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Financial Intermediation in the National Accounts

Asset Valuation, Intermediation, and Tobin's *q*

Carol A. Corrado and Charles R. Hulten

5.1 Introduction

The collapse of the housing price bubble starting in mid-2006 has had far reaching consequences. It led to a crisis in the subprime mortgage market, a relatively small part of the overall debt market, but this soon propagated to the financial markets as a whole and then to the real economy. The financial crisis also altered the landscape of the financial sector, with many of the largest firms forced into buyouts or failure. The effects of the Great Recession are still felt as of this writing, six years later. The depth and duration of the crisis and its aftermath, invite the question: Why wasn't the approaching crisis more apparent in the macroeconomic data and models that inform economic policy?

This is a complex issue, involving the types and frequency of the data collected (or not collected), the way they are organized, and how they are interpreted and implemented. We focus in this chapter on one aspect of the problem: the underlying conceptual adequacy of the national income and wealth accounting practice. We ask the following question: Where in the conventional macroaccounts would one look to see a financial crisis approaching, or to track its progress as it unfolds? Because the epicenter of the recent crisis was located in the financial intermediation sector—the mortgage subsector and investment banks, among others—that would seem the natural place to look first. This raises the further question of where this

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sector is actually located in the current accounting system and how well it is connected to the rest of the economy. This is the central focus of this chapter.

Our starting point in addressing this question is Knight's circular flow model (CFM), which describes the flow of inputs and output through factor and product markets, and the reverse flow of payments. It records the flows of gross domestic product (GDP) and gross domestic income (GDI), as well as their components. These accounts are primarily flow accounts, but the Bureau of Economic Analysis (BEA), which compiles the National Income and Product Account (NIPA) version of the CFM, also provides supplementary data on capital stocks. Data on financial flows and balance sheets are complied by the Federal Reserve Board (FRB) and published in the Financial Accounts of the United States, formerly called the Flow of Funds Accounts. Since 2007, these databases have been combined into the integrated macroeconomic accounts (IMAs), which were made quarterly in 2010. One goal of this chapter is to explore the theoretical underpinnings of the IMAs by expanding the conventional CFM to allow for a capital account like the one in the IMAs.

As part of this overall goal, we focus on the role played by financial intermediation in connecting saving to investment and wealth to the capital stock. The conventional accounting structure views the financial sector as one of many industries competing for scarce resources and providing value added to the economy. In our modified view of the wealth-augmented CFM, we accord the financial sector a separate and central role in connecting the goods-producing sectors of the economy to households, where consumption of these goods takes place. Financial intermediation in this model serves to "lubricate the wheels of industry and commerce," and we argue that the failure to provide adequate lubrication (liquidity) is one factor that enabled a crisis in a relatively small segment of the financial market to propagate so rapidly to the market as a whole, and then to the real economy. A data system designed to spot emerging crises must be able to spot "holes" in a labyrinth of interconnected financial tubes, and reveal how the tubes are connected (i.e., the counterparties to the transactions and the allocation of risk among the parties).

This connectivity perspective on intermediation also helps to understand the role played by the growth in complexity and nontransparency of the intermediation process following the introduction of increasingly complicated financial instruments (derivatives, options), organizations (shadow banking), and practices (computerized trading and hedging). As complexity increased, the difficulty in spotting "local" problems increased, as did systemic risk. Traditional banks report detailed condition data and undergo regular examination, and many financial instruments are traded on exchanges. But such scrutiny generally did not extend to the intermediaries and securities at the epicenter of the crisis.

We do not attempt a full data reconciliation of our wealth-augmented

CFM and the current IMAs. This would be a major undertaking far beyond the scope of this chapter. Moreover, the risk-map analysis of Cecchetti, Fender, and McGuire (2010) (essentially a map of the system tubing) suggests that it may even be beyond the capacity of large statistical agencies, given the multidimensional characteristics of the financial information required and the way the data are currently collected. What we do, instead, is modify the IMA treatment of the housing finance sector, so as to distinguish between capital stock and the associated wealth, an important step in any attempt to understand a crisis originating in the mortgage market. We then examine the behavior of the Tobin's average q statistic before and during the financial crisis. We also estimate the degree of leverage in these sectors, as an indicator of risk and potential illiquidity. One lesson that emerges from this analysis is the importance of the Modigliani-Miller Theorem in interpreting the results. Another lesson is that alternative ways of measuring the productive capital stock also play an import role in interpreting the observed pattern of the q statistic.

5.2 Accounting for Capital and Wealth

National income and growth accounting would be a relatively simple exercise if there were no capital to worry about. In this case, output would comprise only consumption goods and these goods would be produced by labor input alone. If all the output of consumption goods and labor inputs flowed through product and factor markets, the main job of income accounting would be to record the current flows. The aggregate expenditure for consumption would equal aggregate labor income.

The economic world becomes considerably more complicated when capital, in any of its various manifestations, is introduced. Indeed, Hicks (1981, 204) observed that "the measurement of capital is one of the nastiest jobs that economists have set to statisticians." One form of capital is implicit even in a simple all-consumption framework. Some workers may want to shift current consumption to later years, while others may want (or need) to consume more in the current year by borrowing against future consumption. If they can be brought together, the former may lend their current saving to the latter in the form of a consumption loan to be repaid in later years out of the future consumption of the borrowers. The loan of current consumption goods creates an asset (wealth) for the saver/lender and a liability for the dissaver/borrower.

The problem gets messier when capital goods are introduced. In this situation, some of the current capacity used to produce consumption goods is diverted to the production of capital goods. This investment provides an alternative way that current consumption can be shifted to future years, since, while the capital itself cannot be consumed directly, it can be employed in production to produce the desired future consumption. This reveals a key feature of capital: it is both a current output of the economic system, as investment, and a future input as part of the accumulated stock of past investments.

Another key feature of capital is that it is both a productive asset and a source of wealth. Whereas the capital stock is the net accumulation of past investments, wealth is the net accumulation of past saving (which is to say, past forgone consumption). As productive capital, its value reflects a balance between the discounted present net value of the output it produces over its useful life and the cost of acquiring units of fixed assets. From the standpoint of wealth, the value of the accumulated wealth is a balance between consumption forgone and the discounted present value of the future consumption made possible by the return to wealth. The acquisition cost reflects the opportunity cost in terms of consumption forgone.

When the capital stock is owned directly by the person whose own saving enables the acquisition of the capital, the distinction between the value of capital and wealth is somewhat artificial. Direct and unleveraged ownership means that the return to the stock of capital is equally the return to wealth, and capital stock equals wealth. However, owner utilization tends to obscure the fact that the decision to invest is separate and apart from the decision to save. The investment decision is based on the productivity of capital in production, while the saving decision is based upon the benefits of shifting consumption from one time period to another.

The arrangement in which capital is wholly owned by a sole user was more common in the past and important examples remain (e.g., owner-occupied housing without mortgages, unleveraged sole proprietorships). However, the decoupling of individual investments from individual savings was one of the most important innovations that enabled the evolution of modern economic organizations. Decoupling was made possible by the rise of financial intermediaries that, in effect, connected the supply of saving indirectly to the demand for investment. Financial intermediaries aggregate the savings of individual investors and transfer them through a variety of financial instruments to entrepreneurs and businesses, who then use the funds to acquire the capital necessary for their operations. Investment was no longer limited to the opportunities available to individual savers, leading to an increase in capital and a reallocation of assets that greatly increased the efficiency of investment and the return to savers.

This is where the measurement of capital really turns "nasty." With financial intermediation, the link between saving and investment runs through a chain of financial instruments that channel to return to investment back to the owners of the claims against the stock, the owners of the wealth. The households hold claims against the productive stock in the form of instruments like stocks or bonds that channel the income from the productive stock directly to the wealth holder. If the financial instruments connecting the sectors consisted exclusively of basic stocks and bonds issued by businesses and sold directly to the wealth holders, the degree of complexity would be limited. However, financial intermediaries have developed a variety of instruments that package and securitize the debt and equity issued by businesses for passage on to other financial intermediaries or to the ultimate wealth holder. These include more or less straightforward instruments like mutual funds, annuities, exchange-traded funds, and less straightforward ones like derivatives, structured investment vehicles, and private equity arrangements. The degree of complexity of these instruments has grown greatly in recent years with the result that the link between the source of capital income in the business sector and its destination in the household sector has become ever more indirect and opaque.

As noted in the introduction, this complexity and lack of transparency was seen by many observers as a contributing factor in the crisis. As the degree of complexity increased so did the degree of indirection and, therefore, the more steps in the valuation of assets and liabilities. The mortgage market at the center of the financial crisis is an important case in point. Individual mortgages that were, in the past, held by the originating banks, were increasingly pooled to form mortgage-backed securities (MBS), which, as the market evolved, were then pooled again and repackaged into tranches of collateralized debt obligations (CDO). The link back to the individual mortgages became progressively more tenuous, to the point that it became hard to value the complex derivatives or to prove or establish legal ownership of some properties in foreclosure proceedings. High degrees of leverage (with short-term borrowing) and use of credit default swaps (CDS) further complicated asset valuation.

Increasing complexity does not, however, necessarily imply that a valuation problem exists. Under the conditions of the Modigliani-Miller Theorem, an efficient market should see through the complexity and arbitrage away any valuation disconnects. The hold-to-maturity (H2M) value of assets would equal the mark-to-market (M2M) value at each stage of the intermediation process. A valuation crisis must therefore come from an unanticipated shock to the economy or financial markets. The bursting of the housing market bubble in 2006 was certainly a development that seems to have been largely unanticipated by the broader market, but once housing prices starting trending down, the growing understanding that mortgage underwriting standards had been lax and private-label MBS were overpriced seems to have been an even more severe shock. The M2M valuations fell more rapidly than valuation based on H2M, a point noted by Federal Reserve Board Chairman Ben Bernanke.[1] Combined with high degrees of leverage

1. An April 10, 2008, article in Reuters (http://www.reuters.com/article/2008/04/10/usa-economy-bernanke-accounting-idUSWBT00874820080410), "Bernanke: Mark-to-Market Accounting Challenging," reported that "Federal Reserve Chairman Ben Bernanke said on Thursday mark-to-market accounting has helped to destabilize markets for illiquid assets, but regulators need to be careful about any changes to the system. 'It's also true in the current

at investment banks and short-term borrowing to finance the longer-term asset positions, confidence in the solvency of counterparties declined and liquidity began to dry up, propagating the crisis in an unanticipated way. When financial markets have a hard time valuing the underlying worth of an asset class, the job of the statistician is very nasty indeed.

5.3 The Circular Flow Model

5.3.1 Basic Structure

Knight's circular flow model of an economy (CFM) is the conventional framework for organizing the economic flows in the economy as a whole, and is the conceptual underpinning of general equilibrium theory.[2] The CFM distinguishes two essential economic functions: production and consumption. Consumption takes place in the household sector, and, in a closed economy, they are the recipients of the flow of goods and services; they are also the source of the labor and capital used in the production sector. Production takes place in the business sector, which is divided into industries that deliver intermediate goods to each other, and final demand outside the sector. This sector uses labor and capital provided by the household sector.

A simplified version of the CFM is shown in figure 5.1. Resources flow into the factor markets from the household sector, where they are priced and sent on to producers. There, the resources are transformed into outputs via each industry's production function. The outputs are priced in the product markets and sent on to consumers, whose demand is determined by their utility function and incomes, which reflect their utility-maximizing supply decisions. The flow outputs though product markets creates a dollar value that is in principle equal to gross domestic product, and the value of the flow of inputs through factor markets equals gross domestic income. These flows are linked via the standard national income accounting identity, where output is the value of deliveries to final demand and income is split between labor and capital. The counterclockwise flows shown in figure 5.1 are denominated in current prices. The clockwise flows refer to the quantity flows of inputs and outputs between consumers and producers.

The CFM is helpful in laying out the logical structure of the economy and tracking the sources and uses of resources. It covers, in principle, all

context, that mark-to-market accounting has been sometimes destabilizing in that sales of assets into very illiquid markets had led to reductions in prices, which have caused write downs which have sometimes caused fire sales, and you get into an adverse dynamic which has caused problems in some of our markets,' Bernanke said in a question-and-answer session before a business group."

2. Patinkin (1973) traces the circular flow model, in its modern form, to the work of Frank Knight in the 1920s and 1930s, although earlier incomplete forms of the model can be found.

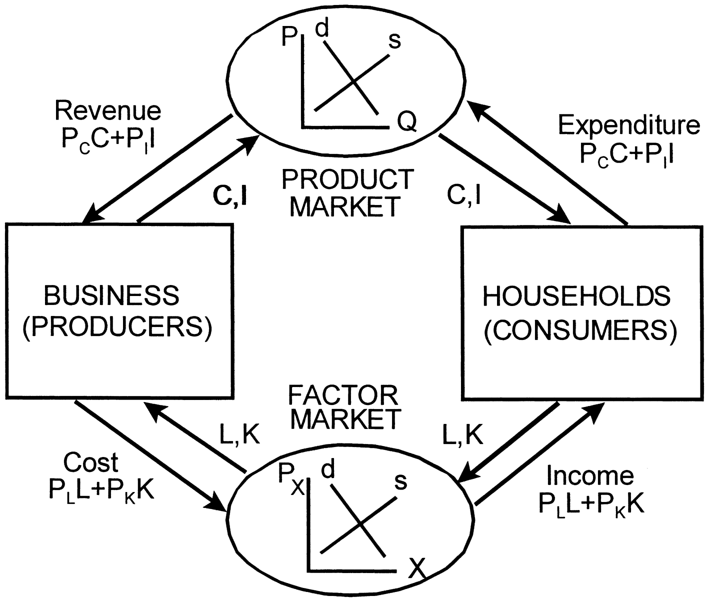

Fig. 5.1 Product market/factor market

sources and uses but, in practice, measured GDP records (with some exceptions) only goods and services that flow through markets. The use of market transactions provides a more-or-less objective, and largely available, metric with which to value the flows, but it is subject to the practical drawback that the market economy is only a fraction of total economic activity. Household production is omitted, and problems also arise from the omission of own-account intangible capital in the business sector.[3]

At a conceptual level, issues arise in the treatment of the government and owner-occupied housing sectors. From the structural standpoint of the CFM, the production of owner-occupied housing services is conceptually no different from the production of rental housing services. Therefore, both are appropriately located on the producer side of figure 5.1, and if the owners of housing assets chooses to rent to themselves, there is no substantive economic difference from the market rental option. A rent is paid to the

3. According to Landefeld and McCulla (2000), the nonmarket production of consumption goods by households amounted to 24 percent of measured GDP in 1946. More recent estimates of the value of investments in human capital alone are 23 percent of GDP in 2005 (Christian 2010). Estimates by Corrado, Hulten, and Sichel (2005, 2009) suggest that the omission of own-account intangible investment may understate the GDP by as much as 14 percent (though this will change in the United States with the capitalization of R&D expenditures in 2013).

landlord, who distributes the payment (less expenses and any interest payments) to the owners of the equity in the assets.[4]

5.3.2 A Wealth-Augmented Circular Flow Model

In the System of National Accounts (SNA) and conventional CFM, finance is treated as just another industry, as we have already noted, drawing from the pool of available resources to produce a flow of deliveries to final demand and deliveries to intermediate demand in other industries. This accounting convention is by no means wrong—it does keep track of the uses of resources—but neither does it illuminate one of the most important functions of financial intermediation, the connection of saving and investment.

The expanded circular flow model of figure 5.2 is designed to make this connection explicit, which is based on Hulten (2006). This formalizes the intent behind the integrated macroeconomic accounts, which combine the GDP flow accounts of the BEA with FRB balance sheets and financial capital flow data. In figure 5.2, a balance sheet is attached to each of the sectors in the diagram (the two circular areas adjacent to each box). The balance sheet associated with the production sector contains the net stock of productive capital in the sector as an asset, and debt and residual equity on the liability side. While businesses are treated as the legal owner of these assets, the household sector is the owner of the claims against the income generated by those assets. These claims form the basis for the net worth of the household sector, shown on the balance sheet on the right-hand side of figure 5.2. The two balance sheets are connected by the flow of saving and investment. Household saving is channeled into financial instruments, which are then held in the household balance sheets as increments to wealth, and the proceeds are channeled into the business sector in order to finance the purchase of investment goods.[5] The new capital goods are added to the existing stock, less reductions in the stock due to wear, tear, and obsolescence. In the process, the deferred consumption of households is matched by the shift in the current production of consumption goods to the production of capital goods that enable additional consumption in the future.

The flow of capital income moves in the opposite direction from saving

4. Similar remarks apply to the public sector. The government is a producer of services and can be located on the left-hand side of figure 5.1, along with other productive entities that draw on a common pool of labor and capital. The fact that government distributes much of its product outside market channels does not change the basic nature of these flows. Problems do arise from the collective nature of much of the consumption and from the collective nature of the "ownership" of public capital. Should these assets be treated as being held in common by the household sector, with the government a separate consumer within the household sector with its own utility function?

5. In practice, large companies can fund part of their investment program via retained earnings and the depreciation reserve. In the framework of figure 5.2, retained earnings are treated as an increment to the firm's capital assets that result in an increase in the value of household equity claims.

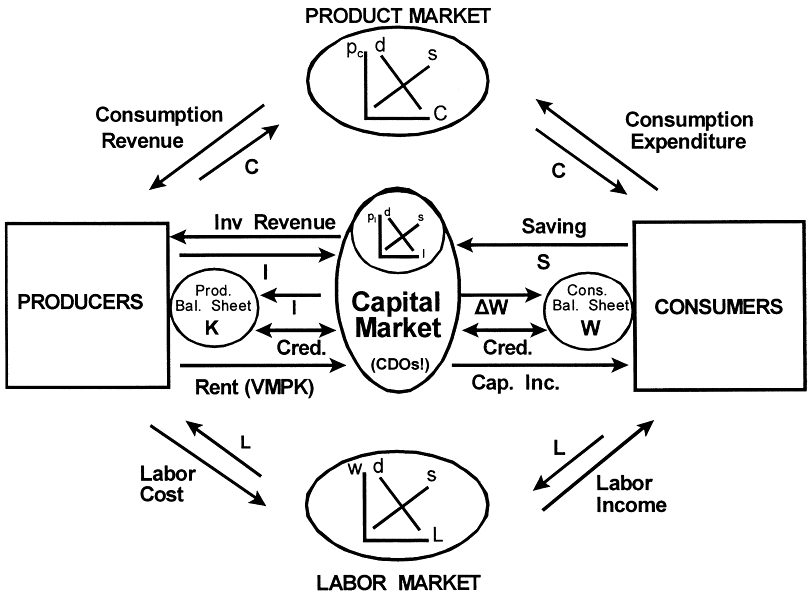

Fig. 5.2 Product market/capital market/labor market

and investment in figure 5.2. The income from the productive stock flows from its origin in the business sector (mostly) through financial intermediaries to households, along the pathways determined by the ownership structure of assets and liabilities. It provides the basis for the income accruing to the instruments held by households (the dividends, capital gains, interest, rents, and other payments associated with the various types of instrument). The channels may be more or less direct, depending on the degree of complexity of the ownership linkages.[6]

5.3.3 Adding Financial Intermediation to the Circular Flow Model

Financial intermediation is represented in figure 5.2 in the oval area in the middle of the diagram, which connects the real and financial markets. It is presented only in a summary way, without the complex channels (the inter-

6. There are, of course, many closely held firms, including family-held firms that control a lot of assets. According to the BEA/Federal Reserve's Integrated Macroeconomic Accounts, noncorporate business holds about 40 percent of the value of total nonfinancial business productive assets, and against this, about 65 percent is direct-owner equity (2001 to 2007). Thus, the equity income generated by about one-fourth of the stock of nonfinancial business productive assets in the United States is not intermediated but rather flows directly to owner-operators (and then back to financial business, to the extent assets are debt financed). Further, 90 percent of noncorporate income-generating assets are real estate assets, about two-thirds of which is residential housing.

connecting "financial tubes" of our introduction are not shown explicitly). This treatment is analogous to the treatment of intermediate input flows within the business sector, an input-output table connecting industry of origin to deliveries to final demand. The financial "input-output" array is more complex, connecting the income from productive business-sector capital to the holder of wealth claims against this capital via financial intermediaries. The risk-map paper by Cecchetti, Fender, and McGuire (2010) describes the multidimensional nature of the intermediation process, as assets are packaged, "sliced and diced," repackaged, leveraged, and hedged. Valuation depends on counterparty risk, currency risk, and local taxation and regulation. An attempt to construct this requires confidential data at the firm level of detail, collected at the global level. This is probably the kind of data needed to spot financial crises before they emerge, but also the kind of data that firms and even governments may be loathe to divulge (although there are new reporting requirements under the Dodd-Frank legislation that may help in this regard). Figure 5.2 indicates where such data are logically located, but not the details of the microintermediation flows.

The treatment of homeownership and mortgage in the balance sheets of figure 5.2 deserves special mention, since the homeowner is both a producer and a direct consumer of the housing services associated with a given home. As producer, the value of the home is recorded as an asset of the "business" balance sheet on the left-hand side of figure 5.2, and the mortgage used to finance the house is recorded as a balance sheet liability. The difference in value is recorded as a shadow net equity. The corresponding consumer balance sheet of the homeowner records the shadow net equity as an asset, and this net equity is also consumer net worth on the liability side of the account. The households that hold the mortgage, directly or through indirect equity (through intermediary securities like banks shares, mutual funds, or exchange-traded funds [ETFs]), record the value of the mortgage as an asset and as net worth on the liability side of their account. When individual household-sector balance sheets are consolidated into a single sheet, the total value of assets is the shadow equity plus the direct or indirect value of the mortgage components, leaving the value of the house as both an asset and an offsetting net worth entry.

This treatment of owner-occupied housing is symmetric with the accounting treatment of rental housing. If the homeowner decides to convert the home into a rental property, it becomes part of the business sector and would be counted as such on the business-sector balance sheet. Thus, there is no economic reason to treat owner-occupancy differently, and the framework of the preceding paragraph preserves this symmetry. This is an important issue when attempting to link the value of the capital stock to household wealth, in both the aggregate economy of figure 5.2 and in the housing subsector.

5.4 Accounting Equations and the Modigliani-Miller Theorem

5.4.1 Valuation of the Productive Capital Stock

The conventional approach to estimating the value of the stock of productive capital at any point in time, V_t, is the sum of the values of current and past vintages of investment goods, $P^I_{t,s}I_{t-s}$.

(1) $$V_t = P^I_{t,0}I_{t-0} + P^I_{t,1}I_{t-1} + \cdots + P^I_{t,s}I_{t-s} + \cdots.$$

One procedure for measuring the stock is to estimate the book value of the asset carried on financial balance sheets. Another is to use the perpetual inventory method (PIM), an approach widely used in national income accounting.

The analytical difference in the two approaches becomes clearer when the deprecation process proceeds at a constant annual rate δ.[7] Because the value of older (used) capital shrinks at a rate δ (other things equal), owning one unit of a vintage of age s is equivalent to owning $(1 - \delta)^s$ units of a new asset, implying that $P^I_{t,s} = (1 - \delta)^s P^I_{t,0}$. In this case the value of capital, as shown in equation (1), becomes

(1′) $$V_t = P^I_{t,0}I_{t-0} + (1-\delta)P^I_{t,0}I_{t-1} + \cdots + (1-\delta)^s P^I_{t,0}I_{t-s} + \cdots.$$

In the book value case, the accounting rate of depreciation is generally used, typically the straight-line form, and the prices reflect the historical cost of the new asset in each vintage when it was put in place, $P^I_{t-s,0}$ (generally leading to an underestimate). In contrast, under the PIM valuation approach, the rate of depreciation is based on estimates of economic (actual) depreciation, and the price of a new asset, $P^I_{t,0}$, is used in each year. In this, the contribution of each vintage to overall value can be interpreted as the effective quantity of vintage s investment surviving to the current year, $(1 - \delta)^s$, times the price of a new investment good, $P^I_{t,0}$.

The valuation form of the PIM, (1′), has a parallel quantity interpretation. The terms $(1 - \delta)^s P^I_{t,0}I_{t-s}$ can be rewritten as $[(1 - \delta)^s I_{t-s}]P^I_{t,0}$, and interpreted as the amount of vintage s investment surviving to the present years, measured in units of productive efficiency. The price terms can then be combined to give

(1″) $$V_t = P^I_{t,0}\left[I_{t-0} + (1-\delta)I_{t-1} + \ldots + (1-\delta)^s I_{t-s} + \ldots\right].$$

7. The productive efficiency is assumed, in equation (1), to decline at a constant (geometric) rate, though a more general form can be adopted. A survey of the literature on capital measurement and depreciation is available in Hulten (1990).

The term in square brackets on the right-hand side of this equation is an index of the quantity of the capital stock, implicitly measured in constant prices,

$$(2) \qquad K_t = I_{t-0} + (1-\delta)I_{t-1} + \ldots + (1-\delta)^s I_{t-s} + \ldots = I_{t-0} + (1-\delta)K_{t-1} .$$

In this formulation, the stock K_t is the total amount of effective capital *denominated in units of new capital*; that is, the equivalent amount of new capital needed to replace the capacity of the actual stock with its various layers of vintage capital. This is the *replacement cost* approach to valuing the capital stock. The annual change in the capital stock is the quantity of new capital units put in place less the units that must be replaced, δK_{t-1}. The resulting value of the capital stock in (1′) is therefore equivalent to $P^I_{t,0}K_t$.

We will revisit this replacement cost interpretation in our discussion of Tobin's q. The key point to note here is that the estimated value of the stock of capital, $P^I_{t,0}K_t$ is based on the price of new assets, and an externally imposed time-invariant estimate of the parameter δ. A negative shock would reduce the mark-to-market price of a vintage asset, that is, the spot price $P^I_{t,s}$ in equation (1), but the decline would not be apparent if this price is measured by the proxy $(1-\delta)^s P^I_{t,0}$ as per equation (1′).

5.4.2 Asset Prices and User Costs

The value of the capital stock in any year is determined by the interaction of the supply price of producing investment goods and the demand of these goods. To complete the description of the demand side, it is necessary to connect the price of the investment good to the future returns generated by the asset. In an efficient-market model, this price of acquiring a unit of capital, $P^I_{t,s}$ in equation (1) is assumed to be equal to the discounted present value of the expected stream of future income, adjusted for depreciation. With a discount rate r_t the equilibrium price $P^I_{t,s}$ for an asset of age s is:

$$(3) \qquad P^I_{t,s} = \sum_{\tau=0}^{\infty} \frac{(1-\delta)^{s+\tau} E(P^K_{t,s+\tau})}{(1+r)^{\tau+1}} .$$

This formulation assumes that the present value on the right-hand side is fully arbitraged against the cost of acquiring the capital good. In many accounting applications, this formulation assumes perfect foresight on the part of the investor.

The term $E(P^K_{t,s})$ is the expected annual user cost of capital. Under profit maximization, the user cost is equal to the value of the marginal product of capital (*VMPK*), connecting the return to capital in the business sector to the flow of capital income. Following Jorgenson (1963), equation (3) can be used to derive an explicit form for the user cost in terms of its logical components: the opportunity cost of capital r_t, expected holding gains (or revaluation) π_t, which is equal to expected asset price change $dE(P^I_{t+1})/P^I_t$, and depreciation δ:

$$(4) \qquad P^K_{t,0} = (r_t - \pi_t + \delta) P^I_{t,0}$$

(we abstract, here, from within-year timing issues and taxes).[8] The $P^K_{t,0}$ is a cost to the user, but at the same time, a return to the owner whose components are part of the capital income flows in figure 5.2.

The total gross income generated by the capital stock in any year is the sum of the income from each of the individual vintages:

$$(5) \qquad P^K_{t,o} I_{t-0} + P^K_{t,1} I_{t-1} + \ldots + P^K_{t,s} I_{t-s} + \ldots = P^K_{t,0} K_t .$$

This is the gross capital income originating in the production sector of the circular flow model. It is the source of the income transferred to the household sector as part of gross domestic income. In view of equation (4), gross capital income from the production of output is the sum of the opportunity cost of capital less holding gains, plus depreciation: $P^K_{t,0}K_t + (r_t - \pi_t)P^I_{t,0}K_t + \delta P^I_{t,0}K_t$. The total return to holding a unit of K_t is equal to the $VMPK$ on the left-hand side net of depreciation plus any holding gain of the asset, that is, $r_t = VMPK_t - \delta + \pi_t = \rho_t + \pi_t$.

5.4.3 Household Saving and Wealth with Financial Intermediation

The asset value of the firm as a business, V_t in the formulation of equation (1), is the value of its productive capital, $P^I_{t,0}K_t$. To obtain a richer picture of a firm's balance sheet, its financial assets, F^B_t, must be added, along with the firm's liabilities, D^B_t plus net worth NW^B_t, in order to more accurately reflect a firm's true financial position (this is particularly important for financial firms where financial assets [loans] and liabilities [deposits] loom large).[9] The firm's "T" account is then

$$(6) \qquad V_t = P^I_{t,0}K_t + F^B_t = D^B_t + NW^B_t .$$

The items on the liability side of the business balance sheet are assets of households, which hold the legal claims to the income from these assets, $\rho_t P^I_t K_t$, in the form of financial instruments, equities E_t and debt D_t, or other instruments of direct ownership that establish legal control over assets and the income they generate and responsibility for the associated liabilities (for simplicity of exposition, we ignore the latter as a separate equity category). In our simplified model, the holders of the value of the equity have a residual claim to the net worth of businesses NW^B_t and are also the holders of the debt D^B_t.

The households' claims on business net worth come in the form of equity certificates E_t that are valued at a price P^E_t per unit (this is a market-

8. For a more complete description of the complexity involved in the user cost model, see Hall and Jorgenson (1967) and the survey by Hulten (1990).

9. The theory of user cost still applies (e.g., see Barnett [1978] and Fixler, Reinsdorf, and Smith [2003]).

determined value when such markets exist and a shadow price when they do not).

$$(7) \qquad P_t^E = \sum_{\tau=0}^{\infty} \frac{E(Div_{t+\tau}^K)}{(1+r)^{\tau+1}} .$$

The value of total household equity claims in any point in time is thus $P_t^E E_t$.

The value of debt is more complicated because it is typically issued in different vintages, each with its own price (a situation similar to the vintages of productive capital in equation [1]). Borrowers (firms in this case) typically carry debt at par value on their books, whereas value of the debt to the (household) lenders depends on market price at each point in time P_t^D. In a model with perfect information, this is not a problem and the aggregate value of the debt instruments carried on the household balance sheet is thus D_t^B. (With imperfect information, the "mark-to-market" disconnect, discussed above, can arise.) Net household assets (with just one type of debt, issued by business) are thus

$$(8) \qquad P_t^E E_t + P_t^D D_t = W_t ,$$

where W_t is household net worth, and intrahousehold lending nets out.

Ignoring sector distinctions and financial assets held by business (or treating them as just another form of K), the net capital income originating in the business sector is transferred to households via interest, dividends, capital gains, or additions to equity. Thus,

$$(9) \qquad \rho_t P_t^I K_t = \sum_n i_{t,n}^D P_t^D D_{t,n} + i_t^E P_t^E E_t ,$$

where

i_N^D = interest rate paid on loan/debt security type n;
$P^D D_n$ = net value of liability in loan/debt security type n;
i^E = return on equity (ROE); and
$P^E E$ = value of equity.

The return to financial instruments held by households is derived from the return to the underlying income-generating assets K_t. This is true even when the intermediation process has multiple stages. Each stage involves a transaction in which an intermediate instrument is transferred from seller to buyer. For example, a pension plan may hold the assets of different managed funds, which may themselves hold the pooled assets of other funds, as well as options and other derivatives. The financial instruments held by households are the last stage in the chain, whatever its length and complexity, but the connection between saving to investment still occurs.

A great deal of simplification is achieved under the conditions of the Modigliani-Miller Theorem, which states that the value of the firm in equation (6) is independent of the debt-equity ratio under certain assumptions.

By implication, net worth is independent of the degree of leverage. In the M&M world, the degree of complexity of the financial instruments connecting the source of income to its distribution to wealth holders is not a problem *per se*, as long as arbitrage works to correct valuation "mistakes" at each point in the chain of intermediation.

5.5 Tobin's Average *q* Statistic

5.5.1 The "*q*" Theory

Tobin's average q is a statistic that links the real and financial sides of asset valuation. It thus has a potentially useful role in any discussion of the adequacy of macroeconomic data systems both before and after large-scale financial crises. Tobin's average q is defined in the CFM context as the ratio of the value of households' wealth (as ultimate owners of businesses) to the value of the income-generating capital held by businesses, or, in the notation of the preceding section:

$$q = \frac{P_t^E E_t + P_t^D D_t}{P_{t,0}^I K_t + F_t^B} = \frac{W_t}{V_t}. \tag{10}$$

Under the Modigliani-Miller Theorem and the strong Efficient Market Hypothesis, Tobin's marginal q should equal one in a closed economy, given the following conditions: zero-rents and constant returns to scale, no adjustment costs, all capital is measured, and the value of the capital stock is constantly revalued. In this situation, Hayashi (1982) shows that average q is also equal to one under these conditions, implying that wealth W_t equals the value of capital stock, V_t, regardless of the degree of financial intermediation or the degree of leverage in the system.

Financial intermediation is present even in the model where q always equals one. The q in equation (8) is based on capital and wealth values at the end points of the intermediation chain. A more general formulation would go beyond the formulation $W_t = q_t V_t$ and allow for a separate q_i ratio for each transaction stage in the intermediation process, defined as the ratio of the value perceived by the owner of the asset and the value as perceived by the buyer. The stages are not independent, in the sense that the separate q_i ratios in any year refer back to the value of the same income-generating asset:

$$P^E = \left(q_N \times q_{N-1} \ldots q_1\right) P^I = qP^I. \tag{11}$$

In the efficient market M&M world, this detail is superfluous, since the individual q_i are all equal to one. In variants of the q model in which this condition does not always hold, equation (11) could be used to identify the points of "failure" in the intermediation process. However, while this formulation may work as an expository device, it fails at a practical level. In the modern financial world of complex financial intermediation, there may be no single chain of q_i emanating from an initial dollar of V_t. Instead, there are multiple chains, just as there are usually multiple chains feeding into each dollar of W_t from different productive assets. This is the "risk map" problem.

5.5.2 Nonunitary Values of q

Violation of some of the assumptions may cause the level of average q to deviate from one. Hayashi shows that the existence of adjustment costs may cause this to happen, even though markets are efficient and profit is maximized. Moreover, the systematic omission of certain types of capital assets from the accounts, like the intangible capital studied by Corrado, Hulten, and Sichel (2005, 2009) will cause an upward bias in average q, since the unreported capital lowers measured V_t while it is included in W_t in an efficient market.[10]

The cyclical mismeasurement of capital can also lead to a nonunitary value of q. We have already noted that the perpetual inventory method of measuring V_t is not robust against an unexpected shock to the economic system. Capital is measured at replacement cost of an equivalent amount of new assets, as per equations (1″) and (2), and uses the vintage value $(1 - \delta)^s P^I_{t,0} I_{t,0}$ as a proxy for the value $P^I_{t,s} I_{t,s}$ in equation (1). The latter may decline in face of a shock because the remaining present value $P^I_{t,s}$ in equation (3), because effective $I_{t,s}$ declines as a result of bankruptcy or retirements from service, or because the rate at which capital is utilized falls. These declines will generally not be measured when $(1 - \delta)^s P^I_{t,0} I_{t,0}$ is used in the PIM. The result is that the replacement value of q based on using equation (1″) in the denominator will show a procyclical pattern, even if the true value of q^e measured as per equation (1) remained equal to one.

Asset-market disequilibrium can also lead q to deviate from one. The increase in complexity of the intermediation process and associated lack of transparency may have put pressure on the arbitrage processes of financial markets and created concerns about the reliability of the counterparties involved in certain transactions. In such cases, valuations based on equations like (3) and (7) may diverge, even though they are based on the same income-generating asset. The mark-to-market versus hold-to-maturity value of some assets (e.g., CDOs) seems to have diverged during the financial crisis because of a lack of transparency and the liquidity problems faced by some lenders who engaged in short-maturity borrowing to fund longer-maturity investments. If the wealth term in the numerator of the q ratio were valued

10. Hulten and Hao (2008) illustrate the importance of including intangible capital in estimates of the q ratio in their study of the price-to-book ratios of a sample of more than 600 R&D-oriented US corporations in 2006. The price-to-book ratio is the ratio of market capitalization to balance sheet net worth and is thus a variant of the q ratio. When intangible capital is added to the denominator of the price-to-book ratio, and tangible capital stock is adjusted to reflect current rather than historical prices, balance-sheet net worth explains 86 percent of the market capitalization of the firms. Without intangible capital, only 42 percent is explained.

on a M2M basis, while the valuation of capital held by business continued on a H2M basis, the disconnect would cause the ratio to fall during the financial crisis and return to its previous value in the aftermath. On the other hand, if both the numerator and denominator were M2M, the ratio would remain relatively stable, although not necessarily equal to one.

The numerator of the q ratio is much more prone to financial speculation than the value of underlying productive assets, and is another potential factor in the volatility of q. Here the mechanism is the wave of technology starting in the mid-1980s that made trading very cheap and more-or-less instantaneous, and not primarily the complexity/nontransparency mechanism. Computerized momentum trading, hedging strategies, and winners-curse are plausible factors causing more volatility in W_t than in V_t, leading to cyclical fluctuation in the q ratio.

The overall conclusion of this analysis is that Tobin's average q may be a weak statistic to use a priori to detect conditions that could lead to a financial crisis and to track a financial crisis should it occur. A crisis could occur with a cyclically varying value of q or with one that is relatively stable. Nor is a high q evidence about the cause of the crisis, given that its value may reflect mismeasurement of capital stocks. Still, the evidence presented in the following section suggests that variations in q over the last two decades have corresponded to real fluctuations in the economy and financial markets.

5.5.3 The Empirics of Tobin's q

The actual value of Tobin's q in any year is an empirical matter. We have therefore calculated the ratio for the years from 1960 to 2012 for the consolidated total US domestic private sector; that is, a sector that includes assets held by households and nonprofit institutions as well as businesses. Our estimates are based on data from the Flow of Funds Accounts (as they were known until recently) and integrated macroeconomic accounts, transformed to reflect the two-sector framework of the CFM and the q (equation [10]). These transformations are not typical, given the five-sector organization of the data, and the equilibrium orientation of each of these sectoral accounts, but all told they are straightforward and described in detail in the notes to charts.

The resulting q ratios are shown in figure 5.3. Consider first the solid line. Its numerator is essentially the value of household net worth (the sector's direct holdings of nonfinancial assets plus its net financial holdings), and its denominator is the value of all private nonfinancial assets at replacement cost. Debt holdings are almost completely consolidated in the numerator of this q ratio. The q ratio shows a steady rise starting in the late 1980s, and an acceleration in the mid-1990s leading to a peak in 2000, some 20 percent above the baseline value of one. This was followed by a sharp decline associated with the "tech wreck," with q falling back to the latter after a few years.

The value of q then began to rise again, retracing its 20 percent rise to

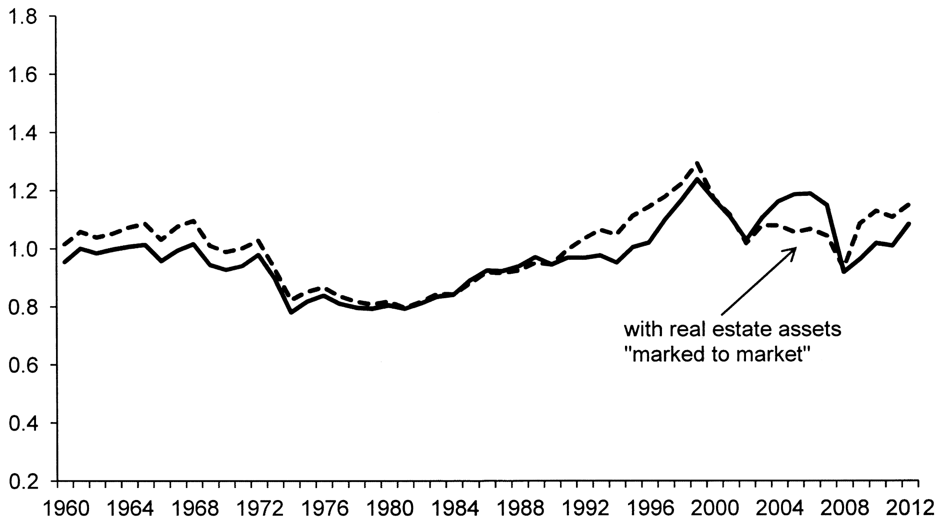

Fig. 5.3 Private sector Q: Value of financial claims relative to the replacement cost of privately held assets, 1960 to 2012

Source: Authors' elaboration of data from the Federal Reserve's Financial Accounts as of March 7, 2013, on the Federal Reserve website. Data for business intangible assets are from an unpublished update to Corrado and Hulten (2010) and Corrado, Hulten, and Sichel (2009).

Note: Financial claims are calculated as household net worth adjusted for (1) foreign holdings of domestic equity and debt issues, (2) household holdings of foreign equity issues, and (3) the net foreign investment position of the United States. The replacement cost of privately held productive assets includes assets held by (1) the IMA business sectors (financial business, nonfinancial corporations, and nonfinancial, noncorporate business); (2) its households and nonprofit institutions sector; and (3) business intangible assets not capitalized in the national accounts as of March 2013. The value of land is not included in replacement-cost measures. To account for this on the level of the Q ratio, the ratio in 1990 is indexed to a ratio calculated using real estate assets at market value in that year. The actual series for the ratio using real estate assets at market value is plotted as the dashed line, that is, where actual land values are used throughout.

its peak in 2007, followed again by a crash as the housing bubble burst and the financial crisis took hold. It has risen from its trough of around 0.90 to its 2012 value of around 1.10. The volatile pattern of the q ratio over these twenty years tracks fairly closely the volatility of the assets markets over the same period.

These results (the solid line) are based on the replacement version of q in which the value of capital in the denominator is based on the PIM, and they are therefore prone to the procyclical behavior noted above. The dashed line in figure 5.3 attempts to correct for this potential bias in the one class of business capital for which an adjustment can be made, real estate. The correction, reflected in the difference between the modified q ratio of the dashed line and the conventional solid line, makes an M2M adjustment for housing in the denominator of the ratio. The increase in the modified q^e ratio in the period preceding the financial crisis (2003 to 2007) now appears muted, rising to a value less than 1.10 before falling to the trough value of around 0.9. This pattern invites the question: What would the dashed line look like if we could measure all types of capital in the denominator on a M2M basis?

These patterns correlate well with the observed facts on the ground: the rise and fall of the stock market over the period of the tech boom and bust, and the collapse and recovery of household net worth. This correlation adds verisimilitude to the use of the Tobin's q, in either form, as an indicator of economic problems. This statistic is not, however, dispositive as to the mechanisms causing the observed patterns. Or, more precisely, as to the relative importance of the various factors that were potentially at work, or the points in the financial intermediation chain where these factors were operative.

5.5.4 Debt and Leverage

The Modigliani-Miller Theorem implies that leverage is not a determinant of asset valuation and should not affect the equilibrium value of q. However, many observers have pointed to a high degree of leverage in many systemically important financial institutions as a factor that greatly deepened the financial crisis. Curiously, the balance sheet data that are available from integrated macroeconomic accounts did not reveal the risks that were building on financial business balance sheets during the period leading up to the financial crisis (Palumbo and Parker 2009). Part of the difficulty owes to the aggregate nature of instruments and institution types in these accounts; another lies in their lack of information on the market values of debt. Although not all assets of financial businesses that were held in the form of debt securities were illiquid, the much-discussed maturity mismatch and build-up of short-term debt at systemically important institutions is not very evident in these data.

The upper panel of figure 5.4 depicts simple leverage ratios based on the balance sheet information for two of the three major business sectors in the IMAs (nonfinancial corporations and financial business). For each major sector, total assets/liabilities as a multiple of the value of equity is shown; that is, the following ratio is calculated:

$$(12) \qquad LVr = \left(\sum_{n} P^D D_n + P^E E \right) / P^E E.$$

The value of LVr for financial intermediaries as a whole (financial business) is shown on the right scale, and exhibits no evidence of overleverage, consistent with Palumbo-Parker. It should be noted that leverage ratios for individual banks calculated using total assets as a multiple of tangible common equity are one of the most basic measures of capital adequacy used in the regulatory analysis of banks and are similar to the ratio we calculate.

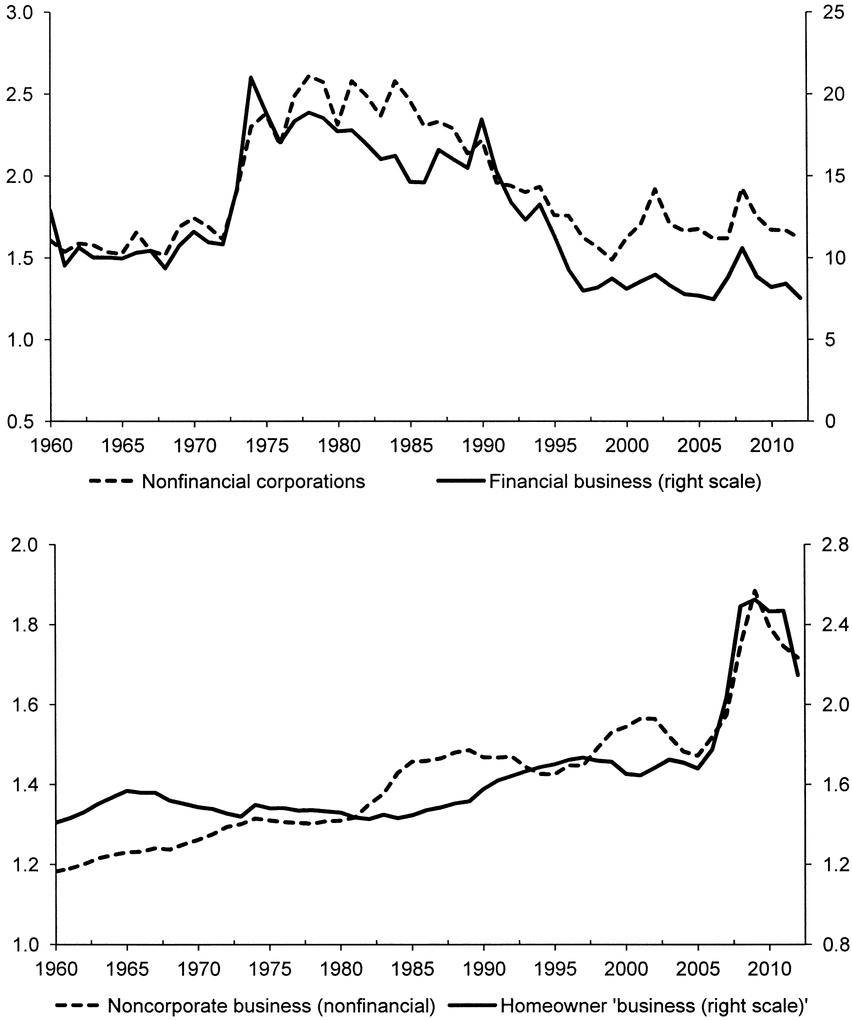

Fig. 5.4 Sector financial claims as a multiple of sector equity, 1960 to 2012

Source: Authors' elaboration of data from the Federal Reserve's Financial Accounts, as of March 7, 2013, on the Federal Reserve website.

Notes: Upper panel: For nonfinancial corporations, sector financial claims are total liabilities as shown in the sector's IMA balance sheet (table S.5.a, line 129) divided by equity and investment shares (line 139). For financial business, sector financial claims are total liabilities (table S.6.a, line 131) divided by the sum of corporate equity issues (line 142), foreign direct investment in the United States (line 145), noncorporate equity (line 146), and net investment by nonfinancial parents in finance company subsidiaries (line 147). Bottom panel: For nonfinancial, noncorporate business equity, a "shadow" value of equity is used, namely, net worth calculated such that total liabilities equal total assets (table S.4.a, line 116) plus the liability shown as equity and investment shares (line 111), which consists of real estate owned by foreigners. Equity and sector financial claims for homeowner "business" are from the FA balance sheet table (B100). Equity in homeowner business is shown on line 51 (itself calculated as line 4, the market value of owner-occupied real estate less home mortgages), and total claims are then the market value of owner-occupied real estate, which includes vacant land and mobile homes.

The bottom panel shows ratios for households as homeowners (and labeled homeowner "business") and for the nonfinancial, noncorporate business sector. As may be seen, both ratios spike after 2005, and both show a steady building of leverage beginning in the 1980s. The finding for households as homeowers is consistent with Palumbo-Parker, who concluded that households could be seen to be overleveraged in the data—but note this ratio implicitly assumes homeowner "business" q equals one because, as per our earlier discussion, if we wished to build a q for homeowner "business," we would need a market valuation for the precise financial assets held as claims against homeowner real estate. This is nowhere to be found in the IMAs. The same can be said for its counterpart in the noncorporate business sector, which as noted earlier, has large real estate holdings against which marketed debt securities are held.

5.6 Conclusion

Macroeconomic models and forecasts have not had much success in anticipating past economic downturns, even before the Great Recession. Diagnosing why this is so is a complicated (and controversial) undertaking that will hopefully occupy the economics profession in the years to come. We have looked at only a piece of the puzzle in this chapter; the way macroeconomic data on income and wealth are organized, and where problems may exist. We have focused on the treatment of financial intermediation in the accounts and argued that the centrality of financial intermediation for the functioning of the economy needs to be recognized more clearly in accounting practice. We have addressed this problem by placing the financial intermediation process at the center of a modified Knightian circular flow model (our figure 5.2). In this modified framework, nonfinancial businesses and households are linked by financial intermediaries, rather than treating these intermediaries as just another resource-using industry. Recognition of this link helps explain how shocks that affect even small parts of the economy can propagate rapidly and widely.

We have also pointed to the fact that the current framework for the macroaccounts is essentially based on a model that assumes the data are generated in a world in which economic equilibrium prevails. This is the subtext of the equations set out in our section 5.4, which can be traced back to the accounting work of Christensen and Jorgenson (1969, 1970). This approach is a highly useful way of organizing and interpreting macroeconomic data, because it uses theory as a guide to accounting practice and vice versa. This symbiosis is useful for many purposes: measuring productivity, studying the determinants of economic growth, and tracking structural changes in the composition of GDP and GDI. Advances by the BEA in recent years—the IMAs, the development of a full production account, and the capitalization of R&D expenditures and artistic originals—have made the accounts even more relevant for understanding a changing economy.

This said, if the objective is to spot, or at least track, emerging asset bubbles, the assumption of asset-market equilibrium is not helpful. To the extent that asset bubbles and their consequences are disequilibrium phenomena, the a priori imposition of equilibrium on the collection and organization of macrodata may conceal the very problems that the accounts were intended to inform, or lead analysts to misinterpret the data that are available.

Accounting frameworks need to be robust against this problem. We have attempted a start in this direction by suggesting an alternative treatment of financial intermediation in the conventional circular flow framework. This alternative is hard to implement, but we have at least suggested how and where the macroaccounts might be changed to be linked to the microfinancial data needed for a full "risk map" of the intermediation process.

Beyond this, major problems loom. Assembling a sufficiently detailed micromap involves data capabilities that are underdeveloped. Moreover, the dynamic economic theory needed to extend the equations of equilibrium-based accounts to a disequilibrium world commands no consensus, even if it can be said to exist in a general form. How is imperfect information to be treated? Risk? Shifting expectations about future states of the world? Unemployed resources? It is not enough for accounting purposes to set out general theories about these phenomena, statisticians must have precise instructions about what new data are needed, which old data must be transformed or discarded, and how the results are to be fitted together to provide estimates of GDP and GDI and their components. Hicks was certainly right: a nasty job indeed.

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