Some Simple Analytics for a "Hard Landing"

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I. The Problem

Let's start with a situation in which the real exchange rate—the dollar price of foreign currency—is being artificially depressed because of large-scale exchange rate intervention by foreign central banks. Thus the real exchange rate ε—which normally depends on long-run fundamentals ε_0, on home and foreign real interest rates r and r^f, and on the sensitivity-of-the-exchange-rate-to-interest rates parameter ε_r:

$$\varepsilon = \varepsilon_0 - \varepsilon_r\left(r - r^f\right) \tag{1}$$

depends as well on the rate of change in (foreign) dollar-denominated foreign exchange reserves R:

$$\varepsilon = \varepsilon_0 - \varepsilon_r\left(r - r^f\right) - \varepsilon_R\left(R\right) \tag{2}$$

Our fear is that at some point in the future foreign central banks' willingness to continue this large-scale intervention will cease. They are doing it because it promotes export-led growth and helps maintain full employment in politically-sensitive urban centers. But it has costs as well—domestic inflation if it is financed by domestic money creation, and fiscal burdens in the long run when

the capital losses on the accumulated past foreign exchange intervention position come do. Suppose that ΔR drops to zero suddenly. What happens then?

II. The Model

Well, first let's set out our consensus short-run finger-exercise Keynesian aggregate-demand model;

(3) $Y = C + I + G + NX$

(4) $C = C_o + C_y(1 - t)Y$

(5) $I = I_0 - I_r r$

(6) $NX = GX - IM$

(7) $GX = X_f Y^f + X_\varepsilon \varepsilon$

(8) $IM = IM_y Y$

Domestic aggregate demand Y then depends on a great deal of stuff:

(9) $Y = \mu \times \ ...$

It equals the Keynesian multiplier μ (that is: $1/[1+IM_y - (1-t)C_y]$) times the sum of:

$$...[C_0 + I_0]...$$

domestic parameters we don't expect to change much, plus…

$$... + [X_f Y^f + X_\varepsilon \varepsilon_r r^f]...$$

foreign parameters we don't expect to change much, plus…

$$... + ZG...$$

government purchases, minus…

$$...-(X_{\varepsilon}\varepsilon_{r}+I_{r})r...$$

the domestic interest rate times the sensitivity of investment spending to the interest rate plus the adverse effect higher domestic interest rates have an exports as they raise the value of the dollar and make U.S. goods more expensive abroad, minus…

$$...-X_{\varepsilon}\varepsilon_{r}(R)...$$

the effect of foreign exchange-rate intervention in discouraging American exports by pricing them out of local markets, plus…

$$...+X_{\varepsilon}\varepsilon_{0}$$

the baseline level of exports determined by foreign exchange traders' beliefs about long-run exchange rate fundamentals.

III. The Soft Landing

Now, in this framework, what's the effect of a sudden end to foreign central banks' large-scale exchange-rate intervention? The first obvious effect is to boost aggregate demand, and thus production and employment:

(10) $$\Delta Y=\mu X_{\varepsilon}\varepsilon_{R}(\Delta R)$$

With the end of large-scale intervention, the price of foreign currency rises, U.S. goods become more attractive to foreigners, and exports rise. If the Federal Reserve thinks that this increase in demand will be inflationary, it could offset it by setting:

(11) $$\Delta r=\frac{X_{\varepsilon}\varepsilon_{R}}{X_{\varepsilon}\varepsilon_{r}+I_{r}}$$

because:

$$\Delta Y = \mu X_{\varepsilon} \varepsilon_R (\Delta R) - \mu (X_{\varepsilon} \varepsilon_r + I_r) \Delta r \tag{12}$$

And so keep aggregate demand in balance. The net result would be a higher price of foreign currency in terms of dollars (that is, a higher value for the exchange rate), and somewhat more exports offset by somewhat less investment. But this is not an obvious problem. This is a very soft landing.

IV. The Medium Landing

Why, then, do we worry about a "hard landing"? We worry about a hard landing because this model is too simple. So let's complicate the model.

First, however, it is convenient to use the relationship between the change in foreign central banks' purchases, the exchange rate, and the domestic interest rate:

$$\Delta r = \frac{\varepsilon_R \Delta R - \Delta \varepsilon}{\varepsilon_r} \tag{13}$$

to rewrite (12) as:

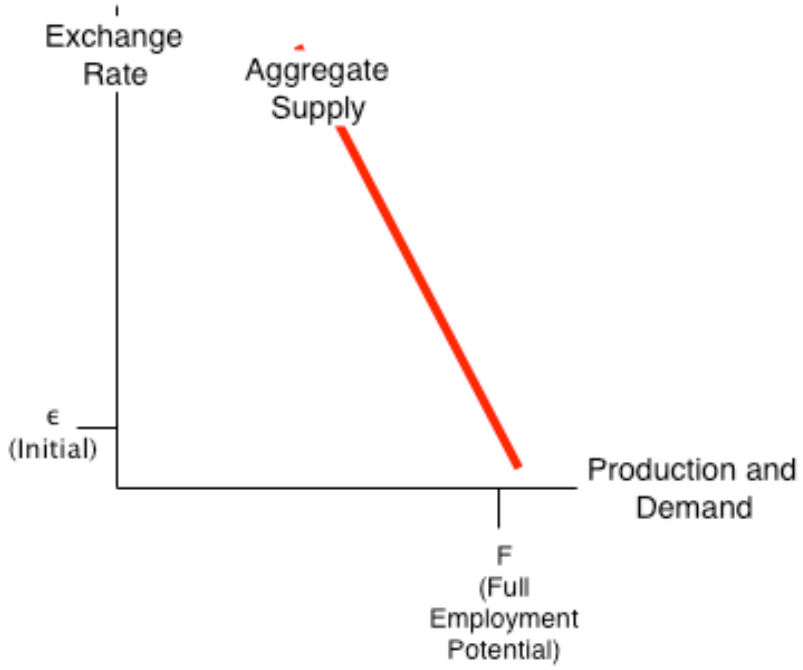
$$\Delta Y = \left(\mu X_{\varepsilon} + \frac{\mu I_r}{\varepsilon_r} \right) \Delta \varepsilon - \frac{\mu I_r \varepsilon_R}{\varepsilon_r} \Delta R \tag{12'}$$

Now let's complicate the model. Our simple finger-exercise model assumes that demand is demand: that as long as demand is there there is no problem taking a worker and a business that on Monday was building row houses and have those labor and capital resources making large turbine generators for export on Tuesday. But that's not how it works: large and sudden sectoral shifts are

difficult to accomplish, and usually require sharp rises in prices and wages in the expanding sector (accompanied by little fall in wages in the contracting sector): hence inflation. In addition, a rise in the exchange rate directly contributes to inflation as import prices rise. In the context of a Federal Reserve that seeks to maintain low inflation, let's call Y* the "potential output" of the economy—the level of output that can be achieved without creating inflationary pressures that the Federal Reserve regards as unacceptable. When the exchange rate is stable or falling, Y* is equal to the economy's fundamental productive capacity F. But when the exchange rate is rising:

(13) $$Y^* = F - y_{\Delta\varepsilon}(\Delta\varepsilon)$$

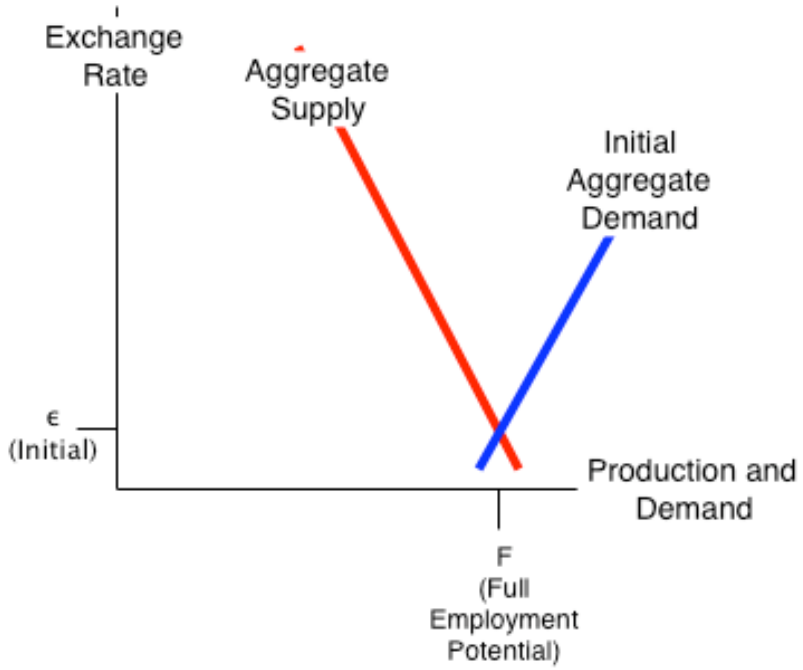
Figure 1
Potential Output and the Exchange Rate



Thus when the foreign central bank dollar purchases cease and the exchange rate rises, potential output—output consistent with low inflation—falls, as is shown in Figure 1.

Initially—while foreign central banks are busily buying dollars—the economy is in equilibrium with the exchange rate ε equal to its initial value, and output equal to normal potential output F. The initial equilibrium is where aggregate demand equals aggregate supply.

Figure 2
Initial Equilibrium



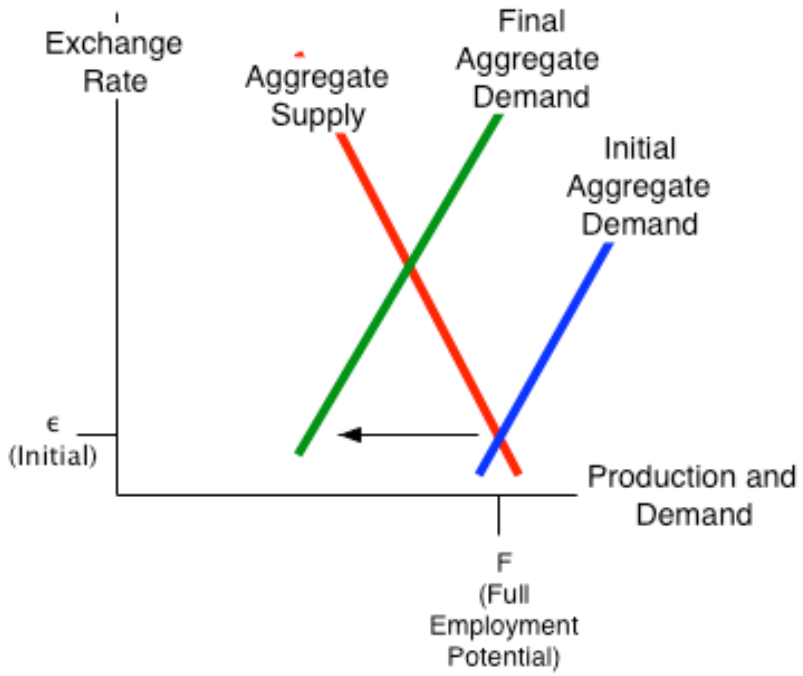
What is the aggregate demand curve? Here equation 12' is helpful. It traces out an aggregate demand curve—aggregate demand as a function of the exchange rate and of the magnitude of foreign

central bank purchases that keep domestic interest rates lower than they would be otherwise. A unit increase in the exchange rate increases aggregate demand by an amount:

(14) $$\left(\mu X_{\varepsilon} + \frac{\mu I_r}{\varepsilon_r}\right)$$

This is the slope of the aggregate demand curve, as plotted in Figure 2.

Figure 3
Foreign Central Bankers Stop Buying Dollars



Now suppose that foreign central banks stop buying dollars and so keeping down the exchange rate. By how much does the exchange rate rise, and by how much does potential output fall? Refer to

equation 12'. When foreign central bank large-scale dollar purchases cease, this aggregate demand curve is pushed to the left by an amount:

$$(15) \qquad -\frac{\mu I_r \varepsilon_R}{\varepsilon_r} \Delta R$$

as is shown in Figure 3.

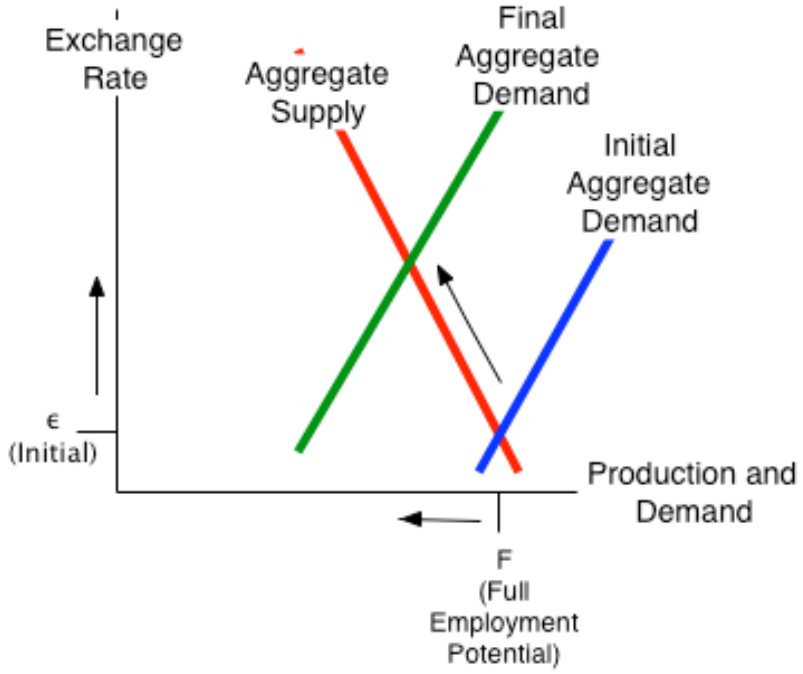
Suppose (just suppose) that the Federal Reserve decides that it wants to respond to the end of foreign central-bank purchases by keeping the exchange rate at its initial level. It doesn't have mammoth amounts of yen and renminbi to use to support the dollar, so it has to raise interest rates. That increase in domestic interest rates is what makes the output level on the new aggregate demand curve at the initial exchange rate level so low.

In fact, the Federal Reserve would have to be insane to want to raise interest rates high enough to keep the exchange rate from falling, and so cause a major recession. It will set its domestic interest rate in such a way as to produce a fall in the value of the dollar—a higher exchange rate—a different point along the shifted aggregate demand curve with a higher level of output. The Federal Reserve will try to push output as high as it can without endangering price stability. That's the point where the curves cross: aggregate supply is lower at the lower value of the dollar (because the fall in the value of the dollar itself creates inflationary pressures that have to be offset, and because the large sectoral shift of labor into exports required raises unemployment and reduces the value of potential output further.

The net effect of the end of foreign central bank support is, with a Federal Reserve adjusting interest rates to maintain internal balance in the sense of neither inflationary nor deflationary pressures, a move up the aggregate supply curve that produces a higher exchange rate (a lower value of the dollar) and a recession:

a fall in output and a rise in unemployment as the rise in the exchange rate and the consequent sectoral shift of labor into export industries lowers the amount the economy can produce without inflationary pressures. This process is shown in Figure 4. It is certainly not a "soft landing." Call it a "medium landing": unpleasant but not devastating.

Figure 4
"Medium Landing"



V. The Hard Landing

Now let's complicate the model further. Suppose that our investment function turns out to be a function not just of the real interest rate:

(5) $$I = I_0 - I_r r$$

but of the real interest rate and the—squared—change in the exchange rate:

(16) $$I = I_0 - I_r r - I_{\Delta\varepsilon}\left(\Delta\varepsilon\right)^2$$

Why might a rise in the exchange rate—in the value of foreign currency—depress investment? Listen to economist Brad Setser, of Roubini Global Economics:

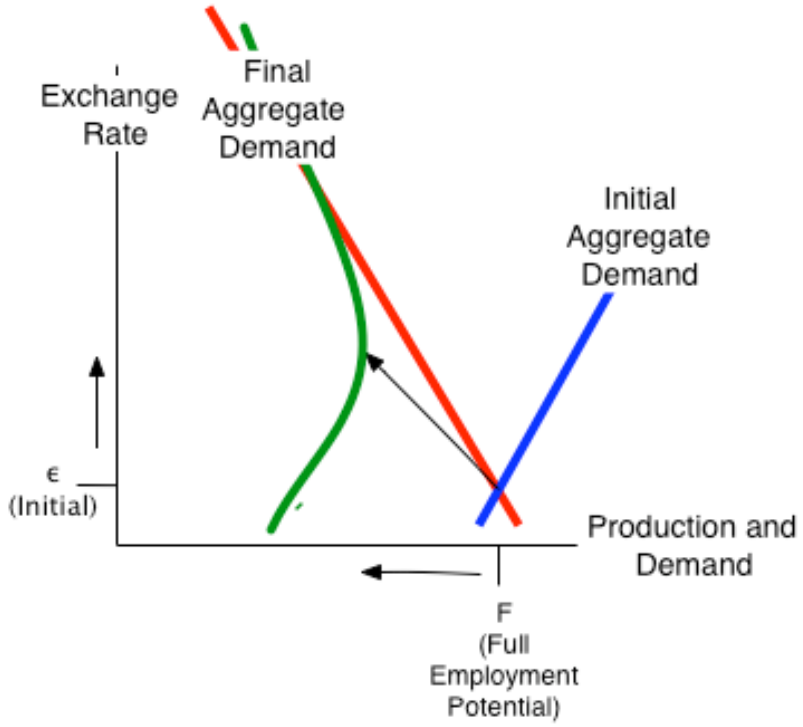
> I worry that already leveraged hedge funds are buying instruments that themselves sometimes have a lot of embedded leverage. It may be that the hedge funds really do know how to hedge their risks, and thus are not as exposed as it would seem. But big risks are sometimes taken by investors looking for high returns to justify high fees in an environment where there is less and less easy money to be made...

If there are lots of leveraged institutions on Wall Street, some of them will have made big bets that the dollar will not fall by very much. When it does, they will be bankrupt. If a rolling chain of bankruptcies occurs, then people are going to be very leery about lending out their cash. Thus risk spreads over safe interest rates will rise sharply, corporations will find finance for investment much harder to obtain, and investment will fall.

Under such a financial crisis scenario, the aggregate demand curve looks different. As the exchange rate rises, it starts to curve around back upon itself, as in Figure 5. The Federal Reserve finds that it cannot boost demand and employment by keeping interest rates lower and allowing the price of foreign currency to rise further: any attempt to do so will cause enough bankruptcy and crisis in the financial system to further reduce investment and deepen the recession. There are, as Paul Krugman says, "no good options." The best bad option is to aim for the furthest-right point on the aggregate demand curve: allow the exchange rate to move as much

as it can before the boost to exports from increased competitiveness (and the ability of sound firms to borrow at investment grade interest rates to finance their own spending) begins to be outweighed by the negative effects of the banking crisis generated as firms that have made unwise leveraged bets start to go under.

Figure 5
"Hard Landing"



This best attainable point will still have a substantial deflationary gap associated with it: production will be lower than what could be achieved with low inflation if only the financial crisis was not

going on. But this will be a hard landing indeed: unemployment due to sectoral shifts plus inflationary pressures from rising import prices plus a deepened recession as financial crises and bankruptcies further cripple investment, oh my!

This is when central bankers really earn their keep. They have to:

- Keep interest rates low so that high interest rates do not unnecessarily discourage investment spending themselves.

- Keep the fall in the value of the dollar from generating an unnecessarily large chain of bankruptcies and recession-deepening financial crisis.

- Quickly merge insolvent into solvent institutions, or quickly nationalize and then privatize the solvent parts of insolvent institutions, in order to restore as fast as possible the ability of the financial system to channel savers' savings to investing businesses that have profitable opportunities for investment spending.

- Avoid allowing rising import prices to produce expectations of general inflation, and thus of an inflationary spiral.

Can they do all four of these things at once? Surely not. Can they try to do as many of them as they can to the extent that they can? They can try. But there are no reliable historical correlations to guide them as they try to figure out what magnitude shift in the exchange rate they need to allow to get to the sweetest spot possible on the new aggregate demand curve, or which financial institutions to merge and privatize in order to damp out as quickly as possible the added unpleasant investment-discouraging effects of financial crisis.

Which of these scenarios are we in? Are we in the "soft landing" scenario, in which the pace of sectoral shifts and structural changes that are going to be caused by the forthcoming rise in the value of foreign currency will not be large enough to materially depress potential output? Are we in the "medium landing" scenario in which the shock and the consequent rapidly-required sectoral shifts will be large enough to cause a significant but not catastrophic recession? Or are we in the "hard landing" scenario in which the financial fragility and vulnerability of many New York institutions is such that all hell will break loose whenever foreign central banks stop purchasing dollars?

I don't know. My guesses are still 70% soft, 20% medium, 10% hard. I do know that the longer the U.S. continues to run its massive twin deficits on the current scale, the greater the "medium" and "hard landing" probabilities will become. And I pray that Tim Geithner and company have a very good handle on these issues, and that they are confident that we are still in the "soft landing" zone…