknowns, with I also being determined endogenously. More precisely, the IS curve in 35 can be re-written as

$$Y = \frac{I + \bar{E}X}{\beta} \tag{43}$$

while the FC schedule in 33 is given by

$$Y = \frac{(1-\lambda) I + \bar{E}(1+\rho) F - \lambda K}{\alpha (1-\theta)} \tag{44}$$

It is easy to check that, when plotted in Y, I space, the IS is steeper if

$$\frac{\alpha (1-\theta)}{\beta} > 1 - \lambda \tag{45}$$

which is precisely the case that we have been analyzing. For an interior equilibrium (whether constrained or unconstrained) to be feasible, therefore, a necessary condition is that the IS cut the vertical axis below the FC. In turn, this is only feasible if

$$\frac{\bar{E}X}{\beta} < \frac{(1+\rho)\bar{E}F - \lambda K}{\alpha (1-\theta)} \tag{46}$$

which boils down to

$$\frac{(1+\rho) F}{X} > \frac{\alpha (1-\theta)}{\beta} + \frac{\lambda}{\beta}\frac{K}{Y}\left\{\frac{\beta Y}{\bar{E}X}\right\} \tag{47}$$

This is a slightly more stringent condition than 37, since the term in curly brackets above is larger than one. But if 45 and 47 are satisfied, multiple equilibria can happen again.

Finally, the BP is given by 32, now evaluated at $E = \bar{E}$:

$$I = \frac{\alpha (1-\theta)}{\beta} \frac{\bar{E} X_1}{1+\rho} \tag{48}$$

The IS, FC and BP schedules, now plotted in Y, I space, are shown in figure 5. The BP is vertical.

The procedure I employ to identify equilibria is the following. Start out with fixed nominal exchange rates but flexible prices. This makes the real exchange rate endogenous and output exogenous. Go back to figure 2, which depicted the same situation under flexible exchange rates. Suppose further that the position of the BP curve was such that there existed an unconstrained equilibrium, such as that at point A. There, output is at its flexible price level $\bar{Y}$, and the real exchange rate is pinned down by the intersection of the IS and BP curves. Call the resulting real exchange rate $\bar{E}$.

Now assume sticky prices and wages, and go back to figure 5. Given $\bar{E}$ we know the location of the BP curve: it must induce a level of output $\bar{Y}$, as indicated in the diagram. That outcome, at point A, is the "good equilibrium." Now suppose that bad animal spirits cause investors to begin reducing investment. Since the relative price can no longer move, the only adjustment variable is output. With lower demand output will fall, which in turn will lower investors' net worth, causing the financing constraint eventually to bind, and so on. The final resting place is point C, with zero investment and low output.

In short, if the economy has a sufficiently high debt/export ratio, fixed rates cannot avoid financial crises either. The only difference is that they manifest themselves via a mega-recession, instead of via a sharp depreciation.

5 Conclusions

What are the causes of the recent spate of financial and currency crises in so-called emerging markets? If the model of this paper is correct, one such cause is a shift in expectations, which suddenly turn pessimistic. With imperfect financial markets and large amounts of dollar debt, such pessimism can become self-fulfilling, causing a fall in investment, a sharp real depreciation, and a deterioration in credit worthiness.

Who was right in the recent acrimonious debate about the right fiscal and monetary response to an incipient currency and financial crisis? The orthodox establishment or the heterodox critics? This paper argues that each side had its hits and misses. When it comes to monetary policy, the model here suggests a tightening was called for. In this regard the orthodox establishment may have got things right. But where fiscal policy is concerned, the model calls for an expansion, even if the government is constrained in international debt markets. Score one point for the heterodox critics.

More importantly, the model shows that either policy has a chance to work if and only if initial conditions are not too bad: when dollar debts are too high and/or exports are too low, there is little macroeconomic policy can do. This argues for putting more attention on prudential policy (avoiding overborrowing) and microeconomic reform (expanding the supply of exports).

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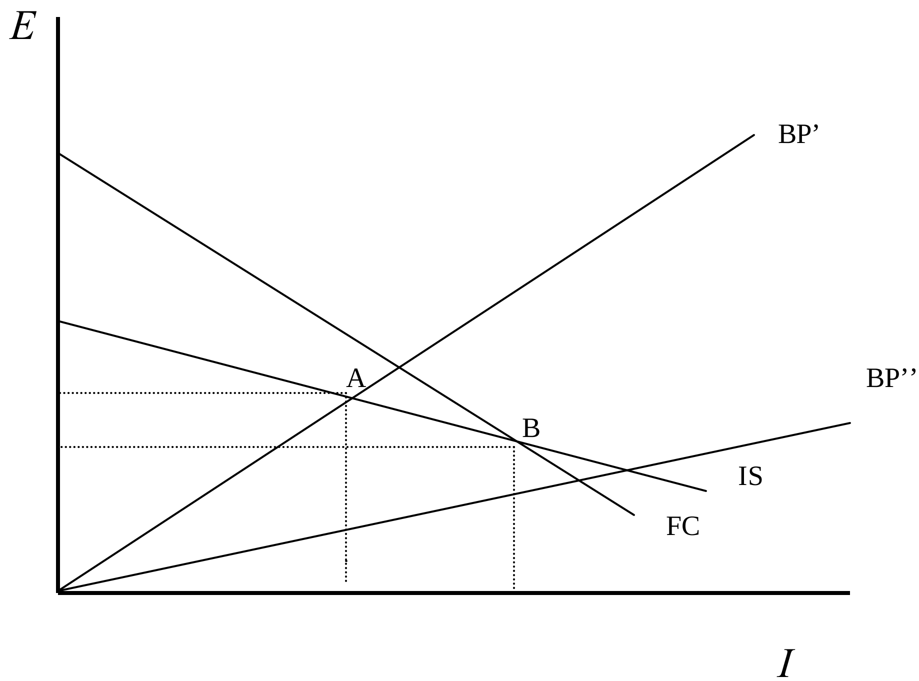

Figure 1: Low Debt
Single Equilibrium and Economy Either
Financially Constrained or Unconstrained

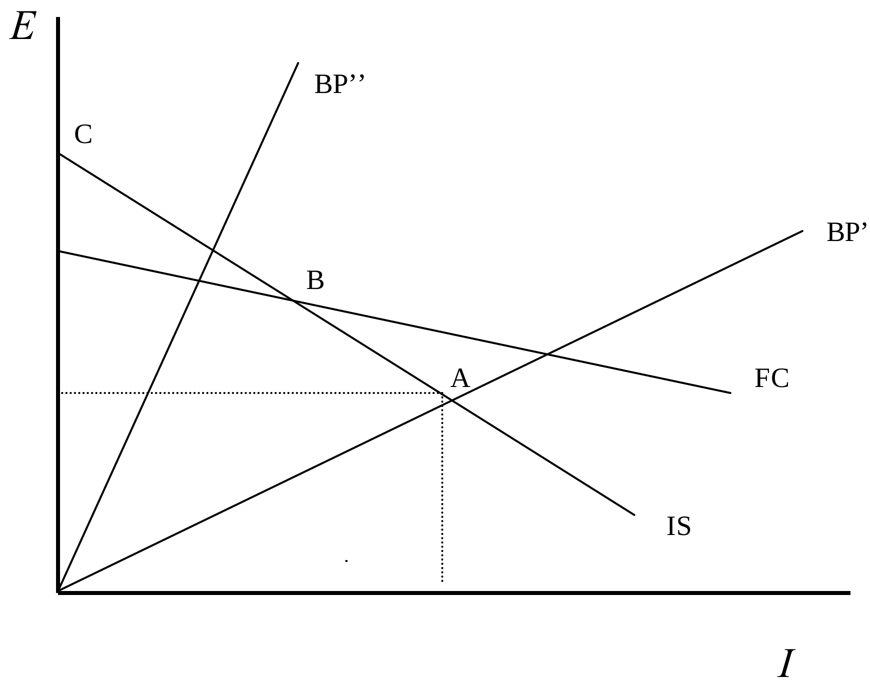

Figure 2: High Debt
Multiple Equilibria and Economy either
Unconstrained or Bankrupt

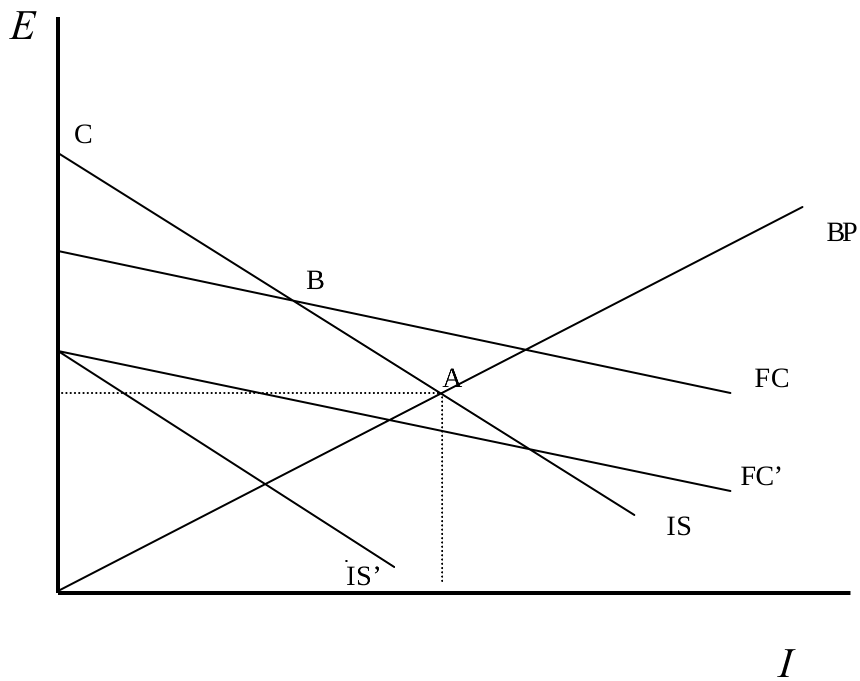

Figure 3: Monetary Policy and Multiple Equilibria

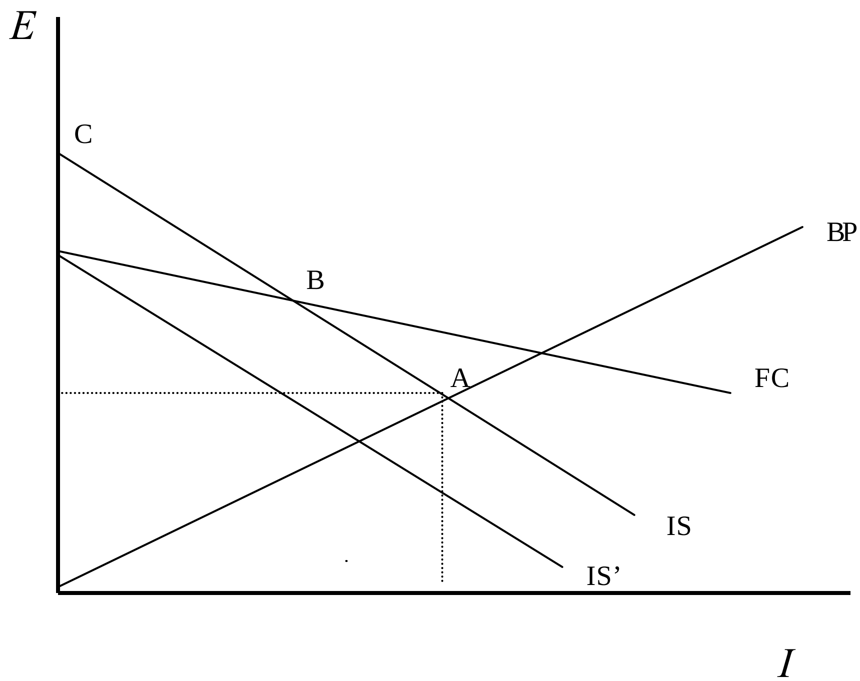

Figure 4: Fiscal Policy and Multiple Equilibria

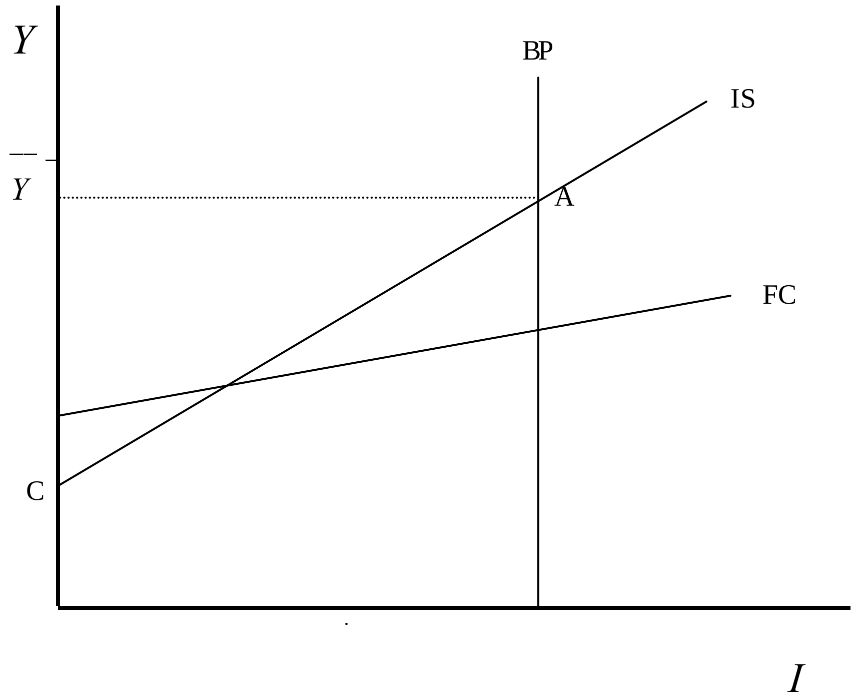

Figure 5: Fixed Exchange Rates