ECGA 5450 **Fall 2010**

Capital Flows and Generations of Currency Crises

Economists can predict crises: all booms come to an end, dramatically with a "hard landing" for the currency and perhaps even a bank run. It is the precise date of the crash that is hard to predict. The appeal of so-called **Generation I speculative attack models is** that they offer a model of both a how and when a currency will collapse. Initially applied by Dale Henderson and Steven Salant (1978) to predict attacks on commodity stocks (gold), Paul Krugman (1979) was the first to apply their model first to a country's "stock" of foreign reserves. Like commodity stocks foreign exchange reserves (dollars) serve as a buffer against destabilizing shortages in normal times. But if stocks get too low there can be problems: even before stocks reach zero, currency holders anticipate a fall in the local currency's and buy all the dollars they can. At some date T there is a run on the Central Bank's reserves vanish very quickly, into the hands of speculators who then wait for the price of the home currency collapse. The speculative attack model remains influential promises a date of crisis, more or less, and because of Krugman's focus on public deficit financing seemed to fit the debt crises of the 1980s. The currency crises of the 1990s, however, including the European ERM crises of 1992, Mexico's 1995 crisis and the Asian crises—seem less consistent with these stylized facts. Many European countries had adequate reserves when they devalued, Mexican interest rate did not rise just before its devaluation and few of these countries were running big budget deficits before their currency crises. Two successors to the classic 1st generation BoP crisis model have been proposed.

Generation II currency crisis models add an optimizing government that may choose to devalue even when it has sufficient reserves to defend a particular exchange rate. This model was applied by Obstfeld (1996) to the collapse of the ERM in 1992-93 (including the speculative attack on the Pound and Swedish Kroner). These crises are particularly vexing because the need not be driven by "fundamentals" (for budget deficits or excess money creation financed by reserves as in Generation I models). Instead governments trapped in an politically difficult situation (high unemployment, deflation, budget cuts, etc.) may the "escape clause" or option to devalue impossible to resist. Currency speculators and local investors know this and attack the currency. This model fits Argentina in 2001 and more recently Paul DeGraue (2010)

Generation III models add banks and financial markets, domestic and international potentially capturing both contagion effects and private sector led credit booms (as opposed to Krugman's public sector deficit led booms). However, these models generally do give us much insight into timing and dynamics of a move from fixed to flexible exchange rates as nicely as the old speculative attack model (however, they have formed the basis for a number of attempts to predict crises).

Interpreting these models broadly, Greece seems to have suffered a class government spending led crisis (as in generation I, with no currency crisis yet). Iceland, Ireland and Spain seem to have had private sector banking and real estate led booms that had to be absorbed by the public sector (as in the U.S. as well). In all cases "balance sheet" or currency mismatch problems are not an issue, so a currency depreciation seems less of a threat than a potential solution to these crises. As a loss of confidence, reserves, government policy priorities (credibility) and banks system play a role in almost all currency crises; the three generations of currency crisis models remain complements rather than substitutes, as is the case with the various "approaches" to modeling current account adjustment studied earlier in this course.

Generation I Currency Crisis Models:

We begin with the same Cagan semi-log high inflation money demand equation used in the discussion of seigniorage except we switch to a continuous time version with $\dot{p}$ representing the inflation rate,

$$m_t - p_t = -\eta\,\dot{p} \qquad (1)$$

where m and p are logs or where $\dot{p}$ is the inflation rate. But now we return to the open economy money supply definition of the financial programming handout except that domestic credit consists solely of a growing stock of government bonds $L_t = B_t$ issued to finance the government deficit,

$$M_t = L_t + ER_t \qquad (2)$$

where domestic credit is growing at the policy determined rate of deficit growth $\dot{B} = \dot{L} = \mu$. Typically there is no bond market, local banks are forced to hold bonds issued by the government but these in turn add to the banks reserves. Purchasing power parity and uncovered interest rate parity hold in this small open economy so that $p_t = e_t p^*$ where for convenience set exogenous foreign prices $p^* = 1$. These assumptions imply $p_t = e_t$ and $\dot{p} = \dot{e}$. Deficit spending drives a steady increase in domestic credit growth, where $\dot{b} = \mu$. Under a fixed exchange rate this leads to a steady decline in total reserves: $-\dot{R} = \dot{L}$.

Capital flows, inflation and the probability of a Balance of Payments Crises

Foreign borrowing offers an alternative method of financing fiscal deficits potentially leading to less seigniorage and lower inflation. The same budget deficit leads to less inflation with higher net capital inflows. This argument applies mainly to long term capital inflows as will become apparent below. Starting with the consolidated government budget constraint,

$$e_f \dot{F} - e_f \dot{R} + \mu = \dot{b} - z(\pi) \qquad (1)$$

where F is foreign capital inflows, R is fx reserves – both converted into domestic currency at the fixed nominal exchange rate e_f and μ is the change in money supply and $\dot{b}$ is the government deficit less the inflation tax component of seigniorage z. If capital flows are zero $\Delta F = 0$, and if $M^d = L(y,p.i)$ (money demand) $p = e\, p^*$ -- the law of one price-- and $i = i^* + \Delta e$ -- interest parity and finally if $M^s = M^d$ then then,

$$-\dot{R} = \dot{L} \qquad (2)$$

as the fiscal deficit steadily depletes foreign reserves with a fixed exchange rate. With flexible rates the deficit can instead be financed by an the inflation tax as $\Delta M = Z(\pi) = \theta$.

In the steady state $\mu = \pi = \theta = \Delta e$, meaning that the law of one price holds after the crisis as well (nontraded goods prices are ignored). Figure 1 shows the transition between the two regimes where is the shadow exchange rate. Under floating rates $\Delta s = \Delta e = \pi$ and reserves stop falling but under a fixed rate regime $e = e_f$ In a perfect foresight world, investors know the date T when $s = e_f$ so at T the convert all there local currency into dollars. By augmenting or creating claims on foreign reserves, capital inflows can accelerate or delay date T since as Obstfeld and Rogof (1999) show under perfect foresight the date of collapse is,

$$T = \frac{e_f - R_0 - \eta\mu}{\mu} \quad (3)$$

where as before μ is rate of money growth and $\eta$is Cagan semi-elasticity of demand for money.

As shown in Figure 1 below, long term capital inflows augment reserves and delay date T to T_{LT} as reserves increase due to capital inflows. However, as emphasized in 3rd generation models, short-term liabilities (bank to bank credit lines for example) are viewed as claims on reserves – so investors anticipate a potential liquidity crisis as in Korea 1998. The date of collapse moves closer to T_{ST} raising the average rate of inflation observed over any 5 year period.

Capital Mobility and the Discipline Effect

The modern approach to the option to Central Banks with the option to float derives from Barro (1983) rules vs. discretion framework. If government maximizes seigniorage subject to private sector expectations and the costs of inflation. Following Agenor and Montiel's (1996) version of Barro (1983) suppose that the Central Bank/Treasury objective function takes the form

$$L = \lambda\mu m^d(\pi^a) - \exp(k_1\pi + k_2\pi^a), \quad (6)$$

where $k_1\pi + k_2\pi^a$ represent the costs of the actual rate of inflation, π and the expected rate of inflation π^a, m^d (.) money demand, and μm^d (.) revenue from money creation – that is, seigniorage. Given the Cagan money demand function eq. (5) above, the seigniorage revenue is maximized at $\pi = 1/\alpha$ but as shown in figure 2, the costs of inflation hold the loss minimizing rate of inflation below the maximum rate. Opening the capital market raises α lowering the optimal rate of inflation. The disciplined (optimizing) CB moves from A to B and inflation falls. However, the undisciplined government raises the inflation tax to obtain the same 3% of GDP seigniorage revenue, moving from C to B.

Figure 2: Inflation and Capital Mobility

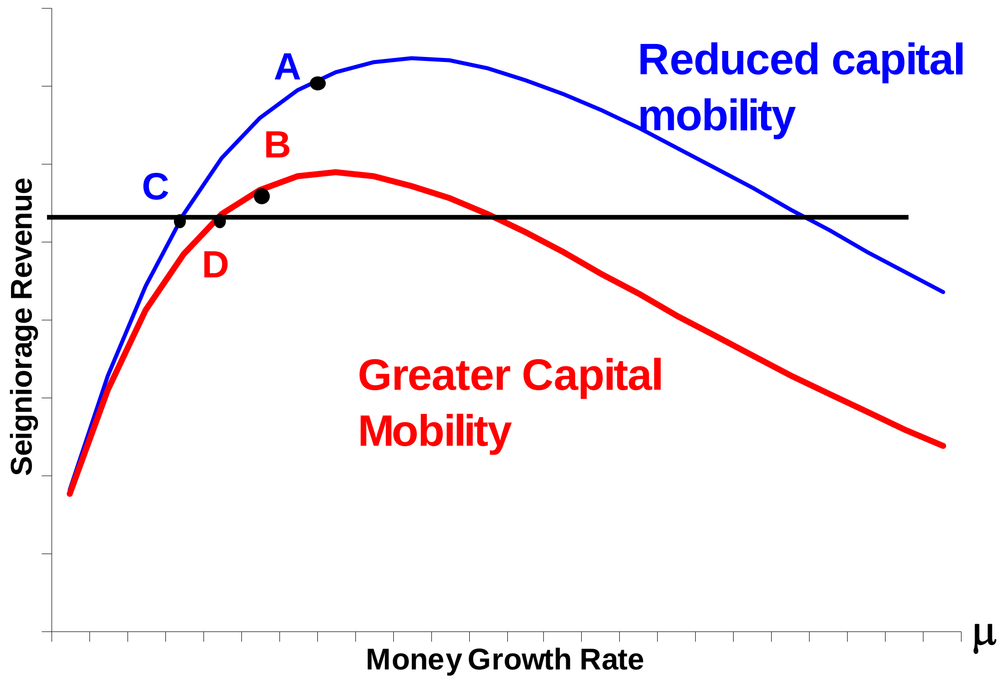


Figure 3

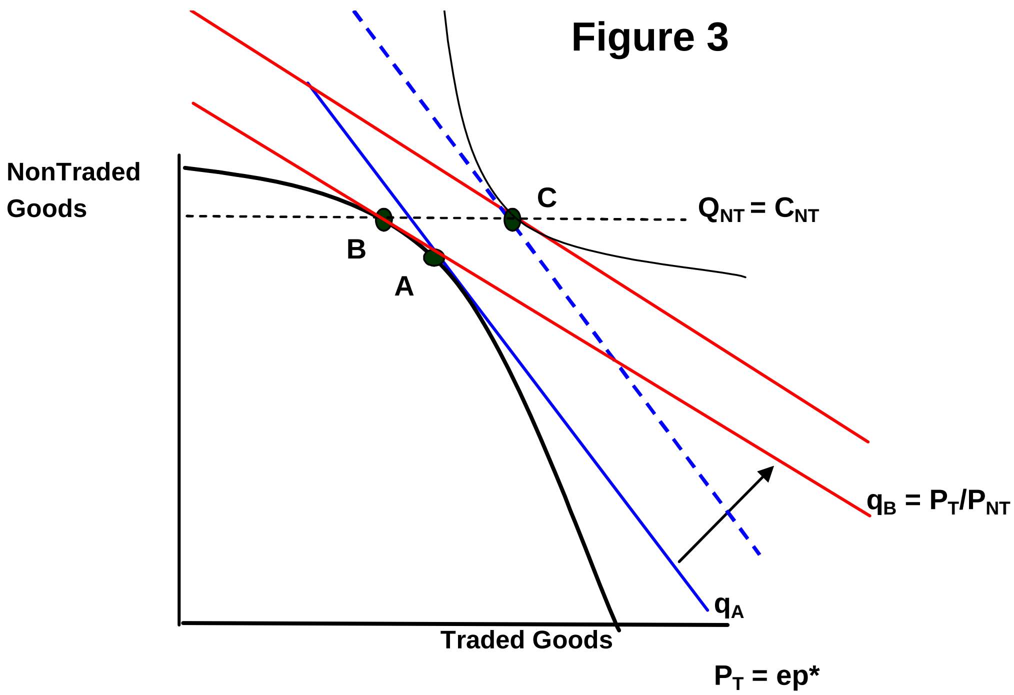
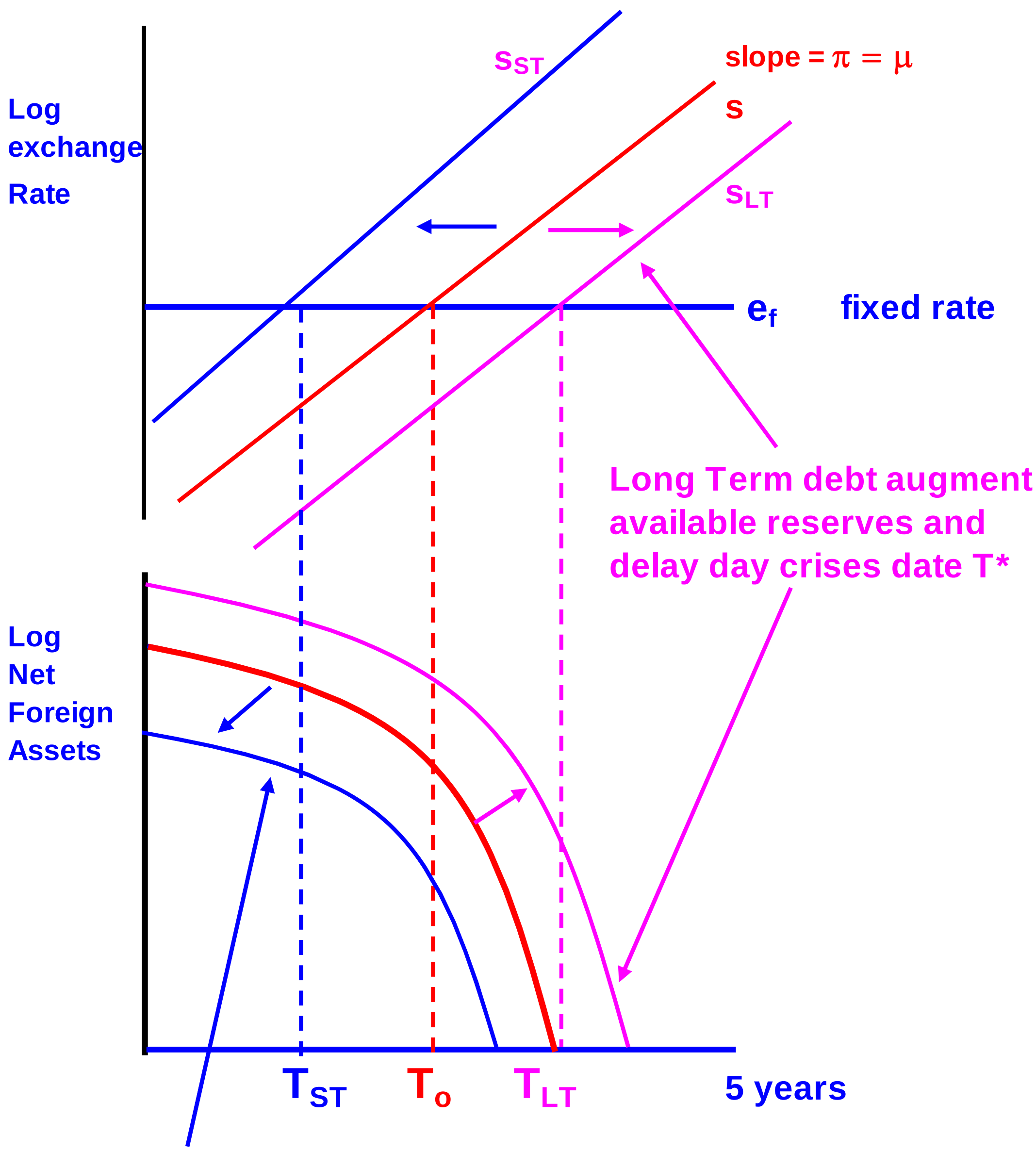


Figure 3: Capital Inflows always cause an appreciation of the real exchange rate, RER or $q = P_T/P_{NT}$ where $P_T = ep^*$.

Slope = $\mu = \pi$ the rate of inflation or expansion of monetary supply necessary to generate the seigniorage to finance the government deficit under a floating rate regime.

Figure 4: Term mismatch: short vs. long term capital flows (marrying Generation I and II concerns)



Short-term debt (often bank to bank) reduce available net foreign assets bringing date T closer: the "crisis" date the exchange rate regime switches from fixed to flexible (and all reserves are exhausted).

Generation 1: Krugman (1979) Speculative Attack Model

Generation 3: Chang and Velasco (1999) Liquidity Crisis Model driven by ST Bank to Bank lending

*note long term debt does not prevent balance sheet effects

References and further reading

Henderson, D and Steven Salant (1978) "Market Anticipation of Government Policies and the Price of Gold" *Journal of Political Economy*, August,

Obstfeld, M. and K. Rogoff (1996) *Foundations of International Macroeconomic MIT Press (Section 9.5)*

Calvo, Guillermo (1996) Varieties of currency crises, IDB Working Paper,