Marking to Market, Liquidity, and Financial Stability

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This paper explores the financial stability implications of mark-to-market accounting, in particular its tendency to amplify financial cycles and the "reach for yield." Market prices play a dual role. Not only do they serve as a signal of the underlying fundamentals and the actions taken by market participants, they also serve a certification role and thereby influence these actions. When actions affect prices, and prices affect actions, the loop thus created can generate amplified responses—both in creating bubble-like booms in asset prices, and also in magnifying distress episodes in downturns.

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I. Introduction

Recent developments in financial markets have posed a challenge to commentators in their assessment of financial imbalances and the outlook for financial stability. On the one hand, signals emanating from the financial markets—in the form of low long-term interest rates, compressed yield spreads, and low implied volatility—seem to indicate a benign economic outlook, underpinned by generally strong corporate and sovereign balance sheets and well-anchored inflation expectations. However, commentators also point to the vulnerability of the benign outlook to several sources of downside risk, including doubts over the sustainability of the current pattern of global capital flows, the possibility of more aggressive tightening of official interest rates, and more generally, an overall repricing of credit risks (see, for instance, Bank of England [2004a, b] and International Monetary Fund [2005a, b]).

One phenomenon that has received particular attention is the "search for yield," otherwise known as the "quest for yield" or the "reach for yield," in which financial intermediaries and investors react to the compression of yield spreads by migrating down the spectrum of credit risk to higher-yielding, riskier assets. The greater flow of funds into the riskier asset classes then further contributes to the compression of yield spreads, inducing migration yet further down the risk spectrum. Central bankers and other public officials have expressed some concern at this phenomenon, airing worries that the true risks are being underpriced by the market. The Bank of England (BOE), in a recent issue of its *Financial Stability Review*, puts the matter thus:

> Financial intermediaries and investors appear to have continued their "search for yield" in a wide range of markets, holding positions that could leave them vulnerable to instability in the pattern of global capital flows and exchange rates, credit events or sharper-than-expected interest rate rises. A number of market participants have also discussed the possibility that risk is being underpriced. In the event of an adverse shock, any overaccumulation of exposures from the mis-pricing of assets may result in an abrupt, and costly, adjustment of balance sheets.[1]

Our paper is an attempt to shed light on the phenomenon of the "search for yield," focusing particular attention on the role of the accounting regime. It is our contention that, when combined with other trends in financial markets (such as financial innovation and the greater stress on short-term incentives), the marking to market of assets and liabilities may play an important role in the propagation of market dynamics that lead to the search for yield.

The proponents of marking to market have emphasized many of its merits. The market value of an asset reflects the amount at which that asset could be bought or sold in a current transaction between willing parties. Similarly, the market value of a liability reflects the amount at which that liability could be incurred or settled in a current transaction between willing parties. A measurement system that reflects the

1. Bank of England, (2004b, p. 49).

market values of assets and liabilities would, it is argued, provide a more accurate indicator of the true economic exposures faced by a firm, and hence lead to better insights into the risk profile of the firm currently in place so that investors could exercise better market discipline and corrective action on the firm's decisions. See Borio and Tsatsaronis (2004) for a wide-ranging discussion of accounting and financial stability.

The accounting scandals of recent years have further strengthened the hands of the proponents of fair value accounting. By shining a bright light into the dark corners of a firm's accounts, fair value accounting precludes the dubious practices of managers in hiding the consequences of their actions from the eyes of investors. Good corporate governance and fair value accounting are seen as two sides of the same coin.

The U.S. savings and loan (S&L) crisis is a case in point. The crisis stemmed in part from the fact that the (variable) interest rates on the S&Ls' deposit liabilities rose above the (fixed) rates earned on their mortgage assets. Traditional historical cost accounting masked the problem by allowing it only to show up gradually through negative annual net interest income. The insolvency of many S&Ls became clear eventually, but a fair value approach would arguably have highlighted the problem much earlier, and resolved it at a lower fiscal cost. See Michael (2004) for further elaboration of this point.

However, the arguments are far from being one-sided. Market prices play a dual role. Not only are they a reflection of the underlying fundamentals and actions, they also *affect* the market outcome through their influence on the actions of market participants. A crude example of such an effect would be the loss of discretion that results when regulatory solvency requirements dictate the cutting of risky positions in the face of adverse price movements. However, the feedback from prices to actions also works through more subtle channels. The managers of a publicly traded bank are accountable to their shareholders, and the various mechanisms put in place to ensure good governance, accountability, and transparency will place subtle (and sometimes not so subtle) constraints on actions. Thus, the management of a bank whose return on equity is lagging behind its peer group will feel pressure to remedy this by leveraging up its balance sheet, changing the composition of its portfolio, or cutting costs. Hedge funds or hedge fund-like institutions that have promised a minimum absolute return on equity will feel such pressures even more acutely. Accounting numbers provide a powerful spur to managers in their actions. They serve a certification role, and hence provide justification for the actions. In short, market prices serve the dual role of both *reflecting* the actions of market participants and serving as an *imperative* for future actions.

If decisions are made not only because one believes that the underlying fundamentals are right, but also because the prices provide the external validation for making such decisions, then there is a potential for a loop whereby prices affect actions, and actions affect prices. Once the loop is established, price changes may be amplified by endogenous responses within the financial system. Mark-to-market accounting gives added potency to market prices by endowing them with the external validation role for actions.

The arguments of the proponents of fair value accounting would be overwhelming in the context of completely frictionless markets where market prices fully reflect the fundamental values of all assets and liabilities. The benchmark results from economics—the efficiency properties of competitive equilibria—could then be invoked, and no further argument would be necessary. However, when there are imperfections in the market, the superiority of a mark-to-market regime is no longer so immediate. The relevant analogy here is with the "theory of the second best" from welfare economics. When there is more than one imperfection in a competitive economy, removing just one of these imperfections need not be welfare improving. It is possible that the removal of one of the imperfections magnifies the negative effects of the other imperfections to the detriment of overall welfare. Thus, simply moving to a mark-to-market regime without addressing the other imperfections in the financial system need not guarantee a welfare improvement.

The policy debate on accounting standards for financial firms has been given a sharper focus by the controversy surrounding the implementation of International Accounting Standard (IAS) 39 governing the accounting treatment of derivatives, itself modeled closely on its U.S. counterpart, Statement of Financial Accounting Standards (SFAS) 133. The European Union (EU) had initially set a deadline of January 2005 for all publicly quoted companies in the EU—numbering more than 7,000—to adopt IAS 39. However, the run-up to this deadline was fraught with controversy, and the EU decided to strike out key provisions of IAS 39 that relate to hedge accounting and mark-to-market rules. Discussions are still ongoing (see Goodhart and Taylor [2004] for a survey).

It would only be partially true to say that the hostility toward IAS 39 is attributable to its fair value provisions. Rather, the hostility arises from the way in which IAS 39 prescribes a "mixed attribute" classification, where some items are valued at market prices but others are carried at historical cost. IAS 39 requires items on the balance sheet to be placed in four categories:

- Originated loans.
- Held-to-maturity (HTM) investments.
- Financial assets available for sale (AFS).
- Trading assets and other items measured at fair value.

Originated loans and held-to-maturity investments are held at amortized cost. AFS assets are marked to market, but valuation changes are fed directly to shareholder equity (not via the profit and loss account). For trading assets, not only are they marked to market, but valuation changes are taken through the profit and loss account. Crucially, IAS 39 requires all derivatives to be marked to market and any changes in their valuations to be put through the profit and loss account, unless the derivative is used to hedge cash flow and stringent hedge accounting criteria are satisfied. IAS 39 sets out stringent hedge accounting rules whereby the hedging relationships should be clearly documented, reliably measurable, and actually effective.

Until recently, a thoroughgoing marking to market of financial assets and liabilities has been limited by the lack of reliable prices in deep and liquid markets. Loans, for instance, have not been traded in large enough quantities to give reliable

prices. The lack of standardization has also been an impediment to marking the loan book to market. These practical hurdles account for the "mixed attribute" nature of IAS 39.

All this is about to change. The advent of deep markets in credit derivatives is removing the practical barriers to marking loans to market. The price of a credit default swap can be used to price a notional loan corresponding to the standardized counterpart of such a loan, much like the price of a futures contract on a bond that indicates the price of a notional bond.

Thus, whereas the debate on full-blown marking to market has not yet taken place, it is easy to envisage such discussions taking place in the very near future. Our paper is an attempt to anticipate this debate, and air some of the issues at stake. Due to the double-edged nature of marking to market mentioned above, it would be reasonable to suppose that the conduct of financial institutions will be changed irretrievably by mark-to-market accounting. Mark-to-market accounting has already had a far-reaching impact on the conduct of market participants through those institutions that deal mainly with tradeable securities, such as hedge funds and the proprietary trading desks of investment banks. However, even these developments will pale into insignificance in comparison with the potential impact of the marking to market of loans and other previously illiquid assets.

The greater immediacy of fair values for capital and profitability may become a source of procyclicality, in which the cycles of boom and bust are amplified. In buoyant economic conditions, perceived credit risk might decline, leading to a rise in the fair value of banks' assets, which would in turn boost banks' capital and encourage an increase in lending, so strengthening the economic upswing. These same effects would go into reverse with a vengeance in downturns. As the economy declines, perceived credit risk increases, leading to a fall in the marked-to-market value of banks' assets, which would in turn erode banks' capital. This will result in a credit crunch that could reinforce the downturns. A recent position paper from the European Central Bank (ECB) conducts simulation exercises on EU banks' assets and capital that suggest the strong potential for amplification of the credit cycle (European Central Bank [2004]). The effects of fair value accounting could, therefore, have far-reaching consequences for the overall stability of the economy.

The regulators are aware of these dangers. The Basel Committee issued a press release in 2004[2] suggesting that credit improvements due to asset price fluctuations on the balance sheet should be disallowed for the purposes of calculating regulatory capital to short-circuit some of the procyclical effects (the idea being that changes in banks' capital resulting from cash flow hedges should not be fed directly into the calculation of Tier 1 and Tier 2 capital for regulatory purposes). However, whatever the adjustments made by the regulators, it is clear that the incentives for market participants will become sharpened by marking to market, and lead to amplification of the feedback mechanisms operating in the financial markets. The question would be *by how much*, rather than *whether*.

2. See Basel Committee on Banking Supervision (2004).

In what follows, we illustrate the amplifying effects of marking to market by outlining an example of a financial system, and exploring the consequences of the marking of assets and liabilities to market for market dynamics and asset prices. The example is not a full-fledged model, but rather an informal discussion that can serve as the precursor to such a model. As such, we will appeal to rather sweeping assumptions that belong only to a thumbnail sketch. However, we believe that the main factors identified in the framework can be given a fuller description in a more developed model.

II. Simplified Financial System

We develop our arguments in a highly simplified financial system that has three main constituents: households, financial intermediaries, and pension funds (Figure 1).

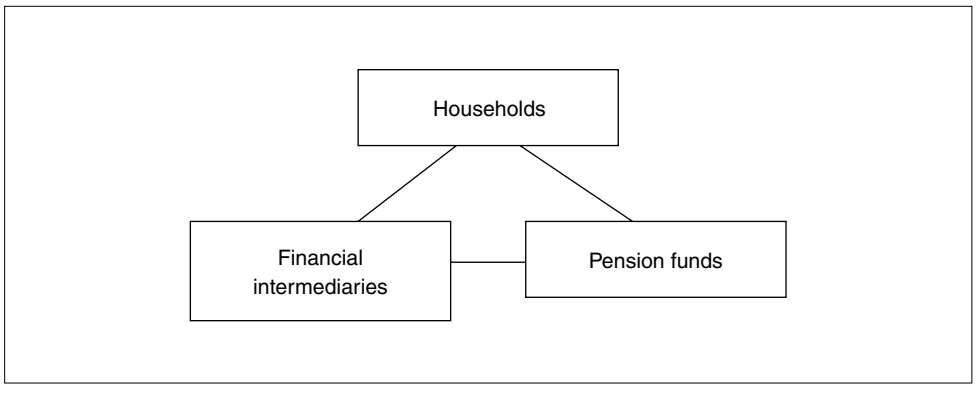
The financial system is built solely on property, which is held by households. The households finance part of their holding of property by borrowing from the financial intermediaries. Households also have other assets. They hold a claim on the pension funds in the form of annuities and future pension claims. They are also equity holders in the financial intermediaries and pension funds. These are other assets as indicated on the balance sheet of the households, as depicted in Figure 2.

The aggregate balance sheet of the households masks the diversity of the individual households. Some households would be more leveraged than others. The response of the household sector to changes in property prices will depend on the distribution of the mortgage liabilities within the sector. We return to this issue below.

The financial intermediaries lend to the households to finance the purchase of property, and the household mortgages constitute the main asset of the financial intermediaries. In turn, the intermediaries finance their lending by issuing liabilities in the form of marketable bonds. We will assume that these bonds are perpetuities that pay a constant coupon, so that the bonds' payoff stream is (1, 1, 1, . . .).

The financial intermediaries in our framework are reminiscent of the mortgage agencies in the United States such as the Federal National Mortgage Association

Figure 1 Constituents of the Financial System



(FNMA), known as Fannie Mae. In our framework, the only real asset that underpins the financial system is property, but a more realistic framework would incorporate firms that borrow from households by issuing corporate bonds. Claims on sovereigns could also be incorporated in a more developed framework. For our purposes, confining attention to property as the sole real asset has the virtue of narrowing down the questions. The balance sheet of the financial intermediaries is given in Figure 3.

Pension funds hold a combination of cash and the bonds issued by the financial intermediaries on the asset side of their balance sheet. With these assets, they must meet the pension liabilities to the households. The balance sheet of the pension funds is depicted in Figure 4.

Figure 2 Balance Sheet of Households

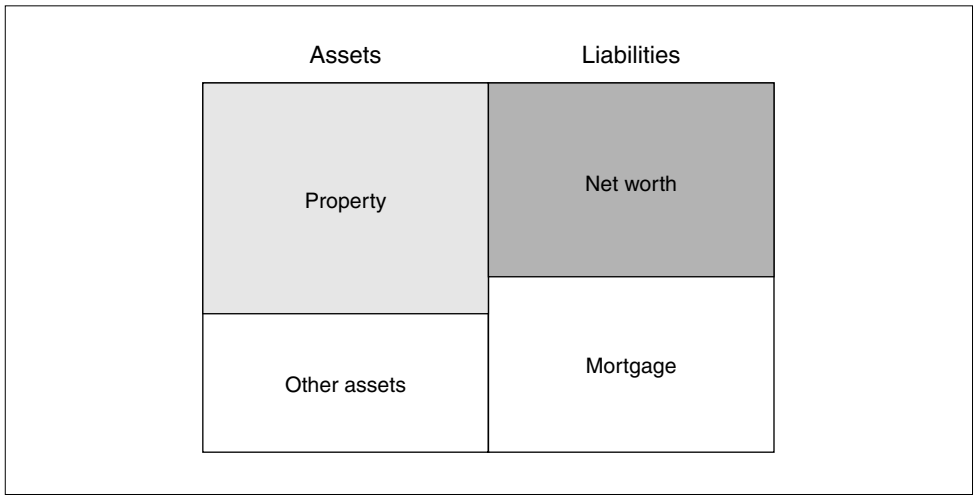


Figure 3 Balance Sheet of Financial Intermediaries

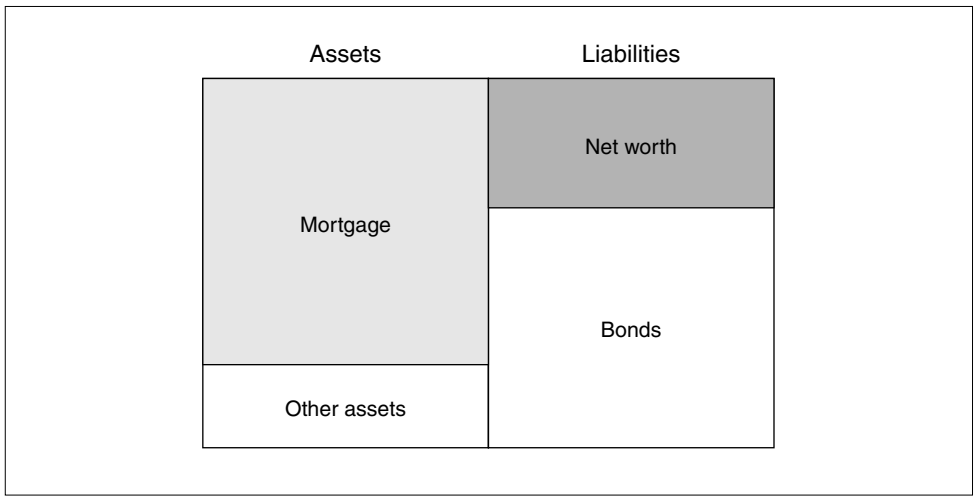
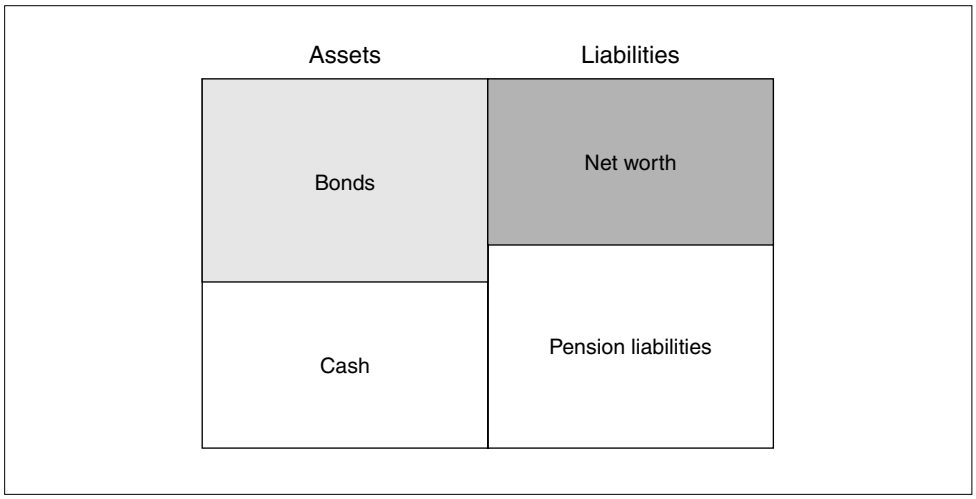


Figure 4 Balance Sheet of Pension Funds

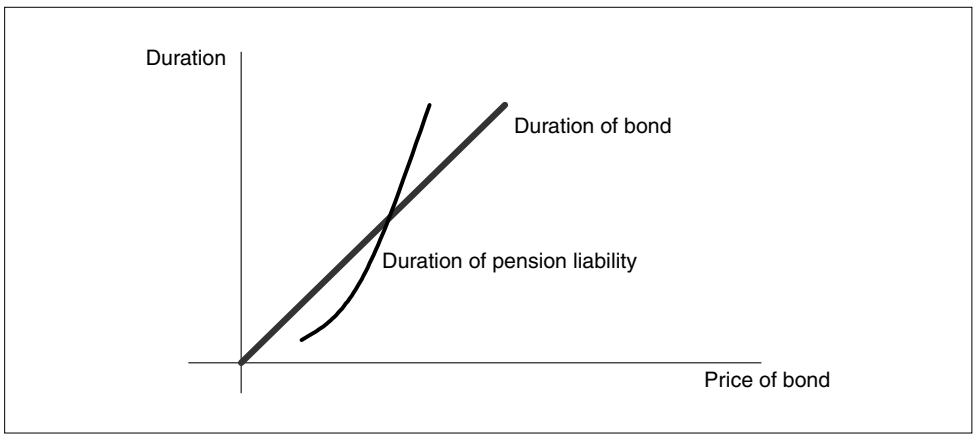


A. Marking Liabilities to Market

Pension funds hold a combination of cash and the bonds issued by the financial intermediaries to meet the pension liabilities to households. We will suppose that the pension funds are subject to regulations that require them to mark their liabilities to market (for instance, Financial Reporting Standard [FRS] 17 in the United Kingdom). In addition, we will assume that the pension funds are required by regulation to match the duration of their liabilities by holding assets of similar duration (Figure 5).

To mark their liabilities to market, the pension funds must calculate the present value of their stream of pension liabilities using the appropriate discount rate. In our simple framework, we do not have the full range of maturities of fixed income claims to accomplish this. We assume, as a crude approximation, that the zero coupon curve used to calculate the present value of pension liabilities is flat, with the intercept given by the yield of the perpetuity issued by the financial intermediary. Thus, if the

Figure 5 Duration of Pension Liability



price of the perpetuity is p, then the yield on the perpetuity is r such that

$$p = \frac{1}{r},$$

and the zero coupon curve used to calculate the pension liabilities is given by

$$(r, r, r, \ldots).$$

The pension funds are required by regulation to match the duration of their liabilities by holding assets of similar duration. The duration (or more accurately, the "modified duration") of the perpetuity is the sensitivity of its price to changes in its yield. The duration of the perpetuity is defined as

$$D = -\frac{dp/dr}{p},$$

and since $p = 1/r$, the duration of the perpetuity is given by

$$D = p,$$

so that the duration of the bond moves one-for-one with its price. Moreover, since the price of the bond determines its yield, and the pension fund marks its liabilities to market according to the yield on the bond, the marked-to market value of the pension liabilities will depend on the price of the bonds issued by the financial intermediaries.

Assume that the pension funds' liability stream is the sequence

$$(\lambda_1, \lambda_2, \lambda_3, \ldots),$$

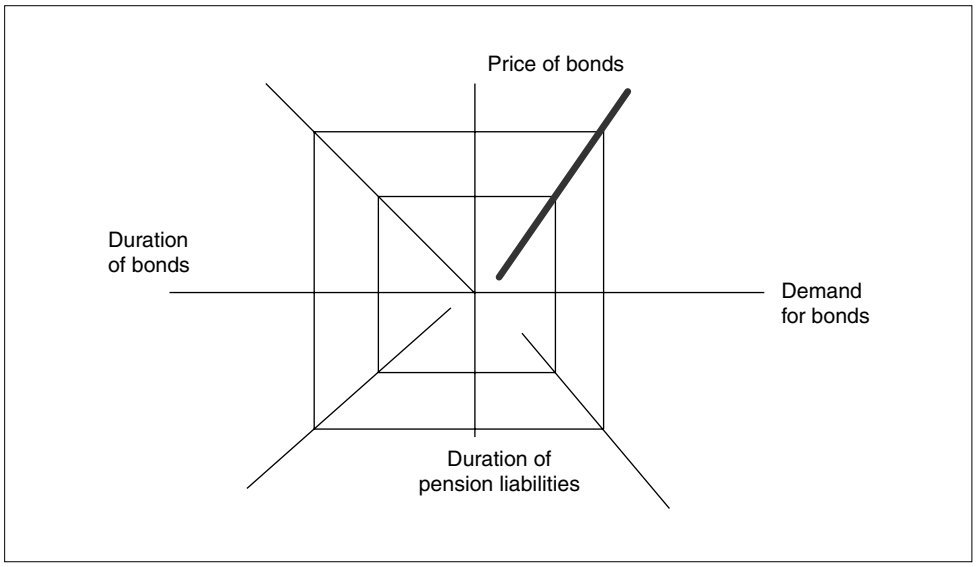
where $\lambda_1 < \lambda_2 < \lambda_3 < \ldots$. The increasing liability stream may reflect, for instance, the fact that pension flows grow with nominal earnings, and earnings rise over time. The implication of the upward-sloping profile of pension liabilities is that a unit of the pension liability stream which has the same price as the agency bond has, nevertheless, a higher duration. In other words, if q is the marked-to-market value of a unit of the pension liability such that $p = q$, we nevertheless have

$$-\frac{dq/dr}{q} > -\frac{dp/dr}{p}.$$

The pension funds must match the duration of their liabilities by holding the appropriate quantity of bonds. Since the duration of their liabilities is not replicated perfectly by the bonds, the pension funds must adjust their holding of bonds in response to changes in the price of the bond.

The demand for bonds turns out to be upward-sloping. Figure 6 illustrates the derivation of the demand for bonds by the pension funds, as shown in the top

Figure 6 Pension Fund Demand for Bonds



right-hand panel. This relationship is derived as follows. The top left-hand panel shows how the duration of the bond is increasing in its price. The bottom left-hand panel shows that the duration of the pension liability is an increasing function of the price of the bond. The key is the bottom right-hand panel. Since the duration of the pension liability is higher than the duration of the bond, any increase in the duration of the bond will lead to an even greater duration of the pension liability, and the pension fund must hold more of the bond (and less cash) to match the overall duration of the liability. This leads to the upward-sloping demand for bonds.

The consequence of the duration matching requirement for pension funds is to restrict their discretion in choosing their portfolio. In response to the fall in the yield of the bond, their reaction is the perverse one of increasing their holding of the bond still further. We now turn to how the market for bonds may interact with that for property.

B. Bond Issuance and Property Prices

Faced with the increased demand for bonds by the pension funds, the financial intermediaries must decide whether to accommodate the increased demand by issuing more bonds. If they do so, the financial intermediaries will be increasing the size of their liabilities, but in return will be obtaining cash on the asset side of their balance sheets. The question is what the financial intermediaries are able to do with the cash that is so obtained.

We will assume that the financial intermediaries can always find households that are willing to borrow from them to finance the purchase of property. Thus, from the point of view of the financial intermediaries, they can always accommodate the greater demand for bonds by issuing new bonds, and lending the proceeds out to households, thereby increasing the mortgage claims on the households. In effect, the financial intermediaries respond to the greater demand for bonds by increasing the

size of their balance sheet—by increasing the amount of bonds outstanding and increasing mortgage claims against households.

The upshot of our assumption on the behavior of the financial intermediaries is that an increase in the demand for bonds by the pension funds leads to a net flow of funds into the property sector, via the financial intermediaries' balance sheets. The response of property prices to this increased flow into the property sector is crucial to our story.

It is important for our framework that the greater flow of funds into the property sector leads to an increase in property prices. A very simple way to achieve this is to assume that the price of property is established by "cash in the market" pricing, where the price is the ratio of the funds seeking to purchase property to the available supply of property. This is a variation of the Shapley and Shubik (1977) model of trade between commodities in which the price of one good in terms of another is the ratio of the quantities offered in exchange. Allen and Gale (2004a, b) and Diamond and Rajan (2005) have recently popularized this approach to price determination in financial markets for the study of market liquidity.

"Cash in the market" pricing is illustrated in Figure 7. If M dollars of funds are seeking to purchase property and there is supply s of property on the market, then the price of property is v dollars, where

$$v = \frac{M}{s}.$$

This is equivalent to the outcome in a competitive market where the demand for property is the rectangular hyperbola M/v, and the supply is fixed at s. Figure 7 illustrates that when M increases, there is an outward shift in the demand curve and the price of property increases to v'.

Figure 7 "Cash in the Market" Pricing of Property

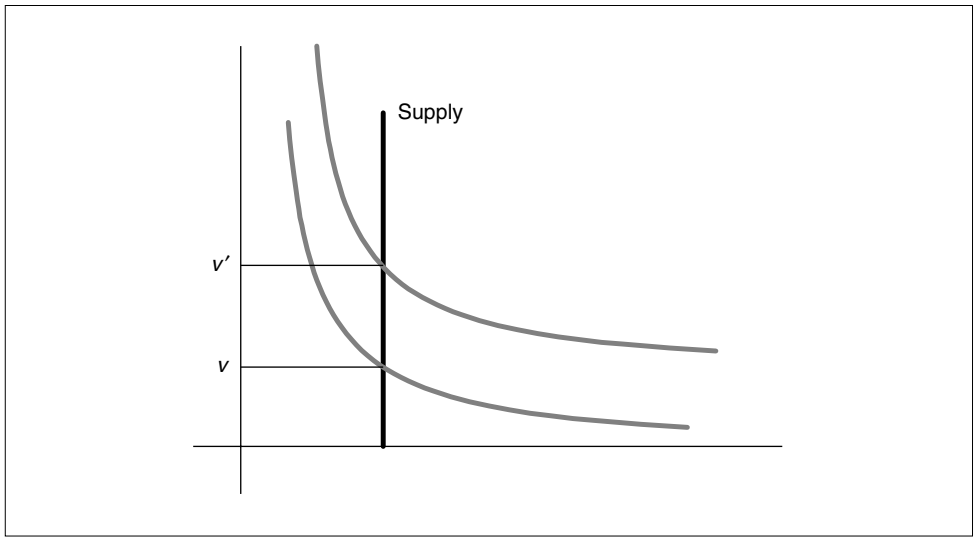
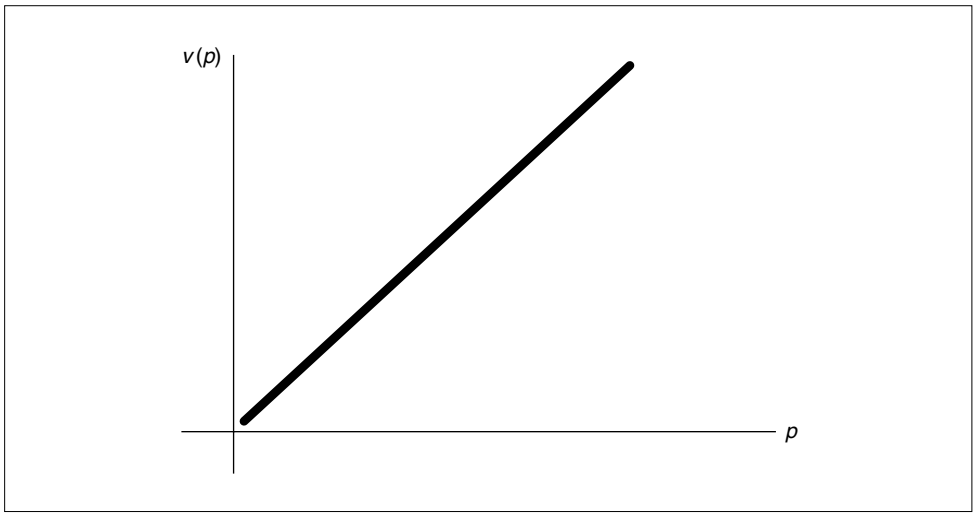


Figure 8 Property Price as a Function of Bond Price



Bringing the various elements of the story together, we can now trace the impact of the pension funds' increased demand for bonds on property prices. We have already commented above that as the price of bonds p increases, pension funds demand a larger holding of bonds. The financial intermediaries accommodate this increased demand for bonds by issuing new bonds, and lending out the proceeds from the bond issuance to households in return for mortgage claims against households. Finally, the households then invest the borrowed funds in the property sector, raising the price of property v. Thus, an increase in bond price p is associated with an increase in property price v. We can thus define $v(p)$ as the price of property that is consistent with the bond price at p. Figure 8 depicts this function.

III. The Search for Yield

As property prices increase, the net worth of the household borrowers who have invested in property increases. To the extent that the loans to the household sector are collateralized against property, the rise in property prices raises the credit quality of the mortgage claims held by the financial intermediaries against household borrowers, raising the marked-to-market value of the assets on the financial intermediaries' balance sheets. In turn, the increase in the marked-to-market value of the mortgage claims increases the marked-to-market net worth of the financial intermediaries, leading to an improvement in the credit quality of the bonds issued by the financial intermediaries. We thus have the following chain of implications.

v increases
⇓
Increased household net worth
⇓
Increased net worth for financial intermediaries
⇓
p increases.

Thus, we can define the value $p(v)$ for the price of bonds that is an increasing function of the price of property. Figure 9 illustrates this increasing relationship. Since the increase in p is due to the increasing value of the assets that back the bond, there is an upper bound to p given by the price of the risk-free counterpart to the bond. This upper bound is indicated by the dashed line.

We can now bring the ingredients together to examine how the price of property interacts with the price of the bond. Let us define $h(\cdot)$ as the inverse of the function $v(p)$. Thus, $h(v)$ is the price p of the bond that would give rise to price v of property. Plotting $h(v)$ and $p(v)$ on the same figure, we can derive the combination (v, p) of the property price and bond price that would be mutually consistent. This is indicated in Figure 10. With this framework, we can conduct some comparative statics with respect to some of the key quantities. Let us consider first the effect of looser monetary policy (through both official interest rates and communication strategies) that induces a fall in the yield of long-maturity Treasuries (Figure 11).

As the yields on long-maturity Treasuries decline, this induces a shift upward in the price of bonds that is commensurate with the perceived risk premium. This initial movement is indicated by the upward-pointing arrow following the upward shift in the $p(v)$ curve. However, this initial change sets off a response from the property market. The higher price of bonds increases the demand for bonds from the

Figure 9 Bond Price as a Function of Property Price

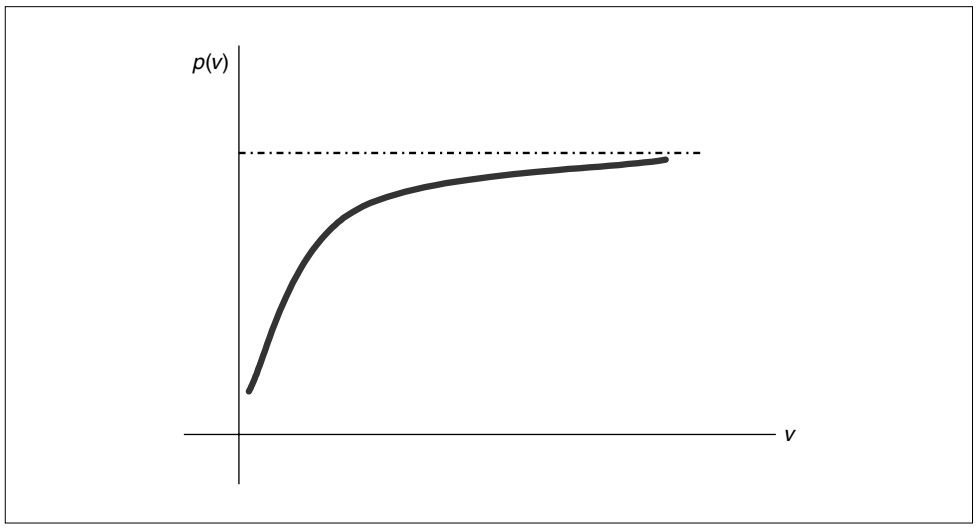


Figure 10 Joint Determination of *v* and *p*

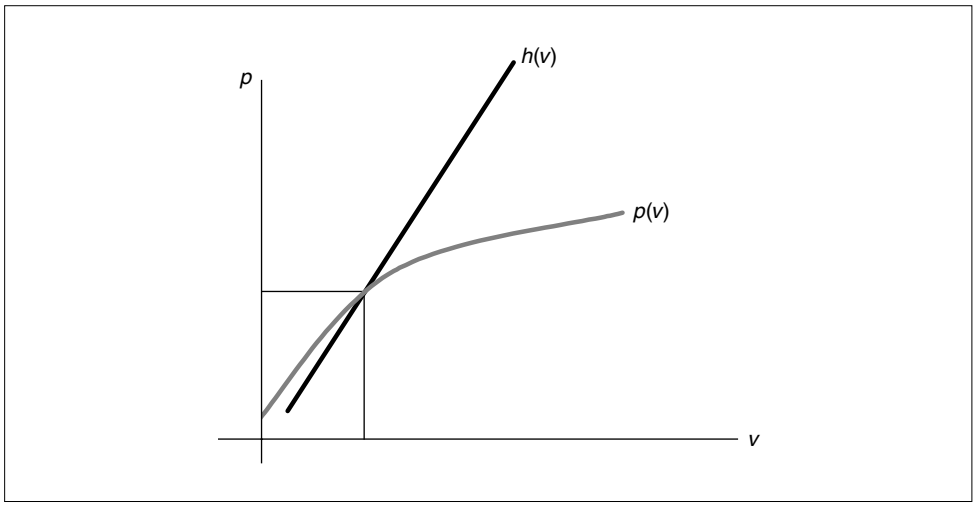
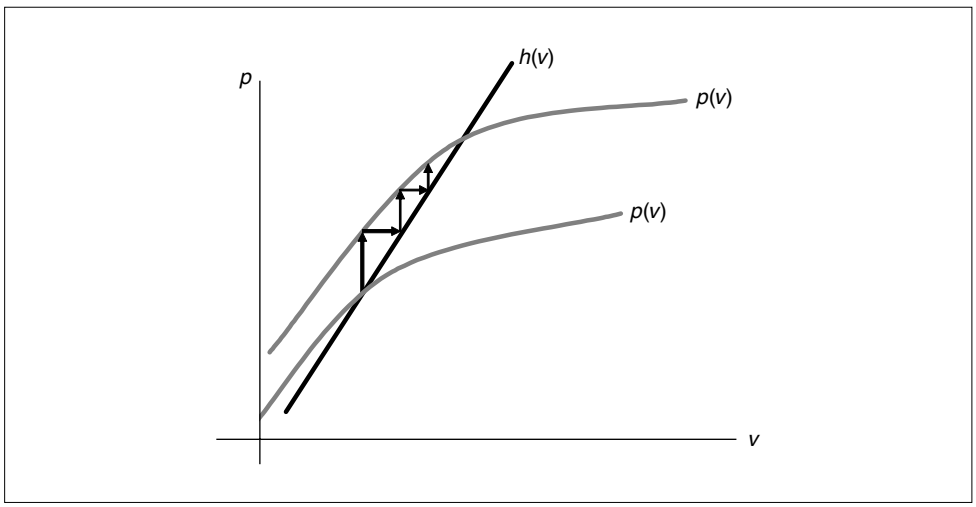


Figure 11 Effect of Looser Monetary Policy

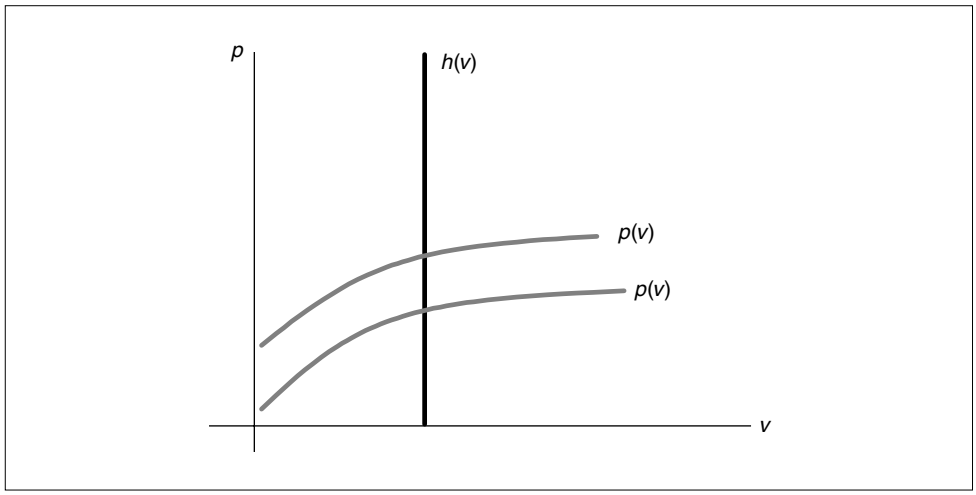


pension funds, and this increased demand is accommodated by the financial intermediaries. The proceeds from the bond issue end up in the property market, driving up the price of property. This second-round effect is indicated by the horizontal arrow pointing right, indicating an increase in v, the price of property.

The knock-on effects then propagate through the financial system. The second-round increase in v feeds through to higher credit quality of the bonds, which induces a further increase in the price of bonds. This is indicated by the second vertical arrow, representing an increase in the price of bonds. In turn, this induces a further increase in property prices, and so on. The financial system finds its new equilibrium where the higher $p(v)$ curve meets the $h(v)$ function.

The importance of marking assets and liabilities to market cannot be overemphasized. The slopes of the $p(v)$ curve and $h(v)$ are determined by the accounting regime

Figure 12 Historical Cost Regime



in place, and these slopes largely determine the size of the comparative statics effects. To see this, let us contrast the effect of looser monetary policy in a regime where neither assets nor liabilities are marked to market. Figure 12 illustrates the argument.

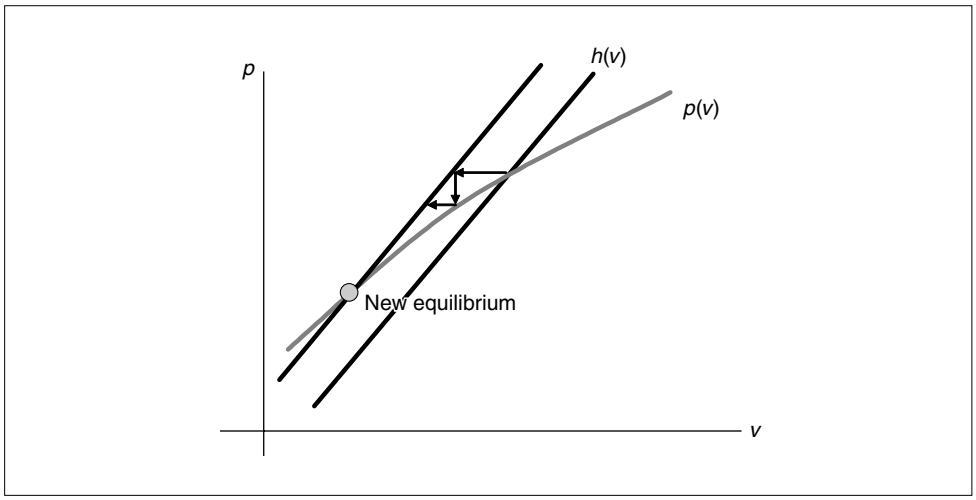
When liabilities are not marked to market, the channel of feedback from the price of bonds to the price of property is severed. Thus, the $h(v)$ function is vertical, indicating that the price of bonds does not have an effect on the price of property. The $p(v)$ curve may also be flatter as compared to the case when assets are marked to market due to the lesser impact of the credit improvement of the bonds. However, this feature is less important for what is to follow. The key difference between the mark-to-market regime and the historical cost regime is that the feedback channel from bond prices to property prices is less potent. The effect of looser monetary policy is simply to raise the price of bonds commensurate with the fall in the long-run Treasury rate, but the second-round impact on the property price is blocked due to the vertical $h(v)$ curve. Under the historical cost regime, the endogenously induced increase in the property price does not materialize.

IV. Reversal

The mechanism outlined above that produces the upward shift in asset prices could also be envisaged in its reverse form, where an initial shock to the system produces an amplified response of asset prices downward. In the downward direction, additional impetus could come from constraints on the actions of the financial intermediaries themselves. These additional channels will be discussed below. We begin, though, by working through the reversal of the mechanism that we have outlined above. Figure 13 illustrates the argument.

Starting from the initial intersection of the $h(v)$ function and the $p(v)$ curve, we follow through the impact of an exogenous fall in property prices, as represented by the leftward shift in the $h(v)$ function. The first horizontal arrow pointing left is the

Figure 13 Fall in Asset Prices



initial fall in the property price. This fall in the property price lowers the equity value of households, and so lowers the marked-to-market value of the mortgage assets held by the financial intermediaries. In turn, this fall in the value of the financial intermediaries' assets lowers the credit quality of the bonds issued by them, leading to a fall in p. This fall in p is represented by the vertical arrow pointing downward in Figure 13. The fall in p then lowers the pension funds' holding of bonds. The sale of bonds by pension funds would have to be absorbed by other alternative holders. In our simplified model, it is the financial intermediaries themselves that absorb the excess supply of bonds, and cancel them while at the same time reducing their loans to the household sector, which then leads to a decrease in the funds devoted to property, leading to a fall in the property price v.

This particular sequence sketched above is, of course, peculiar to our simplified model. The important overall feature that is necessary for the story is that a fall in the bond price (a rise in the long-term interest rates in bonds) leads to a fall in the property price. If we envisage the financial institution as being a mortgage agency such as Fannie Mae, then this particular feature would seem quite natural. The rise in long-term interest rates would be associated with a rise in mortgage rates, and this would have a dampening effect on the property market.

Figure 13 illustrates the interaction of the property price and the bond price following the further fall in property price. The credit quality of the assets backing the bonds declines further, leading to a further fall in the bond price, which then translates into sales of bonds by pension funds and further falls in the property price. The financial system comes to rest at the new intersection point where both the property price and the bond price are considerably lower than their initial values. Depending on the relative slopes of the two curves, the eventual impact of a fall in asset prices can be very substantial. Again, the accounting regime plays a key role.

A. Regulatory Capital Requirements

Mechanisms that operate "on the way down" may differ from the mechanisms that operate "on the way up." To elaborate on this point, let us modify our story somewhat by supposing that the financial intermediaries hold property directly on their balance sheet, and that they mark their holding of property to market. Neither of these assumptions is appropriate in normal times, but they are a good approximation to the situation following the bursting of a property bubble where defaulting borrowers have put property assets back to the lenders. For convenience, we refer to these intermediaries simply as "banks." Thus, the balance sheet of the banks looks as depicted in Figure 14.

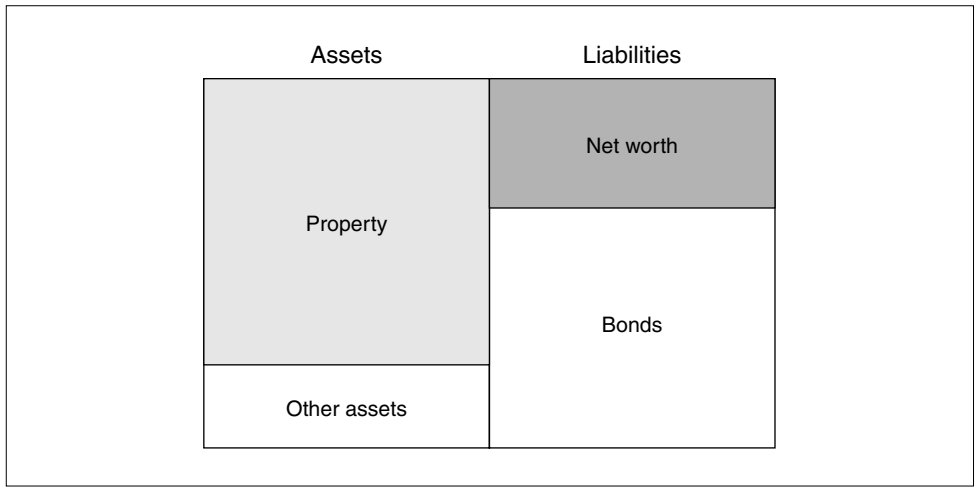
Assume that the assets held by the bank attract a regulatory minimum capital ratio, which stipulates that the ratio of the bank's capital—here taken to be simply its net worth—to the marked-to-market value of its assets must be above some prespecified ratio r^*. When a bank finds itself violating this constraint, it must sell some of its assets to reduce the size of its balance sheet.

We continue to denote the price of land as v. Further, let us denote bank i's holding of property by e_i, its holding of other assets by c_i, and its liabilities as l_i. It would be straightforward to extend this framework to take account of interbank loans (see Cifuentes, Ferrucci, and Shin [2005]). If we denote by s_i the amount of property sold by bank i, and by t_i the sale by bank i of its other assets, the regulatory capital adequacy constraint can be expressed as follows.

$$\frac{ve_i + c_i - l_i}{v(e_i - s_i) + (c_i - t_i)} \geq r^*. \tag{1}$$

The numerator is the equity value of the bank, while the denominator is the marked-to-market value of its assets after the sale of s_i units of property and sale t_i of the other assets. The underlying assumption is that the assets are sold for cash, and

Figure 14 Balance Sheet of Banks



that cash does not attract a capital requirement. Thus, if the bank sells s_i units of property, then it obtains vs_i of cash, and holds $v(e_i - s_i)$ worth of property. Hence, we have the sum of these (given by ve_i) in the numerator, while we have only the marked-to-market value of the post-sale holding of property (given by $v(e_i - s_i)$) in the denominator. By selling its assets for cash, the bank can reduce the size of its balance sheet, reduce the denominator in the capital to asset ratio, and thus satisfy the minimum capital asset ratio.

By rearranging the capital adequacy condition (1) together with the condition that s_i is positive only if $t_i = c_i$, we can write the sale s_i as a function of v. If the capital adequacy condition can be met by sales of other assets or from no sales of assets, then $s_i = 0$, but otherwise is given by

$$s_i = \min\left\{e_i, \frac{l_i - c_i - (1 - r^*)ve_i}{r^* v}\right\}.$$

Thus, the sale of property s_i is itself is a function of v, and we write $s_i(v)$, the sales by bank i, as a function of the price v. Let $s(v) = \sum_i s_i(v)$ be the aggregate sale of property given price v. Since each $s_i(\bullet)$ is decreasing in v, the aggregate sale function $s(v)$ is decreasing in v.

Let us suppose that sales of property by banks can be absorbed by other constituents in the economy, provided that the price is low enough. To give form to this idea, suppose that there is an exogenous demand function for property given by $d(v)$. An equilibrium price of property is a price v for which

$$s(v) = d(v).$$

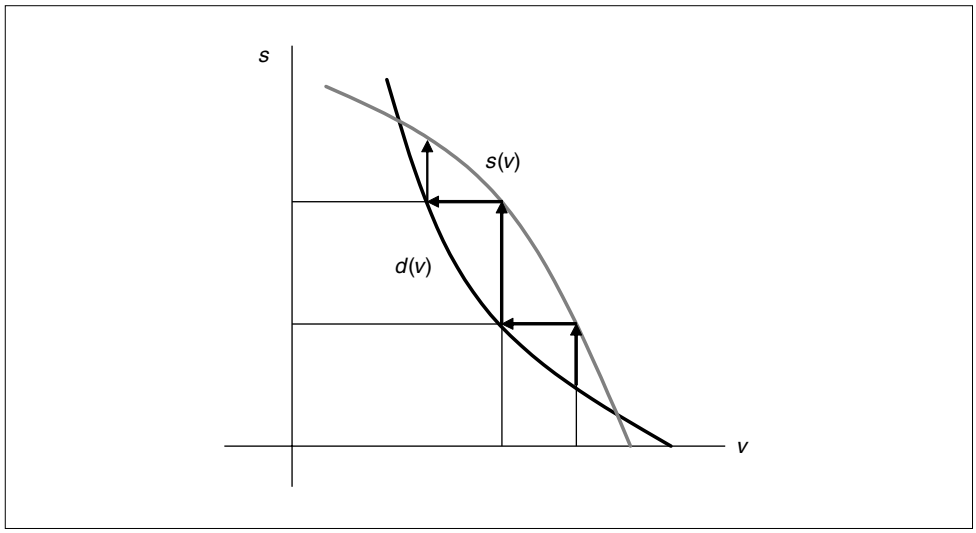
An initial shock to the property price may have an amplified response, if the additional sales of property cause the price to fall further. The argument is illustrated in Figure 15.

Consider a shock to the property price. The price adjustment process can be depicted as a step adjustment process in the arc below the $s(v)$ curve, but above the $d(v)$ curve. The process starts with a downward shock to the price of property. At the new lower price, the forced sales of the banks place a quantity of property on the market as indicated by the $s(v)$ curve. However, the additional supply of property pushes the price further down as implied by the $d(v)$ curve. This elicits further sales, implying an increased supply as indicated by the $s(v)$ curve. Given this increased supply, the price falls further, and so on. The price falls until we get to the nearest intersection point where the $d(v)$ curve and $s(v)$ curve cross. Equivalently, we may define the function Φ as

$$\Phi(v) = d^{-1}(s(v)),$$

and an equilibrium price of property is a fixed point of the mapping $\Phi(\bullet)$. The function $\Phi(\bullet)$ has the following interpretation. For any given price v, the value $\Phi(v)$ is the market-clearing price of the illiquid asset that results when the price of the illiquid asset on the banks' balance sheets are evaluated at price v. Thus, when

Figure 15 Amplified Fall in Property Price



$\Phi(v) < v$, we have the precondition for a downward spiral in the illiquid asset's price. The price that results from the sales is lower than the price at which the balance sheets are evaluated.

The lessons here are quite general. Changes in asset prices may interact with externally imposed solvency requirements or the internal risk controls of financial institutions to generate amplified endogenous responses that are disproportionately large relative to any initial shock. An initial shock that reduces the market value of a firm's balance sheet will elicit the disposal of assets or of trading positions. If the market's demand is less than perfectly elastic, such disposals will result in a short-run change in market prices. When assets are marked to market at the new prices, the externally imposed solvency constraints or the internally imposed risk controls may dictate further disposals. In turn, such disposals will have a further impact on market prices. In this way, the combination of mark-to-market accounting and solvency constraints have the potential to induce an endogenous response that far outweighs the initial shock.

Regulators are familiar with the potentially destabilizing effect of solvency constraints in distressed markets. To take one fairly recent instance, the decline in European stock markets in the summer of 2002 was met by the relaxation of various solvency tests applied to large financial institutions such as life insurance firms. In the United Kingdom, the usual "resilience test" applied to life insurance companies in which the firm must demonstrate solvency in the face of a further 25 percent market decline was diluted to preempt the destabilizing forced sales of stocks by the major market players.[3]

The Long-Term Capital Management (LTCM) crisis of 1998 can also be seen as an instance where credit interconnections and asset prices acted in concert as the

3. Financial Services Authority (2002a). See also Financial Services Authority (2002b).

main channel propagating widespread market distress (see Bank for International Settlements [1999], International Monetary Fund [1998], Furfine [1999], and Morris and Shin [1999]). Furfine (1999), for instance, cites the arguments used by the Federal Reserve to justify intervention during the LTCM crisis in 1998. The Fed wanted to contain the disruption that the liquidation of LTCM would impose on the markets where LTCM was a significant player, to avoid a spillover to other market participants without direct credit relationships with LTCM.

More generally, our paper follows the recent theoretical literature on banking and financial crises that emphasizes the limited capacity of the financial markets to absorb sales of assets (see Allen and Gale [2004b], Gorton and Huang [2004], and Schnabel and Shin [2004]), where the price repercussions of asset sales have important adverse welfare consequences. Similarly, the inefficient liquidation of long assets in Diamond and Rajan (2005) has an analogous effect. The shortage of aggregate liquidity that such liquidations bring about can generate contagious failures in the banking system.

One conclusion is that prudential regulation (in the form of minimum capital requirement ratios or other solvency constraints) when combined with mark-to-market rules can sometimes generate undesirable spillover effects. Marking to market enhances transparency, but may introduce a potential channel of contagion and become an important source of systemic risk.

Of course, any policy conclusions should also recognize the incentive effects of such rules. The adjustment mechanism outlined above only considers the *ex post* stability effects of capital requirements and marking to market for given portfolio choices, and not the positive *ex ante* effects on incentives. For example, capital requirements and mark-to-market rules may deter financial institutions from taking excessive risks *ex ante*. However, even if we modeled these *ex ante* incentive effects explicitly, the level of optimized liquid assets and capital held by financial institutions may still be suboptimal from the point of view of minimizing systemic risk, as individual institutions do not internalize the externalities of network membership. As long as the problem is one of externalities, leaving it up to individual institutions will not resolve the problem.

B. Balance-Sheet Interconnections

So far, we have not mentioned counterparty risk, or the possibility of defaults. A substantial body of work has examined balance-sheet interlinkages as a possible source of contagious failures of financial institutions. Most papers calibrate the models using actual cross-exposures in real banking systems (or an approximation of them) and simulate the effects of a shock to the system resulting from the failure of one or more institutions. Sheldon and Maurer (1998) study the Swiss banking system. Upper and Worms (2001) consider the German system. Furfine (1999) analyzes interlinkages in the U.S. federal funds market. Wells (2002) focuses on the U.K. banks. Elsinger, Lehar, and Summer (2002) consider an application to the Austrian banking system, and provide a stochastic extension of the framework (using the concept of value at risk). Cifuentes (2003) uses the same framework to analyze the link between banking concentration and systemic risk.

The main focus of these papers is on finding estimates of interbank credit exposures. Once this is determined, systemic robustness is assessed by simulating the effects on the system of the failure of one bank at a time. Importantly, solvency is assessed based on fixed prices that do not change through time. Such an assumption would be appropriate if the assets of the institutions do not undergo any changes in price, or if solvency is assessed based on historical prices. Invariably, a consistent finding of these papers is that systemic contagion is never significant in practice, even in the presence of large shocks. In the absence of price effects, this is hardly surprising, as interbank loans and deposits represent only a limited fraction of banks' balance sheets. Conventional wisdom is also that collateralization may have mitigated this risk further.

Cifuentes, Ferrucci, and Shin (2005) construct a model that incorporates both channels of contagion: direct balance-sheet interlinkages among financial institutions and contagion via changes in asset prices. Their results suggest that systemic risk in network models of bank failure may be quite large when the counterparty risks arising from chains of failures are augmented by changes in asset prices, even in the presence of collateralization. The reason is that the risk that materializes is not a credit risk but a market risk. This is a dimension to systemic contagion that is not addressed by the usual network models that keep prices constant.

V. Concluding Remarks

Debates on accounting standards have generated considerable controversy, but these debates are likely to become even more prominent in the future, and rightly so. Much hangs on the outcome of these debates.

It can be argued that mark-to-market accounting has already had a far-reaching impact on the conduct of market participants through those institutions that deal mainly with tradeable securities, such as hedge funds and the proprietary trading desks of investment banks. However, even these developments will pale into insignificance in comparison with the potential impact of the marking to market of loans and other previously illiquid assets. Financial innovation through the advent of credit derivatives has opened up the possibility of finding surrogate prices for standardized loans, much like the role played by bond futures based on notional bonds. Feasibility is no longer a hurdle to a thoroughgoing application of marking to market (or will not remain a hurdle for long). The relevant question for policymakers is this: *Even if we could mark to market, would we still want to do so*?

Far from being an obscure and arcane debate about measurement, accounting issues take on huge significance for financial stability. In this sense, accounting is too important to be left to the accountants. It deserves attention from central bankers and other policymakers as a cornerstone of policy targeting financial stability.

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Comment

ELI M. REMOLONA

Bank for International Settlements

First let me thank the Bank of Japan for inviting me to this conference and moreover for also letting me comment on such a wonderful paper.

I think it was *New York Times* columnist Paul Krugman who said that doing economic theory is like doing brain surgery. When you do brain surgery, if you do it well, you will have amazing results. But if you do not do it well, you will have a big mess! Hyun Song Shin, one of this paper's authors, is one of the best brain surgeons around. He knows the art of the toy model, which is to cut out all the inessentials and go straight to the core issues. This paper is a very good example of a toy model.

In substance, the paper is a note of caution about fair value accounting and marking to market. The general point is that marking to market is the first-best solution in what really is a second-best world. In particular, marking to market can engender financial instability.

Let me just say a few things about why we are in a second-best world. Let us go back to Grossman and Stiglitz (1980), who made the point that the cost of information is a fundamental non-convexity in financial markets. If you have this kind of non-convexity, asset prices cannot possibly reflect all available information. Hence, asset prices must be noisy, because this will give those who collect the information some advantage. Otherwise, they would not bother to get information or to analyze it.

In fact, earlier work by one of the paper's authors has shown for basically similar reasons that investors tend to focus on the same information and neglect a lot of other data (e.g., Allen, Morris, and Shin [2003]). An example of this would be the inordinate attention that is paid to the U.S. non-farm payroll number. Every first Friday of the month, the whole world waits for this number to be released, and the reaction of the markets makes it the single most important number in financial markets. This kind of response is completely out of line with this number's importance in terms of fundamentals. To a large extent, people pay attention to it because others do.

One source of noise in asset prices is time-varying risk premia. It is true that asset prices reflect fundamentals, but that does not mean we can tell from asset prices what the fundamentals are. Hence, if the idea of marking to market is to tell investors what the fundamentals are, then it is not going to work.

Let me provide an illustration. Figure 1 is a graph of credit spreads in the United States. The upper line is the Baa-rated spread shown over time starting from January 1994 to January 2005, and the lower line is the A-rated spread. It is very hard to tell what is going on just by looking at these spreads. For example, what happened during the peak in October 2002? Some might claim that it was news about the accounting restatements by WorldCom, the U.S. telecommunications giant. But this news was actually revealed three months earlier. If you look for events that happened around the peak, it is very hard to identify one that would justify such a peak.

Recently, of course, people have been looking at the unusually tight spreads that we have seen and saying, "We have a bubble in the credit markets." But how do we tell? I argue that we cannot really tell. Here is what theory says. In a well-known paper by Jarrow, Lando, and Yu (2005), the most interesting result is proposition 3.2, which says something like this: "The economy consists of a money market account with a short rate and an infinite collection of traded securities. Under the pricing measure Q, default risk is conditionally diversifiable and defaults are conditionally independent. Then the Q-intensity is equal to the P-intensity for all i, where i indicates a particular bond in existence." In English, if we can diversify, the credit spread at the short end should be equal to the expected loss from default. That is the theory, and it is a sensible one.

But here are the facts. Figure 2 is taken from Amato and Remolona (2003). In the left-hand panel, the line is the average spread for different credit ratings from AAA to BB, thus starting from the least risky and going to the most risky in our sample. The bars are average default losses over five years. As we can see, there is a very wide gap between the line and the bars. It is highly unlikely that the two sets of statistics are consistent with proposition 3.2 of Jarrow, Lando, and Yu (2005).

Figure 1 Credit Spreads

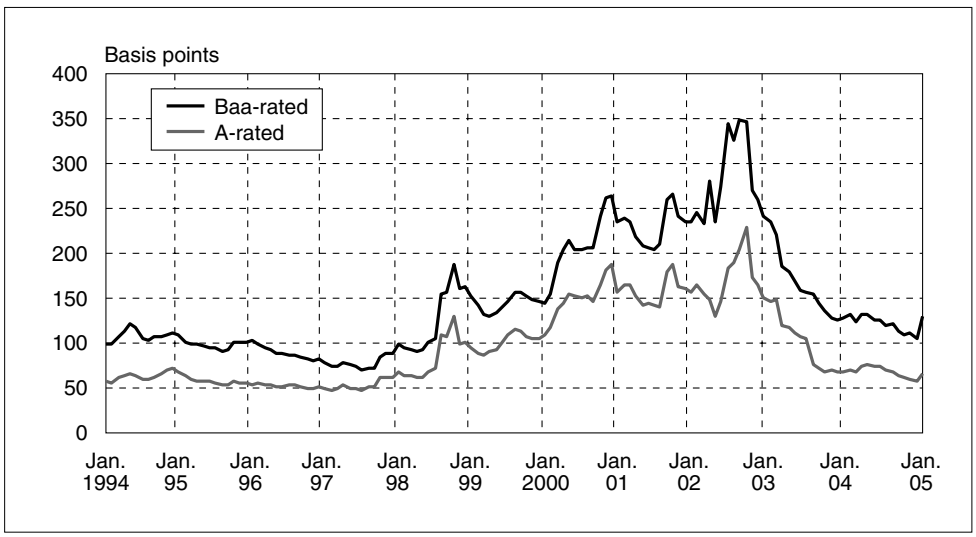
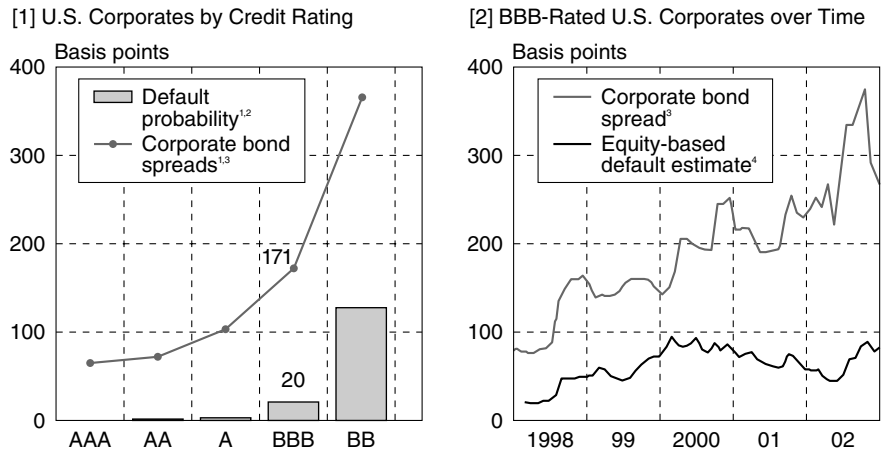


Figure 2 Price of Corporate Risk Default



Notes: 1. Average for the period 1998–2002.
2. Probability of default within one year as calculated by Standard & Poor's.
3. Option-adjusted spread for U.S. corporate bonds with three to five years to maturity.
4. Expected default frequency as calculated by KMV.

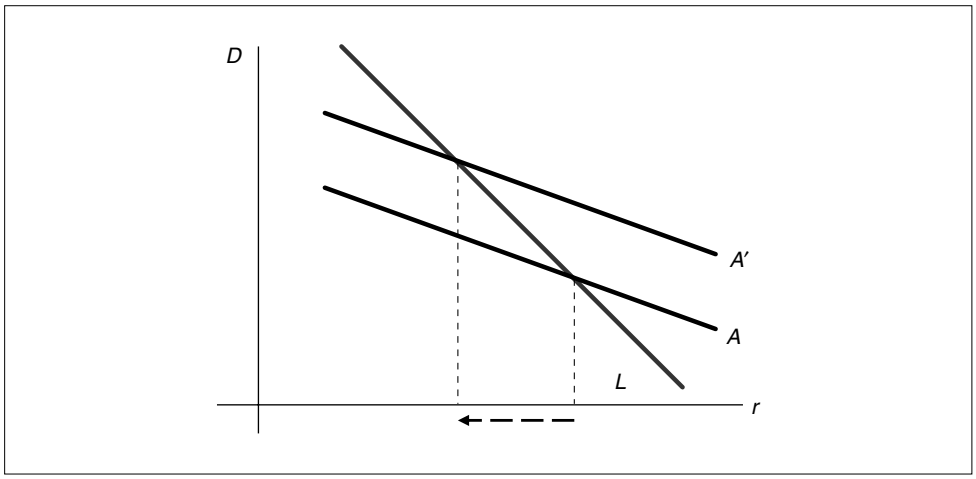
Sources: Bloomberg; Merrill Lynch; KMV; Standard & Poor's Creditpro; Bank for International Settlements calculations.

To examine the phenomenon over time, the right-hand panel of Figure 2 shows two lines. The upper line is the corporate bond spread, while the lower lines shows the equity-based default estimate as derived from a structural model of credit risk. For present purposes, we use the KMV model as the model of credit risk. We can use any existing structural model we want, and we still will not get the two lines to converge in the way that the theory would suggest. This is what is known as the credit spread puzzle. There was much discussion of this puzzle at a credit risk conference in London organized by Moody's Corporation and the London Business School in May 2005. The bottom line seems to be that unobserved risk premia are so important that it is not straightforward to extract information about fundamentals from asset prices. In my example, the fundamentals are expected losses from default and asset prices are credit spreads.

What the authors of the paper have shown is that marking to market can make things even worse. There can be systemic effects. Their model illustrates this by analyzing the behavior of a pension fund in an incomplete market. The important assumption about the model is that the duration of the fund's pension liabilities is more sensitive to interest rates than the duration of bonds.

Figure 3 shows the picture I would draw; it is analogous to the picture that the authors draw. Here, as the interest rate goes up, the duration of the pension liabilities goes down. For the assets of this pension fund, the duration also goes down as interest rates go up, but they do not go down as sharply. Hence, if we start from a position of immunization—in other words, when we have the duration of the assets equal the

Figure 3 Adjusting Duration under FRS 17 in an Incomplete Market



duration of the liabilities—then when interest rates fall, we will no longer have a match between durations and are forced to acquire more bonds and give up more cash.

The authors have worked out the sequence of effects. Their $h(v)$ function is the effect of interest rates on property values, in which the fall in yields leads to greater demand for bonds by pension funds. The banks are the ones that issue these bonds, the issuers the authors call "financial intermediaries," alluding to the Federal National Mortgage Association (Fannie Mae) and the Federal Home Loan Mortgage Corporation (Freddie Mac). As banks issue more bonds and offer households more mortgages, property prices rise.

The authors also have a credit quality function, in which the effect of property values on credit quality gives us this chain of effects: better household credit quality from higher property prices raises the marked-to-market value of the mortgages, and therefore the net worth of the banks that lend those mortgages. Then the improvement in the credit quality of the banks in turn raises the value of the bonds that the banks issue.

Once we have these two functions, we get the phenomenon where the easing of monetary policy that lowers interest rates leads to higher property prices, higher bond prices, and the knock-on effects that result in instability.

Another point made by the authors, which was not covered in the presentation, is that the interactions with solvency rules can amplify shocks. For example, under externally imposed solvency rules, the shock could reduce the market value of financial firms' equity. The rules may then force asset sales that further reduce marked-to-market values. Under internal risk management rules, we may get a situation in which a shock that raises market volatility leads to even greater volatility. With most financial firms now using a value-at-risk calculation for risk management, the heightened volatility would cause them to unwind their positions, and this unwinding would raise volatility further.

I have three suggestions for the authors. First, simplify the model. I would use zero-coupon bonds to fix duration; they are much easier to work with, notwithstanding

the tradition of Keynes, in which consols are the instrument of choice. Second, complicate the model. Here I would distinguish between bonds issued by banks and the benchmark bonds that presumably the pension fund would be using for marking to market. This means introducing a credit spread to bonds issued by banks.

Then finally I would tell the anecdotes more fully. These are very interesting episodes. The authors mention Long-Term Capital Management (LTCM) in 1998 and the episode within Europe in the summer of 2002. The last few weeks have also seen an episode in which hedge funds and collateralized debt obligations (CDOs) lost heavily from unusual movements in credit correlations.

In conclusion, there are two reasons to monitor asset prices. First, they may be wrong about fundamentals. For example, they may be wrong about monetary policy, which is why communications policy is so important. Second, they are subject to risk premia, and these premia can swing wildly. The authors provide a third reason. Under fair value accounting, asset prices may have balance-sheet spillover effects. So the authors have managed to make accounting interesting. Since solvency or risk management rules may amplify the effects, we need to watch those accountants, too.

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Comment

GEORGE PICKERING[4]
Bank of Canada

I am very pleased to be a discussant of this thought-provoking paper by the authors. It is also a delightful opportunity to be reunited with a former colleague and a friend, Eli M. Remolona, who is the other discussant today.

What I would like to do now is reflect on the issues raised by the analysis in the paper from the perspective of someone who is working in the financial markets area of a central bank and from our approach to some of these issues in Canada. I will briefly summarize the key themes that arose from my reading of the paper and then discuss several topics to which the authors might give further consideration.

4. The views expressed in this paper are solely those of the author and do not necessarily represent the views of the Bank of Canada.

The paper is motivated by the question of the "search for yield" and whether financial markets are pricing risk accurately. The paper's main thesis is that an accounting regime is an important part of the pricing dynamic. A regime shift in accounting rules that forces companies to mark to market, when combined with other trends in financial markets (financial innovation and the greater focus on short-term incentives), leads to a systematic underpricing or overpricing of risk.

Price determination in financial markets continues to defy easy description. The modeling of the risk premium is a case in point. We seem to have only a very loose handle on the time-varying nature of the risk premium. What makes this topic all the more important is that there is currently some evidence of speculation in certain asset prices, particularly real estate, in some major economies. Moreover, inflation in asset prices is occurring at a time of very low inflation worldwide in consumption goods.

Two issues raised in the paper are of particular interest to central bankers. First, there is the question of whether and how monetary policy should respond to evidence of asset bubbles. Second, how should central banks define their role in promoting financial system stability.

I would also draw attention to two rather provocative comments in the paper. "Accounting is too important to be left to the accountants," and "Even if we could mark to market, would we still want to do so?" I will return to these two comments in the latter part of my remarks.

The core of the paper is a "description"—not a model—that the authors hope will become the main features of a full-fledged model. It is forthright in stating that its assumptions are rather sweeping. The stylized economy described in the paper has been constructed in such a manner that it is inherently unstable. A major constraint placed on the model is the existence of bonds that are perpetuities. Constraining the pension fund to buy only perpetuities that have risk characteristics different from its liabilities, as the model does, is an important feature in creating the pricing dynamic that causes shocks to be amplified. Thus, as interest rates fall and the value of pension assets increases, the value of liabilities rises even more and forces the pension fund to buy more perpetuities.

The specific assumptions used in this model give rise to an outcome that the authors describe as perverse. I must confess that the dynamic is not intuitive. It is difficult to understand how the liabilities of the pension fund could be hedged by assets even at the start of the experiment. The role of net worth on the liability side of the pension fund and the role of cash on the asset side is also unclear. Both of these concepts need to be brought more clearly into the risk management framework of pension funds.

The financial institutions are also very stylized. They are unconstrained in their behavior. Any request for bonds from financial institutions by the pension funds is met in a mechanistic fashion. A more representative description would be to recognize that financial institutions do have a choice available to them between risky assets and non-risky assets. It might be useful to try to draw out a little bit more what even a simple behavioral model might mean for that sector.

The household sector also plays a very passive role. The happiness of households is maximized as soon as property prices go up. The households have only one function:

mechanistically buying property when the financial institutions approach and offer credit. This dynamic ignores the role played in the financial system by households as shareholders of financial institutions and investors in pension funds.

Earlier today, there was a discussion of the agency problem. Managers and shareholders may have conflicting objectives—managers may not always work in the best interest of shareholders. Financial accounting provides a key vehicle through which the household sector can monitor and control the activities of financial institutions and pension funds. There needs to be greater recognition of the role that shareholders can play and the importance of accurate financial statistics.

A related problem is the inability in the model for households to learn about the risks arising from speculative price increases. Ideally, there could be more discussion of how the household sector might react to excessive financial speculation.

Accounting standards are introduced into this very stylized and somewhat fragile system. The accounting rule in the model requires both the assets and the liabilities of the pension assets to be marked to market, but since there is incomplete hedging perverse outcomes occur.

I wonder whether the simplicity of the model provides a reasonable description of accounting rules. Even historical or traditional accounting needs to take some account of changes in valuation. The paper exaggerates what might happen, since it sets up a worrisome price dynamic caused by accounting rules.

I also was very intrigued by the role played by central banks in this model. The way that they come into this model is to exercise an impact on the long end of the yield curve. The central banks' desire to expand liquidity gives rise to an important dynamic, an amplification process. There is not only an immediate impact on property prices of any policy change, but a continuation of price movements on the same side.

It might be useful for the authors to draw out a little more the transmission mechanism of monetary policy and not ignore the fact that it primarily works through short-term rates affecting lending and borrowing decisions. This needs to be drawn out, because if the pricing signals are not working then the transmission mechanism is impaired. Moreover, the success of any central bank in controlling liquidity is crucially dependent on its ability to meet its objectives. The dynamic in the model in which increased liquidity brings down the long-term interest rate would not persist if over time it led to asset price bubbles and inflation.

As a suggestion for further work, it would be very useful to introduce a second asset into the model, a risk-free asset, particularly given the desire of the paper to explain the search for yield and the pricing of risky assets versus risk free assets.

Now I would like to comment on some of the broader issues discussed in the paper. First, monetary conditions may not only affect the level of interest rates but also the level of risky spreads. The transmission mechanism can lead to a mispricing of risky assets and speculative bubbles, irrespective of the impact of accounting rules.

Second, regarding the search for yield, there are a number of explanations given as to why long-term interest rates are so low. I do not really see the accounting regime as playing an important role at this stage. From my own point of view, if we were to see a regime shift in accounting, we would probably be seeing only a temporary effect as opposed to the type of structural change that we are seeing from some of these other factors.

Third, there may well be transition problems to a new regime, but this is highly dependent on two things: that the accountants get it right and that there is sensible banking regulation. To touch briefly on these two points, the current accounting system as noted in the paper is really a mixed one with both fair value and historical accounting. Fair value accounting will continue to expand as more and more of the assets of banks are traded and hedging is developed in a more sophisticated way. Financial innovation will in a sense require a further expansion of fair value accounting, and accountants need to be encouraged to make these types of changes that we are currently discussing.

On the role of regulators, I recall listening several years ago to a former head of the Office of the Comptroller of the Currency in the United States describe financial institutions as greyhounds and financial regulators as bloodhounds. As we know, it is difficult for a bloodhound to catch a greyhound, but I think it is important for the banking supervisors to be encouraged to develop, modernize, and enhance their tools and techniques. We need to have enlightened regulation, and regulators must take full account of the types of impacts that any change will have. I draw particular attention here to the need to distinguish between financial institutions. Banking regulation needs to have its own perspective, whereas pension funds provide quite a different investment horizon. One size does not fit all when it comes to financial-sector regulation.

To sum up discussion of the accounting standards, I agree with the authors' conclusion that regime shifts can have potentially large and far-reaching perverse outcomes, but am optimistic on the regulatory authorities' ability to anticipate the impact of changes and move to counter them.

Let me turn finally to the financial system role for central banks. We have been giving considerable consideration to this topic at the Bank of Canada, and in some sense we feel that, when we look at central banks around the world, monetary policy seems to be converging. One way or another, they have all become inflation targeters. By comparison, there is really no consistent model yet for the financial system and the role that should be played by central banks.

At the Bank of Canada, we have done two things. We have been trying to focus on the way we can support and underpin financial stability and soundness. At the same time, we are promoting efficiency in the financial system. This has given us a key role in the types of meetings that we have either with our Treasury officials or with regulators. We feel that the issue of efficiency is quite often ignored in policy discussions and so it is important to promote efficient financial markets and efficient financial institutions. That brings us into the debate on accounting rules. We have raised issues centered on accounting, such as changes in the Canadian accounting system, and highlighted the types of impact they could have on both financial institutions and financial markets.

In conclusion, I found the authors' paper to be thought-provoking and stimulating. They have tackled a number of questions arising from fair value accounting through the prism of the issues that currently face us as central bankers. Tackling this issue within a macroeconomic model, as they have sketched out in the paper, will be very challenging. I think their work provides a useful illustration of the potential

problems that might occur with a shift in accounting regimes. Nonetheless, I am confident that regulatory authorities and other participants in financial markets will adapt to changes in accounting regimes. I hope that the authors' concerns will not be an impediment to increase the transparency and accuracy of financial accounting. Accurate and relevant financial statements play an important role in both the transmission of monetary policy and the development of financial system stability.

General Discussion

Hyun Song Shin responded to discussants' comments by emphasizing that the value of what one could achieve at the margin (that is, the marginal revenue from selling one unit of assets, evaluated at current prices, multiplied by the quantity of all assets) was different from the value of what one could fully realize if one were to sell the entire balance sheet and exit the business. He claimed that this question of value at the margin or the entire balance sheet was a very important issue, arguing that in the case of financial distress, for example, the latter might be more important than the former. However, the distinction was not clearly made by accountants. In addition, he stressed that in such a situation, crude historical cost accounting might be a better approximation of how much value could be realized.

There were several comments from participants regarding the properties and implications of the model presented by Shin. Naohiko Baba (Bank of Japan) asked whether it was possible to extend the model, to address the "reach for yield," by adding a sector of nonfinancial corporations that issue bonds with nonzero default probability. Erdem Başçi (Central Bank of the Republic of Turkey) pointed out the possibility of multiple equilibria when there was no mismatch between durations of assets and liabilities, as in the fully funded system. Shin responded to Baba that if he were to write this down as a proper model, he would certainly take account of the actuarial value of the default risk and see whether the reach for yield could be given a more concrete interpretation in terms of default risk. With respect to Başçi's point, Shin stated that if there were long-duration assets, the problem could be solved by matching those durations, but commented that in the real world it was difficult to issue enough long-duration bonds to match the huge pension liabilities. However, he agreed with Başçi's point by referring to the recent issues of French 50-year treasury bonds and U.S. 30-year bonds and stated that these were a step in the right direction in this respect.

Many participants commented on the desirability of a mark-to-market regime. Reuven Glick (Federal Reserve Bank of San Francisco) pointed out that if marked-to-market bank loans amplified the effects of shocks, as shown in the session paper presented by Shin, a similar amplification could apply to other parts of the financial system, such as the trading of securities held by mutual or equity funds, where mark-to-market regimes were already in place. He stated that it would be philosophically inconsistent to say we should not mark to market in one part of the financial system while we knew that there were other parts where this did occur. Marvin Goodfriend (Federal Reserve Bank of Richmond) pointed out that marking to market was

conventionally considered a tool for supervision of regulation or stockholders. Taking the example of bank insolvency, he argued that the essence of marking to market was to create an objective measure by which society could balance the costs of delays in shutting down an insolvent bank against the benefits of prematurely closing it. He commented that it was then a matter of how and whether marking to market should be used in practice and wondered how this conventional point of view could be considered in the session paper. Hiroshi Fujiki (Bank of Japan) suggested that it might be useful to conduct a welfare evaluation of different accounting regimes by putting some arbitrary social weight on the three institutions in the session paper's model to maximize social values. Ulrich Kohli (Swiss National Bank) asked to what extent we could be sure that an increase in property prices really meant an increase in wealth when a homeowner paid himself or herself a higher imputed rent. He stated that if this increase in wealth was an illusion, then it was more damaging if the money was spent because one had not become better off.

In response, Shin emphasized that the mark-to-market issue was not an all-or-nothing issue and that there should be a middle way where one could use marking to market more intelligently. He explained that the session paper's model described the inefficiency that might occur when prices had a dual role, providing an indication of the underlying fundamentals, but also affecting the actions of market participants. He stated that whether one should mark to market depended on how much the marking to market would affect those actions. The more the actions were distorted by the act of marking to market, the less desirable it would be to use marking to market. Shin responded to Kohli that there must be a deep Ricardian equivalence or an illusion, and the issue would bear some more analysis from a purely thought-experiment point of view.

There were some comments regarding the policy implications of mark-to-market accounting. Maurice Obstfeld (University of California at Berkeley) pointed out that if there were contagion from interest rates to other asset markets, as was described in the session paper's model, it would be hard for a central bank to ignore the links between monetary policy and asset prices. He warned that a monetary policy focused solely on inflation ignored the fact that, in the presence of various distortions, monetary policy could have a direct role in accentuating or reducing bubbles. José Luis Malo de Molina (Banco de España) argued that although fair value accounting could create some financial instability, central banks and banking supervisors had instruments, such as an adequate provision system or the capital adequacy rules, to cope with such financial instability due to fair value accounting. Shin agreed that monetary policy and asset prices could not be separated. In addition, he agreed that regulators were very well aware of some of the potential dangers of marking to market and that they could mitigate some of the effects. However, he stressed that once a more thorough mark-to-market system had been introduced, it was going to be a much more challenging job for financial regulators.