

# The International Finance Multiplier

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## 1. Introduction

The current financial crisis is remarkable in many ways, but one aspect is of special interest for international economists: even though the roots of the crisis lie in the U.S. housing market, the crisis is now very much a global affair. Figure 1 shows the decline in a number of stock market indices over the year ending October 4, 2008; essentially, all markets fell by the same amount. The freeze on interbank lending and in the commercial paper market is affecting Europe to much the same degree that it's affecting the United States, with the gap between Euribor and the repo rate similar to that between Libor and the Fed funds rate. Banks are failing, or needing urgent government rescue, on both sides of the Atlantic.

International economists have been interested in interdependence for a very long time – arguably too interested. Global interdependence is one of those topics people love to talk about because it *sounds* sophisticated – the *Wall Street Journal* once published a piece mocking Multilateral Man, who wants to cooperate to improve coordination and coordinate to improve cooperation. (This is as opposed to Euro Man, who wants cohesion to promote convergence ...)

But the interdependence this time is real – and it seems to be operating through channels that are not yet part of standard international macro analysis. Much thinking about international linkages still relies on some version of the traditional foreign trade multiplier: country A's GDP affects its level of imports, which are country B's exports, so demand shocks get transmitted through international trade. As I'll explain shortly, however, this won't work for current events. Instead we seem to be dealing with a phenomenon I'll call the *international finance multiplier*, in which changes in asset prices are transmitted internationally through their effects on the balance sheets of highly leveraged financial institutions.

Before we get there, however, let's review the traditional analysis of interdependence.

## 2. Modeling interdependence

The granddaddy of all interdependence analyses is Romney Robinson's 1952 paper, "A graphical analysis of the foreign trade multiplier." Robinson envisioned a two-country world with fixed exchange rates, fixed prices, and fixed interest rates, so that simple multiplier analysis applied. Home country GDP affected Foreign GDP through its effect on imports: higher  $Y$  led to higher Home imports, hence higher Foreign exports, hence higher  $Y^*$ . And  $Y^*$  affected  $Y$  in the same way. So one had the picture of interdependence shown in Figure 2, in which HH shows Home GDP as a function of Foreign GDP and FF shows Foreign GDP as a function of Home GDP. A negative demand shock in Home would shift HH to the left, inducing a series of reactions that would reduce both Home and Foreign GDP.

With floating exchange rates, the picture becomes more complicated, because shocks affect trade flows through the exchange rate as well as the effect of GDP on import demand. But trade flows remain the channel of influence.

The question is, how important is that channel? The fact is that in spite of globalization, trade flows don't seem large enough to produce all that much interdependence. Figure 3 shows U.S. imports of goods and services as a percentage of rest-of-world GDP since 1980. This share has roughly doubled, but it's still fairly small. One way to think about this is to ask what it would take for a U.S. recession to impose a one percent of GDP negative demand shock on the rest of the world. For this to happen, U.S. imports would have to decline from 6 to 5 – a 17% decline. Given that the typical estimate of the income demand for imports is around 2, this would require a decline of more than 8% in U.S. GDP. So it would take an extremely severe recession in the United States to produce even a moderate-sized negative demand shock abroad.

But we've known for some time that trade flows aren't the only source of international interdependence. The Asian financial crisis of 1997-1998 was notoriously marked by "contagion," the spread of crisis to economies with seemingly weak links to the original victims. In particular, the most severely affected nations were small economies that were not each others' major trading partners, yet they experienced a dramatically coordinated slump. Figure 4 shows real GDP growth in the four "front line" economies; I think the figure speaks for itself.

And as the crisis spread, the linkages became positively baroque: Russia's default seemed to cause a speculative attack on Brazil, and triggered a brief, scary liquidity crisis in the United States (at least it seemed scary at the time; by current standards it was a non-event.)

What was the explanation of global contagion? Some observers suggested that there were informational linkages – such as herding behavior by investors with incomplete information. Others, myself included, suggested that contagion was a sort of "sunspot" phenomenon: the afflicted economies were financially fragile, with the possibility of falling into a bad equilibrium always there, and the crisis atmosphere caused the descent.

The proposed channel that seems most relevant, however, seems to have been originally proposed by Calvo (1998): contagion through the balance sheets of financial intermediaries. Loosely, when hedge funds lost a lot of money in Russia, they were forced to contract their balance sheets – and that meant cutting off credit to Brazil.

An important paper by Kaminsky, Reinhart, and Vagh (2003) provided support for this view: it compared a number of episodes of international contagion, and found that all of the cases involved a "leveraged common creditor."

The argument of this short note is that an expanded version of the Calvo hypothesis is the best way to think about the global crisis now underway: essentially, all economies now share leveraged common creditors, so that balance sheet contagion has become pervasive. Today, we are all Brazilians.

Before we get there, however, it's necessary to lay out a stylized account of the crisis.

### 3. A minimal model of the crisis: single-country version

Imagine a world in which there is only one questionable asset (think mortgage-backed securities). This asset is in fixed supply  $A$ . There are two kinds of investors who might hold the asset: the general public, on one side, and highly leveraged institutions (HLIs) on the other.

The demand of the general public for the asset in question will simply be assumed to be downward sloping in the asset's price:

$$(1) \hat{G} = G(q)$$

You can think of this as arising from some kind of Tobin-type portfolio decision, although I won't try to model the asset markets as a whole.

HLIs will be assumed to behave very differently. Let  $N$  be their initial holdings of the risky asset, and  $D$  be their current debt. Then their equity, on a mark-to-market basis, is

$$(2) E = qN - D$$

We assume that the size of the HLIs' balance sheets is constrained by a maximum leverage ratio  $\lambda$ . So the *value* of the questionable asset they can demand is

$$(3) \widehat{qN} = \lambda E = \lambda[qN - D]$$

and the quantity demanded is

$$(4) \hat{N} = \lambda \left[ N - \frac{D}{q} \right]$$

The implied demand curve from HLIs is therefore upward-sloping, because of the valuation effects on their balance sheets. This is, of course, the key to the whole story.

Market clearing requires that the desired holdings of the questionable asset from HLIs and the general public equal the total supply:

$$(5) \lambda \left[ N - \frac{D}{q} \right] + G(q) = A$$

Which can be written

$$(6) \lambda \left[ N - \frac{D}{q} \right] = A - G(q)$$

The left-hand side of (6) represents the demand for risky assets by the HLIs; as already explained, it's upward sloping because of the balance-sheet effect. The right-hand side of (6) is the supply of risky assets *to* the HLIs, the difference between the quantity available and the quantity demanded by the general public.

Figure 5 shows the equilibrium. As drawn, the supply curve from the general public is flatter than the demand from HLIs; this is the case in which equilibrium is locally stable, because a rise (fall) in  $q$  will lead to an excess supply (demand), pushing the price back to its original level. It's clearly possible in this model for the equilibrium to be unstable instead; in that case we'll have the possibility of vicious circles that drive the asset market to a low-level equilibrium, virtuous circles that drive it to a high-level equilibrium. My reading of developments so far does not seem to require multiple equilibria – notably, house prices are still above the levels that you can justify in terms of traditional fundamentals. In any case, for current purposes I'll focus on the case in which pure self-fulfilling crises are not the problem.

Even in this case, however, balance sheet effects can have a major impact. Figure 6 shows the effect of a negative shock to asset demand – say, the horrifying realization by the general public that housing prices can, in fact, go down as well as up. This reduces the general public's demand for risky assets, shifting the supply of these assets to the HLIs right and down. But this initial effect on the price is magnified through a multiplier effect, as falling asset prices force HLIs to contract their balance sheets, leading to further asset price declines, further contraction of balance sheets, and so on.

The next step is to internationalize the story.

#### 4. A minimal model of the crisis: international version

Suppose now that there are two countries, which in traditional boring fashion I'll call Home and Foreign. We assume that demand for risky assets from the general public in each country is a downward-sloping function of the price (we could introduce cross-effects here, but we'll leave them out for the sake of simplicity:

$$(7) \quad \widehat{G} = G(q), \widehat{G}^* = G^*(q^*)$$

where the asterisk indicates the Foreign equivalent of the Home variable.

Meanwhile, we'll assume that the HLIs hold risky assets in both countries – specifically, that they hold a desired share  $\alpha$  of their assets in Home,  $1-\alpha$  in Foreign. This implies that the desired value of risky assets in each country is

$$(8) \quad \widehat{qN} = \alpha\lambda[qN + q^*N^* - D]$$

$$(9) \quad \widehat{q^*N^*} = (1 - \alpha)\lambda[qN + q^*N^* - D]$$

giving us the demand relations

$$(10) \quad \widehat{N} = \alpha\lambda\left[N + \left(\frac{q^*}{q}\right)N^* - D/q\right]$$

$$(11) \quad \widehat{N}^* = (1 - \alpha)\lambda\left[\left(\frac{q}{q^*}\right)N + N^* - D/q^*\right]$$

The key point, of course, is that Home and Foreign risky assets become complements: a rise in  $q$ , by increasing HLIs' capital, increases the demand for Foreign assets, a rise in  $q^*$  similarly increases the demand for Home assets. And that implies a diagram like Figure 7 – an asset-market version of the Romney Robinson diagram.

Suppose that there is a negative shock in Home. This shifts HH to the left, as shown in Figure 8, and leads to a fall in asset prices in both countries, with balance sheets of highly leveraged institutions the channel of transmission.

Is there any reason to believe that this channel of international linkages is more important now than in the past? Yes: there has been a major increase in financial globalization in the sense that there are large international cross-holdings of assets. Figure 9 shows U.S. assets abroad and foreign claims in the United States, both – as in Figure 3 – measured as shares of ROW GDP. What stands out is a huge increase in *both* sides of the U.S. international balance sheet, mainly since 1995. This suggests, though it does not prove, that the international finance multiplier has become much more important than in the past.

All of this is pretty minimal. I haven't tried to embed the balance sheet effects in a complete model of the asset markets, let alone the whole economy. That, as we always say, is a topic for further research. And quantifying these effects is going to require making the model considerably more realistic. But I would argue that the linkages described in this note offer the best currently available story about the crisis now underway. What else can we learn from this story?

### 5. *Implications*

The story laid out here seems to have two main implications for policy in the crisis.

First, it suggests that the core problem is capital, not liquidity – or at least that you can explain much of what's going on without appealing to a breakdown of buying and selling per se. To the extent that this is true, rescue plans centered on making troubled assets liquid, like the Paulson plan passed last week, won't do the trick. Instead, what's needed is an injection of capital, which can't reverse the original shock, but can undo the financial multiplier effect of that shock.

Second, the international implications: to the extent that we regard falling asset prices and their consequences as a bad thing, which we obviously do right now, this analysis suggests that there are large cross-border externalities in financial rescues. Macroeconomic policy coordination never got much traction, largely because economists never could make the case that it was terribly important. Financial policy coordination, however, looks on the face of it much more important. Capital injections by U.S. fiscal authorities would help alleviate the European financial crisis, capital injections by European fiscal authorities help alleviate the U.S. financial crisis. Multilateral Man, come home – we need you!



## REFERENCES

Calvo, Guillermo. 1998. "Capital Market Contagion and Recession: An Explanation of the Russian Virus." Mimeograph.

Graciela Kaminsky, Carmen Reinhart, and Carlos Vegh (2003), "The unholy trinity of financial contagion," NBER Working Paper #10061.

Robinson, Romney "A graphical analysis of the foreign trade multiplier," *The Economic Journal*, Vol. 62, No. 247, 546-564. Sep., 1952

Figure 1: Synchronized sinking



Figure 2: The Foreign Trade Multiplier

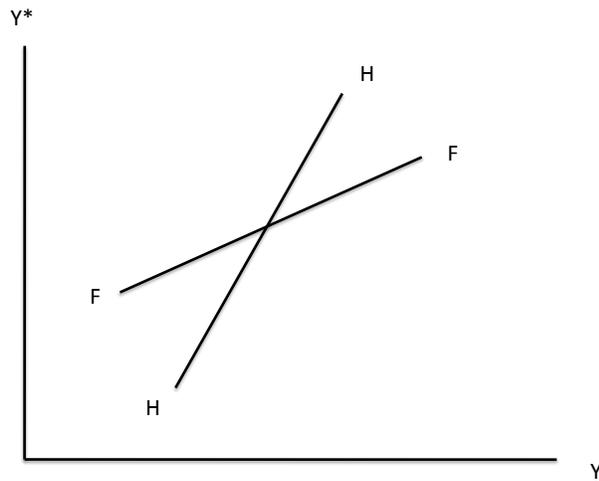


Figure 3: Trade linkages are not enough

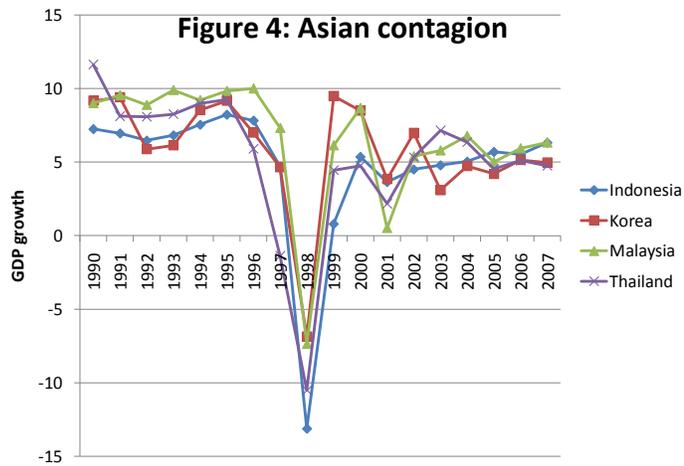
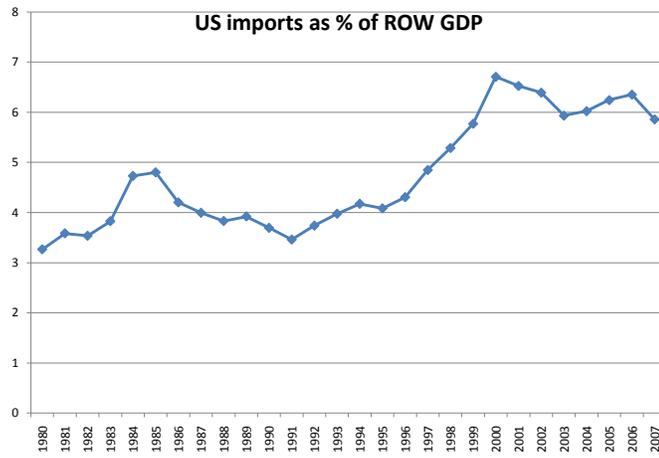


Figure 5: A crude view of the situation

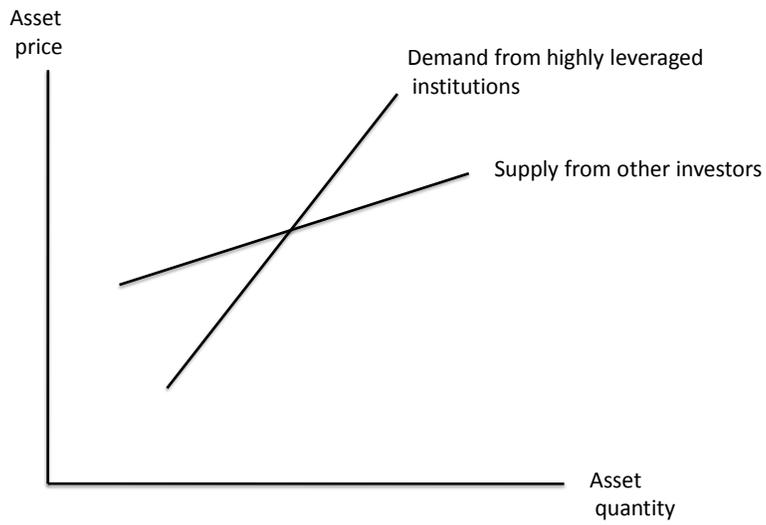


Figure 6: The financial multiplier

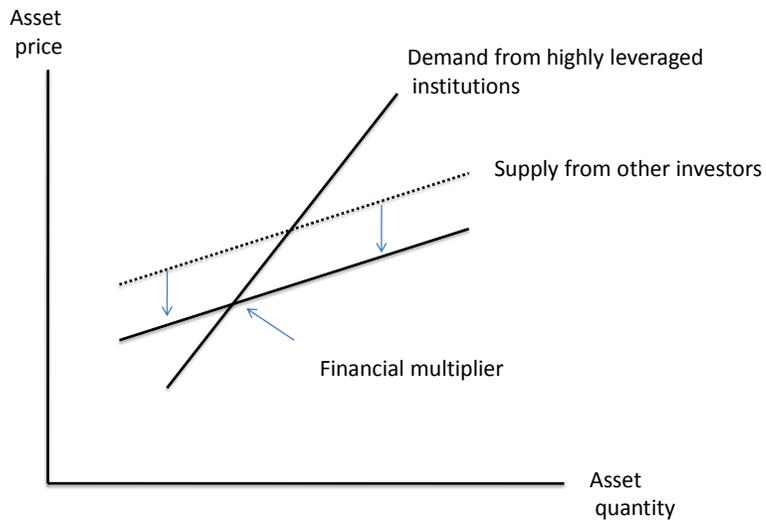


Figure 7: The International Finance Multiplier

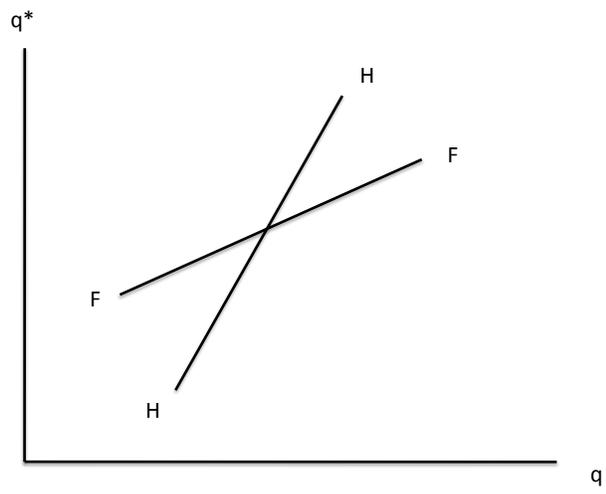


Figure 8: Propagating a crisis

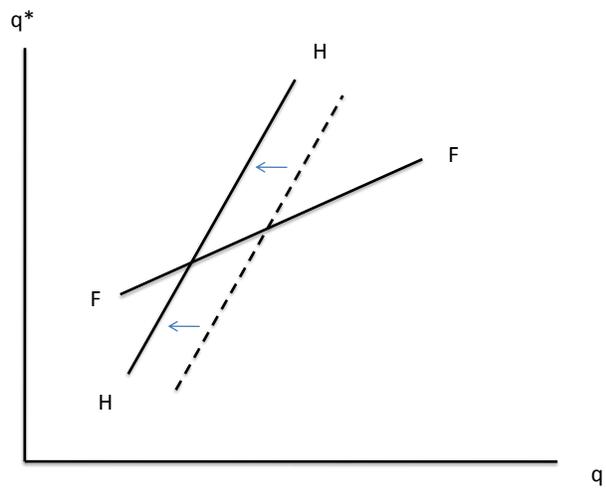


Figure 9: Increasing financial globalization

