

Ec 181  
Seminar in Economic Development  
**Week 12 Problem Set: Capital flows and financial crises**

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**Introduction.** This week we study the macroeconomic implications of current account imbalances and international capital mobility. We start with medium-run approaches that assume full employment. Using a 1-good model and drawing on the Sachs and Larrain (1993) textbook, we develop the intertemporal approach to the current account for a small and financially open economy. Under perfect capital mobility, the domestic real interest rate equals the global interest rate. Shocks to desired investment or desired saving therefore leave the domestic interest rate unchanged and feed one-for-one into the current account. Under zero capital mobility, the same shocks leave the current account unchanged (at zero) and alter the domestic interest rate. The case of imperfect capital mobility lies in between: macroeconomic shocks alter both the current account and the domestic interest rate.

Debts must be repaid, implying that current account deficits must ultimately be followed by current account surpluses – and therefore by a contraction in spending relative to income. When we disaggregate the economy between traded and nontraded goods, however, the efficient adjustment to a reversal of capital flows requires not just a reduction in spending relative to income, but also a real exchange rate depreciation that induces producers to shift resources from nontraded to traded goods and consumers to substitute nontraded goods for traded goods. In the absence of these *switching* effects, the spending reduction (i.e., austerity) required to achieve a given improvement in the current account will be much larger. Some of the smaller members of the Euro zone (particularly Greece) have recently been facing this problem – as did, for example, the members of the two CFA Franc Zones in West and Central Africa between the mid-1980s and mid-1990s, when their pegged exchange rate against the French franc prevented the nominal depreciation that would have aided their adjustment to the debt crisis of the 1980s (they finally implemented a maxi-devaluation in 1994).

Last week we studied the so-called *trilemma* of international macroeconomics, which states that a country can maintain only two of the following three conditions: high capital mobility, a monetary policy guided by domestic priorities (i.e., monetary autonomy), and a managed exchange rate. The Bretton-Woods system allowed countries to maintain capital controls, so as to reconcile the pursuit of domestic monetary-policy objectives (including controls on the domestic financial sector) with fixed exchange rates. But after abandoning the Bretton-Woods system in the early 1970s, the USA moved towards financial liberalization and an open capital account. Capital controls were eliminated in the USA by the early 1980s, and the advanced countries soon followed by liberalizing their own financial markets and capital accounts, as did many emerging-market economies by the early-to-mid-1990s. But in a phenomenon described by Calvo and Reinhart (2002) as *fear of floating*, most countries continued to manage their exchange rates heavily, even after abandoning formal exchange-rate commitments and opening their capital accounts. The period from 1994 to 2002 was characterized by a sequence of severe balance of payments crises in emerging-market economies, often occurring in concert with banking-sector crises.

### Problem set.

NOTE: Problems 1, 3 and 4 are from Sachs and Larrain (1993). PDFs of the relevant sections are on Moodle.

1. **Capital flows and intertemporal behavior.** Do problem 7 from S&L Chapter 6, for the small-country case. Contrast the results with what happens in a small country under a closed capital account. What would the impacts look like under imperfect capital mobility? [Hint: This will be an intermediate case.]
2. **Debt sustainability and external adjustment.** Starting with equation 13-1 in PRLB, divide on both sides by exports, and derive the expression

$$\Delta d = (i - g_x) \cdot d + a$$

where  $d = D/X$  is the ratio of (dollar) debt to (dollar) exports,  $g_x$  is the growth rate of exports, and  $a$  is the ratio of the trade surplus to exports. Now suppose that a country starts with a stable debt to export ratio, and then experiences a fall in the growth rate of its exports – as Nigeria and other oil exporters have been experiencing since 2014. What adjustment in the trade balance is required to prevent debt from rising? [To derive the equation, note that  $\Delta D/X = (\Delta D/D) \cdot d$ , and use the formula for the growth rate of a quotient to derive an expression for  $\Delta d/d$  that can be used to substitute for  $\Delta D/D$ .]

3. **The real exchange rate and external adjustment.** The TNT model (more often called the Australian or ‘dependent economy’ model) underscores that real exchange rate adjustment is essential to understanding the equilibrium of a country that shifts from external borrowing to repayment? As illustration, do problem 8 in Sachs and Larrain Chapter 21. [Hint: You can answer this question using the Australian model as in Figure 21-10 of Sachs and Larrain or Figure 15-1 page 548 of PRLB. You can alternatively do the analysis in an IB/EB diagram with total absorption on the horizontal axis and the real exchange rate on the vertical.]
4. **The debt crisis of the 1980s.** Do problems 1, 4 and 8 from S&L Chapter 22. [Answering these questions will require reading the chapter.]
5. **The 1990s vs the 1980s.** What differentiates the emerging-market financial crises of the 1990s (Mexico 1994, the Asian financial crisis 1997) from the developing country debt crisis of the early 1980s? [Note: the treatment in PRLB is useful.]
6. **Anatomy of a first-generation BOP crisis.** Consider the following statement: “So-called ‘first-generation’ models of balance of payments crisis are typified by the Krugman (1979) model outlined in Section 11-1 of Sachs and Larrain. In these models, the speculative attack is driven by the *fundamentals* in the sense that there is a clear inconsistency between macroeconomic policy and maintenance of the exchange rate regime.” Explain this statement by tracing out the evolution of a balance of payments crisis over time in the Krugman model.

[Hint: The Krugman model is a beautiful application of the simple 4-equation model of monetary equilibrium we studied last week. See if you can follow the exposition of Krugman's model in the Sachs/Larrain textbook.]

**7. Second- and third-generation BOP crisis models.** Read PRLB chapter 13 and the Krugman 'Nobel lecture' at Princeton.

**7.1.** Distinguish "second generation" models of self-fulfilling creditor panic from the first generation BOP crisis models you analyzed in question 6. What observable differences are there between the two versions? Does the second-generation version have different policy implications?

**7.2.** What is a "third-generation" BOP crisis model? What does this third generation add to the previous generations, in terms of new policy implications?

**8. Currency and banking crises.** Read Kaminsky and Reinhart (1999).

**8.1.** These authors construct an index of currency market turbulence – a variable that in the broader literature is called "exchange-market pressure" – to assess whether a country is experiencing a balance of payments crisis or not (see the Data Appendix). Explain how this variable is measured, and why it makes sense as a consistent measure, across countries, of adverse pressures on the balance of payments. What values of exchange-market pressure constitute a currency crisis, in their empirical work?

**8.2.** The *interest-rate defense* during a currency crisis involves the central bank raising short-term interest rates to very high levels, to make domestic-currency assets look more attractive and discourage speculators from taking leveraged positions against the domestic currency. Why is this strategy painful for a central bank, even if it works? Should a short-term interest rate be included in measures of exchange-market pressure?

**8.3.** Briefly, how do the authors identify useful leading indicators of currency crisis?

**8.4.** How is a banking crisis different from a currency crisis? Why are these two types of crisis 'twins', particularly in the more recent data in their sample?

**8.5.** What variables are strong predictors of currency crisis? Interpret the economics: why do these variables signal an increased probability of a crisis?

**9. International architecture.** Read Eichengreen (2001). Inflation stabilization and the international financial architecture are distinct concepts, but the tendency for *exchange-rate-based stabilizations* to produce balance of payments crises – sometimes after a substantial lag – can put these two concepts on the same page. Eichengreen (2001) provides a thoughtful assessment of lessons for the design and operation of the international financial institutions from the exchange-rate-based stabilizations undertaken in Argentina (starting in 1991) and Turkey (starting in 1999). Both episodes culminated in spectacular BOP crises and rescue

packages from the IMF. What do we learn from these two experiences? Does Eichengreen think current international institutions are up to the task of maintaining financial stability among emerging-market economies?

**10. [Optional problem] Inflation stabilization.** As described by Eichengreen (2001), the exchange-rate-based stabilizations implemented in Argentina and Turkey created an initial economic boom. This is a common feature of such stabilizations, and certainly a non-intuitive result for anyone used to the idea that reducing inflation is costly in terms of output. The latter idea is typically confirmed in *money-based stabilizations* – like the Volker disinflation in the USA starting in 1979 – which tend to produce a recession up front. Why does the exchange-rate-based approach produce such a different outcome, at least at the outset?<sup>1</sup>

An *exchange-rate-based stabilization* is an attempt to bring actual and expected inflation down by committing to a fixed exchange rate. We will use the following 3 equations to see why an exchange-rate-based stabilization is likely to create an initial economic boom, while a *money-based stabilization* (like the Volker disinflation in the USA starting in 1979) is likely to create an initial economic recession.

Perfect capital mobility implies uncovered interest parity:

$$(1) \quad i = i^* + \Delta E^e / E$$

Desired spending ('absorption' in the IB/EB model) depends negatively on the expected real interest rate and positively on the real exchange rate:

$$(2) \quad A = A(i - \pi^e, EP_T^* / P_N), \quad \partial A / \partial (i - \pi^e) < 0, \quad \partial A / \partial (EP_T^* / P_N) > 0$$

The domestic price level is a geometric weighted average of traded and nontraded goods prices, like  $P = (EP_T^*)^\alpha P_N^{1-\alpha}$ , and the foreign inflation rate  $\Delta P_T^* / P_T^*$  is zero, so with  $\alpha = 1/2$  (rough guess), the inflation rate is:

$$(3) \quad \pi = \alpha \left( \frac{\Delta E}{E} + \frac{\Delta P_T^*}{P_T^*} \right) + (1 - \alpha) \frac{\Delta P_N}{P_N} = \frac{\Delta E}{E} + 0.5 \cdot \left[ \frac{\Delta P_N}{P_N} + \frac{\Delta E}{E} \right]$$

[Note: the approximations used here – that the domestic-currency yield on foreign assets is  $i^* + \Delta E^e / E$  and the expected real interest rate is  $(i - \pi^e)$  – are not good approximations when inflation is high, as it is in this question. Nonetheless they are not qualitatively misleading in the present case, and so we will go ahead and use these 'lousy' approximations rather than the more complicated exact formulae.]

**10.1.** Suppose that before the stabilization program is implemented, we are in a stationary 'rational expectations' equilibrium. This means that the real economy is not changing – real GDP is constant (at full employment), as are the real interest rate, real exchange rate, and real money stock – and expectations about inflation and exchange rate depreciation are correct. Assume that foreign inflation is zero ( $\Delta P_T^* / P_T^* = 0$ ) and that the foreign interest

<sup>1</sup> I say 'at the outset' because exchange-rate-based stabilizations tend to produce a delayed contraction – sometimes a spectacular one as discussed in problem 7.

rate is 5 percent ( $i^* = 0.5$ ). Explain why the following must be true in this high-inflation equilibrium, if the actual ongoing domestic inflation rate is 100% ( $\pi = 1.0$ ).

$\pi^e = 1.0$	(expected inflation = 100%)
$\Delta E/E = \Delta E^e/E = 1.0$	(rate of actual and expected nominal depreciation = 100%)
$i = 1.05$	(domestic nominal interest rate = 105%)
$\Delta M/M = 1.0$	(nominal money growth = 100%)
$r = 0.05$	(domestic expected real interest rate = 5%)

There are two obvious ‘nominal anchors’ the central bank can seize in order to bring actual and expected inflation down: an exchange-rate-based stabilization uses  $\Delta E/E$ , while a money-based stabilization uses  $\Delta M/M$ . Let’s characterize these programs as setting  $\Delta E/E = 0$  and  $\Delta M/M = 0$ , respectively.<sup>2</sup> It would be nice if we could just move immediately to a new equilibrium with zero actual and expected inflation, and certainly a steady-state equilibrium exists with these properties. But even well-informed expectations are unlikely to adjust immediately.

- 10.2.** Suppose that when either program is implemented, the actual and expected inflation rate for nontraded goods,  $\Delta P_N/P_N$ , only falls to 0.5 initially, rather than all the way to zero. What happens to the expected real interest rate, and therefore to total desired spending, when an exchange-rate-based stabilization is implemented? What is driving this spending boom? [Hints: Assume that the stabilization itself was unanticipated, so you are starting with the initial conditions laid out above. But you now have the ingredients to determine what happens to actual inflation initially, and therefore, under rational expectations, what happens to expected inflation. Use this to figure out what happens to the real interest rate. The real exchange will start to evolve over time, but initially it does not change, so you can figure out what happens initially to desired absorption  $A$ .]
- 10.3.** Remaining with the exchange-rate-based case, consider the path of the real exchange rate as  $\Delta E/E$  remains at its new level of zero. Why do we know, given our assumptions, that the real exchange rate will start to appreciate? What is likely to happen to the trade balance? Can you depict the economy’s trajectory in an IB/EB diagram? Is the situation sustainable?
- 10.4.** For the money-based case, the analysis is more complicated because the exchange rate can now jump around (overshooting, etc). But we can proceed heuristically to argue that for a similar path of actual and expected inflation, a money-based program is likely to produce a higher path for the nominal and real interest rate, and very plausibly an absolute *increase* in the real interest rate and therefore an initial recession rather than a boom. After all, if the path of the real exchange rate doesn’t change much then both  $\Delta E/E$  and  $\Delta P_N/P_N$  must fall by about the same amount initially. This means that if  $\Delta P_N/P_N$  is sticky the resulting change in actual and expected inflation is much smaller than the reduction in money growth (equation 3). So the slowdown in the growth rate of the money supply will

<sup>2</sup> Remember, a central bank can choose either the path of  $E$  or the path of  $M$  – so it can set either one of these to zero if it wants.

cause the real money supply to start contracting sharply over time. From Ec 1, what will this do to the nominal interest rate, relative to a path along which the real money supply does not contract?<sup>3</sup> We can conclude that the nominal interest rate can't possibly fall as far as it does under an exchange-rate-based stabilization, and is unlikely even to fall far enough to lower the real interest rate. The real interest rate is likely to rise, producing a contractionary impact on desired spending. Money-based stabilizations are therefore likely to produce an initial recession.

## References

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<sup>3</sup> We have to be careful – whether  $i$  actually rises or falls relative to the pre-stabilization path is a complicated question. I'm asking whether the path of the nominal (and real) interest rate will be higher or lower than it would be in the exchange-rate-based case, for the same path of expected and actual inflation