CURRENCY CRISIS MODELS

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There have been many currency crises during the post-war era (see Kaminsky and Reinhart, 1999). A currency crisis is an episode in which the exchange rate depreciates substantially during a short period of time. There is an extensive literature on the causes and consequences of a currency crisis in a country with a fixed or heavily managed exchange rate. The models in this literature are often categorized as first-, second- or third-generation.

In first-generation models the collapse of a fixed exchange rate regime is caused by unsustainable fiscal policy. The classic first-generation models are those of Krugman (1979) and Flood and Garber (1984). These models are related to earlier work by Henderson and Salant (1978) on speculative attacks in the gold market. Important extensions of these early models incorporate consumer optimization and the government's intertemporal budget constraint into the analysis (see Obstfeld, 1986; Calvo, 1987; Drazen and Helpman, 1987; Wijnbergen, 1991). Flood and Marion (1999) provide a detailed review of first-generation models.

In a fixed exchange rate regime a government must fix the money supply in accordance with the fixed exchange rate. This requirement severely limits the government's ability to raise seigniorage revenue. A hallmark of first-generation models is that the government runs a persistent primary deficit. This deficit implies that the government must either deplete assets, such as foreign reserves, or borrow to finance the deficit. It is infeasible for the government to borrow or deplete reserves indefinitely. Therefore, in the absence of fiscal reforms, the government must eventually finance the deficit by printing money to raise seigniorage revenue. Since printing money is inconsistent with keeping the exchange rate fixed, first-generation models predict that the regime must collapse. The precise timing of its collapse depends on the details of the model.

The key ingredients of a first-generation model are its assumptions regarding purchasing power parity (PPP), the government budget constraint, the timing of deficits, the money demand function, the government's rule for abandoning the fixed exchange rate, and the post-crisis monetary policy. In the simplest first-generation models there is a single good whose domestic currency price is P_t and whose foreign currency price is 1. Let S_t denote the nominal exchange rate. PPP implies $P_t = S_t$. Suppose for simplicity that the government has a constant ongoing primary deficit, δ. It finances this deficit by reducing its stock of foreign reserves, f_t, which can either evolve as a smooth function of time or jump discontinuously. In the former case, f_t evolves according to $\dot{f}_t = rf_t - \delta + \dot{M}_t / S_t$, where r is the real interest rate, M_t is the monetary base, and a dot over a variable denotes its derivative with respect to time. When foreign reserves change discontinuously, $\Delta f_t = \Delta(M_t / S_t)$. When $\delta > rf_0$ interest income from foreign assets will not be sufficient to finance the deficit.

To illustrate the key properties of first-generation models, we make three simplifying assumptions. First, money demand takes the Cagan (1956) form, $M_t = \theta P_t \exp[-\eta(r + \pi_t)]$, where $\theta > 0$ and $\pi_t = \dot{P}_t / P_t$ is the inflation rate. Second, the government abandons the fixed exchange rate regime when its foreign reserves are exhausted. Third, as soon as foreign reserves are exhausted, the government prints money at a constant rate μ to fully finance its deficit.

These assumptions imply that after the crisis the level of real balances, $m_t = M_t / P_t$, is constant and equal to $\overline{m} = \theta \exp[-\eta(r + \mu)]$. The post-crisis government budget constraint reduces to $\delta = \mu \overline{m}$. This equation determines μ. Let t^* denote the date at which foreign reserves are exhausted and the government abandons the fixed exchange rate regime. PPP implies $S_{t^*} = P_{t^*} = \overline{M} / \overline{m}$, where $\overline{M}$ is the monetary base the instant after date t^*. Under perfect foresight the exchange rate cannot jump discontinuously at t^* since such a jump would imply the presence of arbitrage opportunities. Given that the exchange rate must be a continuous function of time at t^*, $S_{t^*} = S$ and $\overline{M} = \overline{m} S$.

Prior to the crisis real balances are given by $m = \theta \exp(-\eta r)$. Therefore, at date t^*

there is a sudden drop in real money demand from m to $\overline{m}$ implying that reserves drop discontinuously to zero at time t^*: $\Delta f_{t^*} = \overline{m} - m$. This is why the literature refers to t^* as the date of the speculative attack. Prior to the crisis the government's reserves fall at the rate $\dot{f}_t = rf_t - \delta$. The budget constraint implies that $t^* = \ln\{[\delta - r(m - \overline{m})]/(\delta - rf_0)\}/r$. While the collapse of the fixed exchange rate regime is inevitable, it does not generally occur at time zero unless $m - \overline{m} > f_0$.

A shortcoming of this type of first-generation model is that the timing of the speculative attack is deterministic and the exchange rate does not depreciate at the time of the attack. These shortcomings can be remedied by introducing shocks into the model, as in Flood and Garber (1984).

Early first-generation models predict that ongoing fiscal deficits, rising debt levels, or falling reserves precede the collapse of a fixed exchange rate regime. This prediction is inconsistent with the 1997 Asian currency crisis. This inconsistency led many observers to dismiss fiscal explanations of this crisis. However, Corsetti, Pesenti and Roubini (1999), Burnside, Eichenbaum and Rebelo (2001a), and Lahiri and Végh (2003) show that bad news about prospective deficits can trigger a currency crisis. Under these circumstances a currency crisis will not be preceded by persistent fiscal deficits, rising debt levels, or falling reserves. These models assume that agents receive news that the banking sector is failing and that banks will be bailed out by the government. The government plans to finance, at least in part, the bank bailout by printing money beginning at some time in future. Burnside, Eichenbaum and Rebelo (2001a) show that a currency crisis will occur before the government actually starts to print money. Therefore, in their model, a currency crisis is not preceded by movements in standard macroeconomic fundamentals, such as fiscal deficits and money growth. Burnside, Eichenbaum and Rebelo argue that their model accounts for the main characteristics of the Asian currency crisis.

This explanation of the Asian currency crisis stresses the link between future deficits and current movements in the exchange rate. This link is also stressed by Corsetti and Mackowiak (2006), Daniel (2001), and Dupor (2000), who use the fiscal theory of the price level to argue that prices and exchange rates jump in response to news about

future deficits.

In first-generation models the government follows an exogenous rule to decide when to abandon the fixed exchange rate regime. In second-generation models the government maximizes an explicit objective function (see, for example, Obstfeld, 1994; 1996). This maximization problem dictates if and when the government will abandon the fixed exchange rate regime. Second-generation models generally exhibit multiple equilibria so that speculative attacks can occur because of self-fulfilling expectations. In Obstfeld's models (1994; 1996) the central bank minimizes a quadratic loss function that depends on inflation and on the deviation of output from its natural rate (see Barro and Gordon, 1983, for a discussion of this type of loss function). The level of output is determined by an expectations-augmented Phillips curve. The government decides whether to keep the exchange rate fixed or not. Suppose agents expect the currency to devalue and inflation to ensue. If the government does not devalue then inflation will be unexpectedly low. As a consequence output will be below its natural rate. Therefore the government pays a high price, in terms of lost output, in order to defend the currency. If the costs associated with devaluing (lost reputation or inflation volatility) are sufficiently low, the government will rationalize agents' expectations. In contrast, if agents expect the exchange rate to remain fixed, it can be optimal for the government to validate agents' expectations if the output gains from an unexpected devaluation are not too large. Depending on the costs and benefits of the government's actions, and on agents' expectations, there can be more than one equilibrium. See Jeanne (2000) for a detailed survey of second-generation models.

Morris and Shin (1998) provide an important critique of models with self-fulfilling speculative attacks. They emphasize that standard second-generation models assume that fundamentals are common knowledge. Morris and Shin demonstrate that introducing a small amount of noise into agents' signals about fundamentals will lead to a unique equilibrium.

Many currency crises coincide with crises in the financial sector (Diaz-Alejandro, 1985; Kaminsky and Reinhart, 1999). This observation has motivated a literature that emphasizes the role of the financial sector in causing currency crises and propagating their effects. These third-generation models emphasize the balance-sheet effects

associated with devaluations. The basic idea is that banks and firms in emerging market countries have explicit currency mismatches on their balance sheets because they borrow in foreign currency and lend in local currency. Banks and firms face credit risk because their income is related to the production of non-traded goods whose price, evaluated in foreign currency, falls after devaluations. Banks and firms are also exposed to liquidity shocks because they finance long-term projects with short-term borrowing. Eichengreen and Hausmann (1999) argue that currency mismatches are an inherent feature of emerging markets. In contrast, authors such as McKinnon and Pill (1996) and Burnside, Eichenbaum and Rebelo (2001b) argue that, in the presence of government guarantees, it is optimal for banks and firms to expose themselves to currency risk.

Different third-generation models explore various mechanisms through which balance-sheet exposures may lead to a currency and banking crisis. In Burnside, Eichenbaum and Rebelo (2004) government guarantees lead to the possibility of self-fulfilling speculative attacks. In Chang and Velasco (2001) liquidity exposure leads to the possibility of a Diamond and Dybvig (1983) style bank run. In Caballero and Krishnamurthy (2001) firms face a liquidity problem because they finance risky long-term projects with foreign loans but have access to limited amounts of internationally accepted collateral.

An important policy question is: what is the optimal nature of interest rate policy during and after a currency crisis? There has been relatively little formal work on this topic. Christiano, Braggion and Roldos (2006) take an important first step in this direction. They argue that it is optimal to raise interest rates during a currency crisis and to lower them immediately thereafter. Studying optimal monetary policy in different models of currency crises remains an important area for future research.

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See also currency crises

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