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Financial Structures

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Chapter Six

Financial Structures

The financial side of an economy undergoes structural change through the development process. There is no strict progression of financial development and initial conditions matter. But, broadly speaking, new financial structures gradually evolve, in a process that can be seen as a sequence of five “stages” of increasing financial complexity. Understanding financial structures is crucial for the analysis of macroeconomic policy in Chapter 7, since they can increase policy flexibility but can also constrain policy maneuver and generate risks of destabilization for the entire macroeconomy.

National Financial Accounts

The underlying concepts are a blend of flows of funds accounting and more traditional approaches. The main distinction lies in the treatment of “equity” or “net worth.” When consolidated economy-wide, the net worth of the business sector has to be the value of its assets less liabilities. According to the flows of funds, the liabilities include debt *plus* the market value of the sector’s outstanding shares. A more conventional alternative is to *define* equity as the value of assets minus debt. In the late 1990s in the US during the stock market boom, business net worth was negative by the former definition and equal to zero (as it always is) by the latter. Net worth in the US flows of funds was positive as of mid-2008.

Table 6.1 defines the balance sheets for six types of agents or sectors: private non-financial actors, the government, the central bank, commercial banks, a non-bank financial sector, and the rest of the world.[1] The entries represent values of *stocks* of financial claims. Many financial instruments are included in the table. We begin by considering a very restricted subset of them, and then bring more claims into play in successive stages of finance.

Table 6.1

Values of claims can change in two ways. One is through *flow* accumulation or decumulation over time of the stocks in response to net lending or borrowing by different actors. The other mechanism applies to outstanding shares and foreign loans which have explicit asset prices (a price index for equity and the exchange rate respectively), so their values can jump "instantaneously" due to capital gains or losses.

Stage I Finance

The simplest financial structure, which we will call "Stage I", still applies in a large number of developing countries today. In normal times (one historically significant sort of "abnormality" is considered below), the only private assets are "money" (broadly construed) H_p and the value of tangible capital $P_K K$ with K as the existing stock at historical or replacement cost and P_K as its asset price.

[1] A natural extension would be to split the private sector into households and business. To simplify the exposition, it is not pursued here. IMF financial programming and monetarist macroeconomics often consolidate the commercial and central banks into one sector. To allow us to bring in relevant monetary policy issues we keep them separated in Table 6.1.

On the liability side, private business and households may borrow L_p from the banks but loans from abroad eL_p^* and the value of equity outstanding $P_V V$ are negligible or effectively non-traded. There is no significant market in bonds, so private (B_p) and commercial bank (B_{comm}) holdings of government securities are near zero. The government's total borrowing, which at this stage is only from the central bank, is $B = B_{cent}$.The corresponding asset is the "full faith and credit" of the State, Γ.

The money supply *H* is the sole liability of the commercial banking system.[2] In simple financial systems, a typical monetary policy instrument is to require commercial banks to hold reserves (or "high-powered money") η against deposits, according to a rule such as $\eta = \rho H$ with $\rho < 1$ (assuming for simplicity that all money is held as deposits in the banking system[3]).

Besides deposit reserves, the only commercial bank asset is outstanding credit or loans *L* (at this stage only L_p to the private sector). The banks' balance sheet is $L + \eta = H$, implying that L and H are linked via the reserve requirement. Boosting ρ forces banks to contract both money and credit. For reasons discussed below, in more sophisticated systems reserve ratios tend to be minimal and other regulatory methods are used.

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[2] As is often the case in macroeconomic modeling for the moment we ignore bank equity Ω_{comm} held by the private sector as an asset. It is brought into the discussion about financial regulation below.

[3] Standard definitions of high-powered money also include currency and coins, which we omit to save on symbols. They were key components of the rich countries' financial systems well into the nineteenth century and remain important in many developing economies today.

Besides the bonds B_{cent} placed with it in one way or another by the government, the central bank's only other asset is international reserves eR^*, with R^* as the value of reserves in foreign currency and *e* as the exchange rate (units of local currency per unit of foreign currency). Consolidating the accounts of the central and commercial banks shows that the money supply is given by the equation $H = L + B_{cent} + eR^*$, so that it is equal to total domestic credit plus foreign reserves. As will be seen below, formulas of this sort play a central role in monetarist macroeconomics in general and its particular incarnation in the form of IMF financial programming.

Liquidity is often interpreted as a measure of the financial flexibility of an individual actor, group of actors, or the financial system as whole. It constitutes "wherewithal" -- the resources readily available for purposes of capital formation or financial transactions. For the private sector in Stage I, liquidity takes the form of one *asset*, namely money. Nothing else is at hand.

The accounting framework just sketched puts strict limitations on policy options. First, it is the preferred arena for the IMF's venerable version of open economy monetarism. Suppose that money demand is described by the equation of exchange $H_pV = PX$ with *P* as the price level, *X* as output, and *V* as an institutionally determined "velocity" of circulation of money, which in the most simple frameworks is assumed to be constant. If *X* is set by "full employment" and *P* comes from an inflation forecast or target, then money demand must follow.

Suppose, somewhat mysteriously, that money demand is always equal to supply, $H_p = H$. If loans L_p to the private sector are set by needs of production, the sum of bank

loans to the government and international reserves is determined from the consolidated banking system's balance sheet: $B_{cent} + eR^* = H - L_p$. If international reserves are targeted to increase as the current account or inflow of external finance improves, then government debt $B = B_{cent}$ must fall via a larger fiscal surplus. This exercise is the basis for the "twin" fiscal/foreign deficits which are at the heart of IMF financial programming.

Along with twin deficit hawks worldwide, the Fund implicitly assumes that causality runs from the fiscal to foreign deficit, but as we saw in Chapter 5, it can easily go the other way. Furthermore, as we pointed out there, these particular twins are not frequently observed in the data. Roughly parallel movements of external financing and private net borrowing flows are a more frequent phenomenon.

Stage I accounts also support the basic closed economy monetarist inflation model, set out by the Swedish economist Knut Wicksell in the late nineteenth century and propagandized worldwide by Milton Friedman and disciples as recently as the 1970s and 1980s. The logic is that a higher fiscal deficit gets "monetized" (because the government cannot place debt obligations except with the central bank). Still on the assumptions that money demand equals supply, and that economic activity (X) is constantly at full employment, the resulting increase in $H_p = H$ forces P to go up, as determined by the equation of exchange written in the form $P = H_pV/X$.

Because liquidity in many economies now comprises a spectrum of financial assets and liabilities far wider than simple money, financial programming and monetarist inflation models are often anachronistic. Inflation in Zimbabwe, which took off in the mid-2000s, can be interpreted along monetarist lines but this is not a common phenomenon today.

Finally, it is worth noting that even in simple Stage I finance (and certainly in the more complicated systems discussed below), financial manias can appear in "abnormal" circumstances. Unfortunately, such situations have arisen pretty regularly for the last 400 years.[4]

One familiar scenario is based on government assets P_0G (with an asset price P_0) which have been privatized and sold through a dealer to the public.[5] If the dealer happens to have a captive bank at his disposal, he can lend money to himself and cronies to bid up the share place leading to a capital gain (or on-going inflation) at rate π: the asset price rises to $(1+\pi)P_0$. Other actors may then start borrowing from the captive and other banks to try to buy shares, setting off a boom that ends inevitably in a crash.

Premiere examples were the Mississippi and South Sea crises early in the eighteenth century, in which John Law's Banque Générale in Paris and the Swordblade Bank in London issued the loans. With international complications discussed below, the Chilean crisis of 1982-83 followed the same pattern around companies privatized by Pinochet's Chicago Boys. These examples illustrate a recurring theme in financial instability: capital gains are financed by liquidity in the form of *liabilities* assumed by financial actors to buy the appreciating assets. Manifold possibilities along these lines are sketched below.

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[4] Kindleberger and Aliber (2005) is the classic narrative.

[5] The "assets" might be claims on hypothetical future revenue streams (the South Sea and Mississippi cases discussed below) or equity of former state enterprises (a standard case in late twentieth century developing country events).

Stage II Finance

The key element in “Stage II” is a domestic market in (at least short term) government and/or central bank debt. It may have been created by careful husbandry on the part of the central bank. We first sketch banking system interactions in such a system, and then take up broader issues. This discussion brings many more entries in Table 6.1 into action.

The conventional treatment of Stage II is to assume that government bonds are held by both the private sector and banks, $B_p + B_{comm} + B_{cent} = B$. In outline form, Keynes in the 1930s thought in terms of this sort of finance, with the significant extension of having markets in corporate debt instruments as well.

In developing countries today, the central bank will often offer in the market its own bonds, A, which constitute a non-monetary liability of the institution and may be held by the public and commercial banks, $A_p + A_{comm} = A$. A major advantage of this practice is that it is easier to develop a market for central bank bonds than a fully fledged set of transactions for government (not to mention corporate) paper. The central bank may also provide commercial banks with direct lending or advances Φ (from a rediscount window or by injecting funds directly into interbank overnight credit markets) which commercial banks can then use to increase their own loans L and thereby money H. Finally, we should consider commercial bank own-funds or equity Ω_{comm}, held by the private sector as an asset.

Four monetary policy instruments can be illustrated with the table.

As noted for Stage I, shifting the reserve requirement ρ is a traditional control mechanism. As discussed below, this simple tool can be used in attempts to "sterilize" or offset credit and money expansion resulting from increases in international reserves eR^*. But deposit reserve requirements usually generate a strong opposition from commercial banks because these institutions are forced to hold deposits that they cannot lend and therefore increase the cost of financial intermediation. Other monetary policy tools can also be used.

For example, the central bank can increase or decrease its own lending, Φ, to encourage commercial banks to expand or contract their loan book.

More importantly, open market operations become feasible when commercial banks or the private sector hold significant amounts of government and/or central bank bonds. Once enough of these instruments are traded in the market, to expand the money supply the central bank can buy bonds from commercial banks by crediting their deposits η of high-powered money. Or it can buy bonds from private agents who then place the funds in the banking system as deposits. With excess reserves on hand, the banks have an incentive to increase L and H. A complication is that in a crisis commercial banks may prefer to hold higher quantities of government or central bank bonds rather than lend to the private sector. This sort of "liquidity trap" is unfortunately quite common (and appeared with a vengeance among rich country banks in the late 2008 crisis).

In turn, to contract the money supply, the central bank can sell bonds to the banks or the private sector. The objective here is to reduce both the money supply and lending to the private sector by commercial banks (H and L, respectively).

Finally, contemporary approaches to regulation such as the internationally accepted standards issued by the Basel Committee on Banking Regulation – widely known as Basel I and II — focus on bank capital Ω_{comm}. Complications are taken up below.

Turning to macroeconomics more generally, it remains true that primary liquidity in Stage II is still money. Keynesian ideas about liquidity preference come into play, with the interest rate mediating portfolio choice between more liquid money and less liquid bonds (with government and central bank bonds being more liquid than those of the corporate sector, which are subject to interest rate spreads associated with both liquidity and solvency risks). As far as the private sector is concerned, the liquidity spectrum still spans a collection of assets, with specific holdings responding to returns and costs.

If a corporate bond market exists, it can be of significant support to capital formation. But even without one, Stage II governments can issue bonds to fund national development banks specialized in production-oriented loans. As discussed in Chapter 8, such institutions have been very important in developing countries; they played a significant post-war reconstruction role in advanced economies as well.

Finally, Keynes analyzed financial instability in terms of sharp shifts in liquidity preference. Mixed with overborrowing (high leverage), they provide the foundation for Minsky's "financial instability hypothesis" (Minsky, 1982). The essential insight here is that as the confidence of private agents builds up during the boom, they tend to over-

borrow – from the banks or in corporate bond markets — to buy real assets subject to capital gains (speculation in financial assets will come in later stages), pay for investment, or even to increase consumption.

Sooner or later the borrowers can end up in very risky positions. Even if they were initially secure in the sense of having enough income to cover investment and interest payments (a hedged position), they can increase borrowing and spending to the point where current revenues become insufficient to pay for investment (speculative position), or even for interest payments (Ponzi finance). This sets the stage for a crisis when the end of the credit boom that sustains the borrowing exposes these positions. There can be a credit squeeze as creditors turn risk averse and move into larger holdings of money or government bonds.

In microeconomic terms, the squeeze can be seen as a case of rationing on the part of creditors in a world with “asymmetric information” (Stiglitz and Greenwald, 2003). When risk perceptions rise, it may be rational for lenders to stop giving credit altogether to those borrowers that are viewed as risky rather than charge them a larger risk premium that would in fact further increase the risk of lending to them. This is the simplest form of a cycle of “appetite for risk” followed by “flight to quality.” More complex versions are discussed below.

Although Keynes was certainly aware of possibilities for financial instability involving credit booms and asset bubbles, they do not figure prominently in either the *Treatise on Money* or the *General Theory.* Certainly in the post-1929 world he was analyzing, the use of liabilities as liquidity to acquire assets (allegedly) subject to capital gains was not an immediate threat.

Stage III Finance

In "Stage III" foreign financial capital comes onto the scene. The economy gets access to *hard currency* foreign loans (eL_p^* to the private sector and eL_g^* to the government, expressed in *domestic* prices). Many countries and regions have gone through such a transition – Austria and Germany around 1930 when bank deposits from foreigners were used to acquire domestic assets leading into the Credit-Anstalt crash and Western Europe when capital markets were liberalized in the 1970s.

This may be seen as the typical stage in which developing countries are placed today. Before the recent commodity price boom, sub-Saharan African countries had seen little development in their financial structures that would take them beyond Stage II or even Stage I, as they continued to be deprived of access to private external financing. In a growing group of developing countries, however, the importance of bond markets, especially central bank and government bonds, has been on the rise and over the years, and they have fared better in attracting external private finance, even if in an unstable way. These countries may be said to be firmly based in Stage III financing.[6]

The key point is that external *liabilities* become a form of liquidity which can be used to acquire assets at home. Local actors such as the government may or may not be able to issue liabilities aboard denominated in domestic currency (such as government borrowing B^* in Table 6.1). If they cannot, the limitation is quaintly called "original sin" in the academic literature. But Stage III sinners in good standing with their

[6] The World Bank's database on *Financial Structure* (World Bank, 2006) provides indicators on the size of equity and public and private bond markets for both developed and developing countries. These indicators can be used to group regions and countries according to the stages of finance described in the text.

creditors are welcome to borrow in foreign currency terms. Unfortunately this situation may not persist.

The presence of foreign liabilities in portfolios immediately exposes their holders to exchange rate risk due to currency misalignment – or mismatch. If their assets and expected net revenues are denominated in domestic currency but their liabilities are denominated in foreign currency, then an increase in the exchange rate *e* generates both capital and income losses. The higher rate cuts directly into net worth and jacks up the cost of debt service. The threat to balance sheets is greater if (as has often been the case) there is a maturity mismatch involving short-term foreign liabilities and long-term domestic assets.

These dangers are especially grave for actors such as firms producing non-traded goods and the government itself insofar as their main sources of income are set in local currency. Although some assets of exporters (e.g., the real estate that they own and their deposits in the domestic financial system) may be denominated in local currency and be subject to the same problems, they could be more than offset by the larger domestic value of their current and expected net income in foreign currency.

Money and credit expansion due to the accumulation of international reserves during phases of booming capital inflows has become a persistent problem in emerging market economies.[7] If there is a market in domestic bonds, the central bank can in principle sterilize the monetary effect of international reserve accumulation by selling its

[7] If the exchange rate *e* stays constant, the home country's net foreign assets $e(R^* - L^*) - B^* - P_V V^*$ can only change gradually over time via a surplus or deficit on current account. Hence a jump in foreign lending eL^* or B^* must be met by an equal increase in reserves R^* which can stimulate money and credit expansion through the usual channels.

own or government paper in exchange for money in an open market operation, although at the risk of driving up interest rates which may then bring in still more foreign capital.

Two other options for sterilization exist: reducing the public sector debt by running a budget surplus, or accumulating the domestic money generated by the additional international reserves as deposit reserves of commercial banks. These options are the only ones available if there is no well developed domestic debt market (that is, we are closer to Stage I in terms of domestic financing). A long sequence of currency crises shows that such interventions may be of limited effectiveness.

Stage IV Finance

Use of liabilities as a source of liquidity expands greatly in "Stage IV." A local market for equity issued by the private sector can provide the trampoline. This is the stage where the most successful developing countries as well as some of the slow growing regions (Central and Eastern Europe and the semi-industrialized countries, in particular) are placed now or towards which they are moving. Historically, the emergence of significant stock markets dates from the 1990s in many developing countries (with privatization of state enterprises often providing the impetus) and is fairly recent even in non-Anglo Saxon industrialized economies.

In Table 6.1, the value of private sector shares outstanding is $P_v V$ with P_v as a price index and V a measure of outstanding volume.[8] In a wonderful seventeenth

[8] For the private non-financial sector, Table 6.1 follows the accounting convention of the flow of funds by treating equity outstanding as a "liability" and allowing non-zero net worth. To illustrate a point made earlier, in flow of funds terms Google has highly negative net worth because its stock market valuation vastly exceeds its tangible capital

century Dutch word, a Stage IV economy can enter into *windhandel* or "wind trade" based on the use of liabilities (and derivatives built around them) as sources of liquidity. This possibility is reflected in Table 6.1's "finance" sector which holds shares $P_V V_F$ financed by borrowing from banks and abroad (ignore the QS_F term from the moment). The sector's equity or net worth is Ω_F, held by the private sector as an asset.

Within the financial sector, there are offsetting asset and liability entries Z. Individual financial actors such as broker-dealers, financial agents active in mortgage bond markets (e.g., some pension funds in developing countries, or Fannie Mae and Freddie Mac in the US), and hedge funds can borrow from one another but for their subsystem as a whole many of these transactions will be mutually offsetting.[9] By increasing transactions such as Z, financial institutions can add to cash flow as they build up asset/equity or leverage ratios $\lambda_F = (P_V V_F + Z)/\Omega_F$. The liabilities $L_F + Z + eL_F^*$ underlying total assets $P_V V_F + Z$ can support imposing structures of leverage and liquidity.[10]

So long as P_V continues to rise, growing intra-financial sector claims make it possible to mobilize large sums of money to buy stock. Of course P_V can also fall, precipitating a collapse. Again, appetite for risk during a boom becomes flight to quality

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and financial assets. On a balance sheet set up to follow accountants' conventions, Google like all other corporations would have zero net worth.

[9] They may not offset completely. In available US flows of funds data, for example, leveraged financial institutions typically have negative *net* positions in fed funds and security repurchase (repo) agreements. *Gross* repo asset and liability positions are not reported.

[10] In the US at the end of 2007, leverage for households was around 1.2, for commercial banks it was about 10, and for investment banks it was over 30!

in a crash marked by “deleveraging” or a contraction of liquidity in the form of liabilities and a retreat to assets such as government bonds and even money.

The financial sector can also be dependent on the rest of the world. If local operators borrow heavily from abroad (eL_F^* in Table 6.1) and invest at home ample possibilities arise for currency and maturity misalignments in national balance sheets of the sort that led to the succession of emerging market financial crises in the 1990s.

Diversified finance as in Stage IV also creates opportunities. Somewhat surprisingly, firms in Chapter 3’s rapidly growing economies have relied on selling new shares for a significant portion of their investment finance, certainly not the practice in many advanced economies where share buybacks predominate (Singh, 1995; Staritz, 2008). Active stock markets also allow entrepreneurs to cash in on their innovations via initial public offerings (IPOs) of shares, a significant incentive for technological advance.

Stage V Finance

“Stage V” finance – not yet significant in most developing economies – adds the contemporary twist of asset securitization. In just one of many possible examples, suppose that besides productive capital the private sector holds a tangible asset C with price P_C (the obvious example is residential housing). It borrows M_F (for “mortgages”) from banks, using $P_C C$ as collateral. The banks in turn bundle the mortgages into a security S with price Q which is sold to financial actors. Such maneuvers make it possible to borrow large sums of money and pump up leverage by increasing claims on the non-financial sector.

But there are also problems. How to evaluate collateral for securitized loans is one. Aside from ample opportunities for fraud, a key point in recent US experience is that the housing collateral for "subprime" mortgages was itself subject to capital gains and losses, and that the ability of the borrowers to be able to meet their payment obligations was open to question (without, needless to say, any prior provision being made on the part of the lenders during the upswing for the loan losses they were likely to incur during the succeeding downswing).[11] To the extent that these assets were traded, they were valued at market prices (mark-to-market). Rating agencies were asked to judge as to their quality before they were marketed, and changed the rating through time. A capital gain on the primary asset (housing) led directly to a jump in the asset price Q which stimulated balance sheet expansion.

Secondly, a large portion of these complex securities were not marketed. They were given a hypothetical valuation Q based on mathematical models internal to the financial institutions. These procedures were flawed, as we will see below. But they were a wonderful source of liquidity until the bottom fell out of the subprime market, carrying down with it the values of securitized assets. Then a crisis hit, with drastic deleveraging and shrinkage of liquidity.

As this book went to the press, the industrialized economies are still sorting out the consequences of deleveraging Stage V. But it seems clear that public regulation of both bank and non-bank financial operations can help reduce the likelihood of booms

[11] In US usage, subprime mortgages are not of sufficient quality to be bought and securitized by the government sponsored enterprises Fannie Mae and Freddie Mac. Their securitization was undertaken by the private financial sector.

and crashes. Financial safety nets can be constructed. However, when liquidity takes the form of liabilities which can be used to pay for profit-seeking in financial markets (not to mention fees for the people who "guide" investors), sources of potential volatility will always appear, even in constricted early stage financial systems.

Pro-Cyclical Regulatory Complications

Stage V but also Stage III and IV finance raises numerous problems of regulation. As noted above, the Basel I and II standards concentrate on commercial bank capital. Besides issuing equity per se, banks also make provisions (or reserves) for expected losses in their loan portfolio. They are held in liquid assets and add to the net worth of the banks as they are built up, but are expected to be spent sometime in the future when losses are made. For simplicity in notation, we assume that they are part of bank capital Ω_{comm}. When a bank gets into trouble, it has to use the provisions it has accumulated or reduce its leverage by disposing of assets or building up equity. Cutting shareholder dividends and/or selling new stock are the usual mechanisms for the latter. Examples were rife in the industrialized economies in 2007-08. For developing countries at higher stages of finance, the Basel methodology which sets targets for how much capital and provisions financial firms have to hold as backing for assets is increasingly relevant. We provide a brief sketch with emphasis on the problems it may present.[12]

[12] There is an enormous literature on the Basel standards. The discussion here draws heavily on Alexander et. al. (2008).

Basel II rests on three “pillars”, with the first being that a bank should maintain capital and provisions adequate to guarantee that if there is an adverse shock to its assets, there will be only a small probability of a loss. The bank’s assets should be valued on the basis of market parameters (interest rates, expected losses given market conditions, etc.), including to the extent possible asset prices set in relevant markets that can be used to value such holdings (mark-to-market pricing).

Pillar One emphasizes that such calculations should be based on the bank’s internal risk weighting models and could take into account the information provided by the ratings agencies. In developing countries, however, few assets are rated by these agencies. Some asset-backed securities are rated in industrial countries but the more complex rarely trade, so there is no market on the basis of which to estimate values. Furthermore, even in industrial countries, the loan portfolio is not rated and is only imperfectly tradable. When it has to be sold during a crisis, discounts can be considerable.

The complicated mathematics used for asset valuation creates problems of its own. A major consideration is that going into the 2007 crisis all financial institutions were using models based on the same theory (the basics involving comparisons of returns and risks described by hypothetically *known* probability distributions go back to Markowitz, 1952) and estimated using the same historical data. There was already a lot of homogeneity built into their market perceptions. Worse still, the models presuppose that financial actors can always trade at stable “market-determined” prices. As we pointed out above, this assumption is inapplicable for many assets and, equally important, fails for those assets for which there is a market if all the players are thinking

more or less the same thing and then change their minds in the same direction – not everybody can attempt to buy or sell at the same time without causing prices to move! Similar perceptions then lead to greater asset price volatility. Marking-to-market turns highly pro-cyclical, as assets are overpriced during booms but possibly underpriced in the environment of pessimism that prevails during crises.

Such herd behavior was exacerbated by Basel Pillar Three calling for market discipline enforced by greater disclosure of banks' financial status and their internal risk management procedures. Such measures were not the most effective means to confront *systemic* risk caused by the herding behavior discussed above – an externality not encompassed by internal procedures and not accounted for in the market place. Supervision, the second Pillar, could potentially deal with this problem, but evidence indicates that it is ignored or seriously underutilized until crises actually strike.

To understand in a more formal way the source of the problem, we should observe that major financial actors generally operated on the basis of "value at risk" or V as estimated by their models. Value at risk is linked to the equity capital Ω that the firm must hold to stay solvent with high probability (Adrian and Shin, 2008). Firms presumably adjust their balance sheets to target a ratio of economic capital Ω to V, say:

$$\Omega = \theta V \quad .$$

With A as their assets, leverage λ then becomes:

$$\lambda = \frac{A}{\Omega} = \left(\frac{1}{\theta}\right)\frac{A}{V} \quad . \qquad (1)$$

These are all *static* relationships, supported by models with probability distributions estimated from existing data at a point in time. The dangers they create

result from their impacts on the *dynamic* behavior of financial firms. The heart of the matter is that leverage responds *inversely* to asset price increases. In highly simplified form, a firm's balance sheet can be written as:

$$A = D + \Omega$$

with D as debt.

Suppose that there is a capital gain on a firm's assets. If debt stays constant for the moment, equity Ω will rise by an equal *absolute* amount. Because $\Omega \ll A$ for financial firms, the *proportional* increase in Ω markedly exceeds that in A. Hence leverage or $\lambda = A/\Omega$ goes down. Financial firms then have a strong incentive to increase debt to buy additional assets to build up leverage, engaging in *windhandel* to profit from increased cash flow while still respecting pre-set limits on risk. In the subprime mortgage adventure, firms were typically borrowing short-term to acquire long-term assets in anticipation of capital gains – back to the Mississippi and South Sea Companies of 300 years ago!

So what happens if asset prices go down? Leverage jumps up, and from equation (1) above, $\frac{V}{A}$ increases for a given θ. With greater value at risk relative to assets, Basel rules obligate the firm to reduce leverage by disposing of assets or building up equity. If firms are largely similar and react in much the same way to an adverse shock, the resulting fire sale of assets can lead to dramatic price reductions and a liquidity conflagration as in 2007-08.

As we will see in Chapter 7, there are ways to attenuate this behavior, basically building rules that try to correct for the pro-cyclical behavior of financial and asset

markets. In practice, in industrial and developing countries alike, , crises hit when financial institutions are seriously undercapitalized (after all, undercapitalization is the other side of the coin of large profits made during the boom on the basis of high leverage). The sales of assets in markets with one-sided expectations then lead to losses that further feed into expectations and market valuations. The final result is a credit crunch.

Table 6.1: Illustrative Balance Sheets (“T-accounts”)

Private		Commercial Banks		Central Bank	
$P_K K$	L_P	L	H	B_{cent}	η
H_P	eL_P^*	B_{comm}	Φ	eR^*	A
B_P	$P_V V$	η	QS	Φ	
A_P	M_P	A_{comm}	Ω_{comm}		
$P_C C$	Ω_P	M			
Ω_{comm}					
Ω_P					

Government		Rest of the World		Finance	
Γ	B	eL^*	eR^*	$P_V V_F$	L_F
	eL_G^*	$P_V V^*$	$e\Omega^*$	QS_F	eL_F^*
		B^*		Z	Z
					Ω_F

Total wealth: $P_K K + P_C C + \Gamma = \Omega_P + e\Omega_R^*$

Net foreign assets: $-e\Omega^* = e(R^* - L_P^* - L_G^* - L_F^*) - P_V V^* - B^*$

Bank loan balance: $L_P + L_F - L = 0$

Government bond balance: $B_P + B_{comm} + B_{cent} + B^* - B = 0$

Central Bank bond balance: $A_P + A_{comm} - A = 0$

Foreign loan balance: $e(L_P^* + L_G^*) - eL^* = 0$

Equity balance: $P_V(V_F + V^*) - P_V V = 0$

Mortgage balance: $M_P - M = 0$