Merton Miller’s Contribution to Modern Finance

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Merton Miller was a great economist. He was also a fine warrior. In the 1950s he takes up finance and engineers a stunning campaign that, after a period of years, decisively undermines the Old Guard and installs Modern Finance. That done, he brings his methods to the Real World, and becomes a strategist for Chicago’s commodity crowd in their battles with New York’s establishment and Washington’s power brokers. He does all this with such finesse, such humor, and, above all, such devotion to economic principle that you reluctantly admire him even as he rides past you to victory.

—Fischer Black

or the last 30 years, the field of academic finance was new enough that most of its founding fathers were still active and influencing its development. And until his death last spring at the age of 77, Merton Miller stood at the center of these founding fathers. It has been impossible to work in finance without being continually reminded of his contributions and his presence.

Miller’s accomplishments were many, but if we were to remember only one of his contributions to the field of finance, which would it be? Most financial economists would cite the famous “M&M” capital structure and dividend irrelevance propositions. But I will argue that although any finance scholar would be thrilled to have produced one of the M&M propositions, Miller’s most important contribution to our field went well beyond the propositions themselves.

In making my case, I will start with the first Modigliani and Miller paper, “The Cost of Capital, Corporation Finance and the Theory of Investment,” which was published in the American Economic Review in 1958. The main conclusion of that paper is the well-known M&M Proposition I, which states that “the market value of any firm is independent of its capital structure and is given by capitalizing its expected return at the rate... appropriate to its (risk) class.”1 In other words, changes in companies’ leverage ratios should not affect their market values; such values are determined solely by their expected future earnings power or, more technically, by the discounted present value of their expected cash flows. And the companion to Proposition I, the dividend irrelevance proposition, maintains that changes in dividend policy should also have no effect on corporate values.

In the real world, of course, we have all seen dramatic movements in stock prices in response to announcements of dividend changes and leveraged recapitalizations. And in the last 30 years, finance scholars have provided convincing empirical evidence that changes in capital structure and dividends have fairly predictable effects on corporate values. But, as I argue below, the M&M propositions’ apparent lack of predictive power in no way diminishes either the validity of their logic or their importance to our current theory of corporate finance. As Miller himself wrote in a 1988 article called “The Modigliani-Miller Propositions Thirty Years Later,”

the view that capital structure is literally irrelevant or that ‘nothing matters’ in corporate finance, though still sometimes attributed to us... is far from what we ever actually said about the real-world applications of our theoretical propositions. Looking back now, perhaps we should have put more emphasis on the other, upbeat side of the ‘nothing matters’ coin: showing what doesn’t matter can also show, by implication, what does.

“More constructive approach,” as Miller went on to note, “has now become the standard one in teaching corporate finance.” 2 That is to say, even if the M&M propositions have not been confirmed by empirical research—and it is unlikely they ever can be—they have nonetheless served as the starting point for virtually all academic research in corporate finance in the last three decades.

What has enabled the M&M propositions to transform modern finance into a serious scholarly undertaking is not their predictive power, but rather the proofs on which the propositions rest—the way of thinking that Miller and Modigliani used in arriving at their conclusions. In the proof of Proposition I, M&M began by making a set of assumptions that, while clearly violated in practice, enable them to produce useful—and in some respects surprising—insights. They started with a set of conditions known as “perfect capital markets” (which Miller himself once referred to as “the economist’s frictionless cream world”), in which there are no taxes or transactions (including bankruptcy) costs, reliable information about a company’s future performance is freely available to investors, and managers’ operating and investment policies are completely unaffected by financing choices. Under such conditions, as M&M demonstrated, changes in capital structure (and dividend policy) cannot affect a company’s operating cash flows. And if operating cash flows— that is, the total amount of cash profits to be divided among all the firm’s security holders—remain unaffected by such changes, then investors continually in quest of profit opportunities can be counted on to eliminate any differences in valuation resulting solely from differences in financial policies.

The mechanism by which investors eliminate the effects of such differences is called “arbitrage.” The arbitrageur identifies two assets with identical payoffs that are trading at different prices, and then earns riskless profits by selling the higher-priced asset and buying the lower-priced one. In the words of M&M, arbitrage works as follows:

If Proposition I did not hold (and levered firms sold for, say, higher values than identical unlevered firms), an investor could buy the risky asset and sell the safe bond in such a way as to exchange one income stream for another stream, identical in all relevant respects but selling at a lower price. The exchange would therefore be advantageous to the

* The article is based on a keynote address at the annual meeting of the Financial Management Association in San Diego this past October, and differs substantially from the version of that paper that was published in "Merton Miller in 1995: An Interview with Don Shaw’s, a Colleague and Admirer," as well as a recent article "Inter-deck Review: New Work on Capital Structure, Corporate Finance, and Merton Miller," by Richard W. Thaler.


The cause for which Miller fought was the social efficacy of financial markets—the idea that financial markets, when allowed to function with minimal interference from regulators and governments, are extraordinarily effective in allocating resources in ways that create social wealth.

Arthur S. Mencher, a well-known financial economist, argued in his book "The Economics of Capital Markets" (1973) that financial markets operate efficiently when they are free from regulatory intervention. He believed that the primary role of regulators should be to ensure that the markets function properly, rather than to micromanage their operations. Mencher's views were influential in shaping modern financial theory and practice, and his ideas continue to be debated and discussed in the field of finance today.
aging them for (possible) distribution to investors. And as long as "merely financial" decisions do not affect "real" decisions in any systematic way—for example, provided managers make the same investment in debt-to-capital ratio as 10% or 90%—financial decisions do not matter." As mentioned earlier, the M&M propositions were developed under a restrictive set of conditions, the most important of which are these: (1) there are no taxes paid by companies or their investors; (2) there are no costs associated with bankruptcy or other forms of financial trouble; (5) reliable information about the firm's earnings prospects is freely available to investors (and, thus, what management knows about the future cannot be significantly different from what investors know); and (4) corporate investment and operating decisions are not influenced by financing or dividend choices.

What, then, do the M&M propositions have to say about corporate practitioners? There are really two distinct messages. The first is that there is no "magic" in leverage or dividends. Since the heyday of the conglomerates in the late '60s, investment bankers have been fond of showing their clients the miraculous effect of increasing leverage—with benefits of issuing new debt or buying back stock—on pro forma earnings per share. The message of Miller and Modigliani is that this EPS effect is an illusion. It is true that if companies issue debt and use the proceeds to retire their shares, their EPS will go up as long as the return on the firm's capital exceeds the after-tax corporate borrowing rate—hardly an accurate standard of profitability. The problem with this strategy, as M&M showed, is that as companies take on more financial leverage, the risk of the equity rises commensurately. And as the risk of the equity increases, stockholders raise their required rate of return, and the P/E of the firm goes down. The net effect is a wash; overall value remains unchanged. In response to those who claim that investors value companies largely on the basis of dividends, M&M showed that dividends are simply a way of distributing earnings, and as long as the company's earning power remained unaffected, the shareholders' total return (dividends plus capital gains) should stay the same.

The second message of M&M can be seen by standing the propositions on their heads. That is, if changes in corporate financing or dividend policy are going to increase stock prices, they are likely to do so only for the following reasons: (1) they reduce taxes or transactions costs paid by the companies or their investors; (2) they reduce (the present value of) the expected costs of financial distress; (3) they reduce information asymmetries between management and investors; or (4) they provide stronger incentives for management to invest wisely and operate efficiently. It is in this sense that the M&M propositions can be seen as laying the groundwork for the modern theory of corporate finance; they showed future scholars (as well as practitioners) where to look for the real effects of financial decisions.

Thus, Miller and Modigliani identified four possible sources of value added by corporate financing decisions was begun by Miller and Modigliani themselves almost 40 years ago. In the so-called "tax-adjusted" M&M proposition presented in a 1963 paper, they argued that the benefits of substituting debt with tax-deductible interest payments for equity with non-deductible (and thus potentially twice-taxed) dividend payments could push up the optimal capital structure toward 100% debt. But this result seemed completely at odds with the conservative and temporate practices of the time. Faced with corporate debt-equity ratios in the early 1960s that were not much higher than they were in the low-tax 1920s, Miller recalls, "we seemed to face an unhappy dilemma: either corporate managers did not know (or perhaps care) that they were paying too much in taxes, or something major was being left out of the model..." (Our thinking) suggested that the high bond ratings in which the management took so much pride may actually have been a sign of their incompetence, that the managers were leaving too much of their stockholders' money on the table in the form of unnecessary corporate income tax payments.

The initial way out of this dilemma was to focus on the costs of high leverage—and the most obvious candidate was bankruptcy costs. But the findings of a much-cited study of a sample of bankrupt railroad suggested that the direct, or "out-of-pocket," costs associated with formal bankruptcy proceedings were

13. Stewart Myres, "The Determinants of Corporate Borrowing," Journal of Political Economy, Vol. 89, No. 5, Part 2 (October 1981), pp. 1057-1085. At the core of this problem, as Myres demonstrated, is the conflict between shareholders and bondholders. If the firm's assets yield a higher return than the cost of the new debt, the bondholders benefit because their debt becomes more valuable. But if the return is below the cost of the new debt, the new debt 'crowds out' the old debt, reducing the assets that can be financed, and therefore the returns to the existing shareholders, who accordingly may choose to bypass the investment rather than incur the costs of a new stock issue. In addition to Myres's discussion of the underinvestment problem, other shareholder-bondholder conflicts arise from incentives of shareholders to make the debt rather and as less valuable (tax protected) by realizing and would need to be at least partly offset by the higher pre-tax promised rate of return that debt holders require as compensation for the risks they pay on their interest income. And in the somewhat extreme situation where the debt holders' interest is fully taxed while the stockholders' goes essentially untaxed, the entire tax benefit from debt would disappear. Based on this new development, the leverage irrelevance proposition could hold even in the presence of taxes. In the late '70s, there was another attempt to take finance theory beyond capital structure irrelevance by exploring the possibility that corporate financing decisions provide "signals" to investors by communicating important "insider" information about the firm's earnings prospects. This theory seemed especially suited to explain the widely noted tendencies of new equity issues to meet with large price drops and of stock buybacks to cause price increases. But, as Miller himself concluded in his 1986 paper on "The Informational Content of Dividends," none of the signaling models has provided—nor is one likely to provide—a signaling equilibrium in which one dividend or financial policy is clearly superior to another. That is, even though signaling theories offer a plausible explanation of how investors interpret dividend changes and payout ratios, they provide little guidance on the questions of optimal capital structure and dividend policy.

By the early 1980s, then, the finance profession had come up with one (good reason for some companies (mainly high-growth firms) to avoid debt (naya), to reduce the possibility of underinvestment), (2) one possible reason to increase leverage (to reduce corporate taxes), and (3) a third factor—information asymmetries—that would lead most companies to stay away from high leverage (to avoid the "informational" costs associated with having to
Economic historians will conclude that the growth of the '90s, far from being constrained by the high leverage of the '80s, was made possible in large part by the efficiency gains accomplished by the leveraged restructurings of that period.

raise new equity). In sum, there was no clear message coming from the academic finance profession about how greater use of debt financing could be expected to add value. But a novelty of the capital structure dilemma presented itself in the wave of leveraged restructurings in the 1980s. During that period, debt-equity ratios in LBOs and some "public" leveraged recaps achieved levels that Miller described as "far beyond anything we dared to in our classroom illustrations of the tax advantage." But, as many observers suspected and research later confirmed, tax savings were not the only benefit of high leverage, nor were they probably the most important. As early as 1976, Michael Jensen and William Meckling posited that even higher possible benefit of debt financing in their pioneering paper on "agency costs." 17 Jensen and Meckling demonstrated that, in a world where managers often pursue their own interests at the expense of their shareholders, raising equity capital from outside investors can be costly. The more dispersed the firm's ownership (and the less stock owned by the firm's managers), the greater is this value-reducing conflict of interest between ownership and control. For this reason, instead of replacing equity with debt (and perhaps, as in LBOs, increasing managers' stock ownership in the process) could be expected to lead to greater operating efficiency and higher firm value.

But the application of Jensen and Meckling's agency theory to the LBOs of the 1980s did not come until Jensen's formulation of his "free cash flow" theory of corporate finance. Published in the American Economic Review in 1986, Jensen's paper argued that the massive substitution of debt for equity in leveraged takeovers, LBOs, and leveraged stock repurchases was adding value by curbing wasteful reinvestment in mature industries with few promising investment opportunities. 18 In Jensen's view, high leverage excites a discipline on management that, while potentially costly in high-growth firms, is highly valuable in mature industries with few large companies, with far more capital than growth opportunities. 19 As Miller himself summed up Jensen's argument: "By accepting such heavy debt-service burdens, the managers are making a binding commitment to themselves and to the other residual equity holders against yielding to the temptation to pour the firm's good money down investment rat holes."

In the 1990s, the academic finance community furnished supporting evidence for Jensen's argument in the form of studies after study documenting significant increases in operating efficiency and value in the LBOs and other leveraged restructurings of the 80s. But, with the collapse of the junk bond market in 1989 and the ensuing wave of defaults and bankruptcies, this was far from the popular view of leverage and financial markets. So, when Mentor Miller was awarded the Nobel Prize in Economics at the end of 1990, it was not a complete surprise that he chose "Leverage" as both the title and subject of his Nobel lecture. After briefly noting the "substantial real efficiency gains" accomplished "by leveraged entrepreneurs" during the 1980s "by concentrating corporate control and redeploying assets," Miller quickly turned to the main business of the speech—the use of economic logic to combat what he called the "particularly virulent strain of anti-leverage hysteria" then prevailing among U.S. politicians and regulators. The main thrust of Miller's argument, which can be traced back to the M&M propositions, is the irrelevance of debt financing per se causing significant changes in the value of the 90s, for firms being leveraged against the high leverage of the '90s.

In Miller's view, the high leverage of the '80s has been funded mainly with equity rather than debt. Such firms are widely reported to have large losses in value but such losses would then have been borne largely by stockholders instead of being shared with the debtholders. And even those losses that could correctly be attributed to overleveraging were more likely to be represented "private" than "social" costs, since the forgone investment opportunities and laid-off employees were likely to move to other (in some cases new) firms. Hence Miller's skepticism of the popular argument that a cluster of bankruptcies could lead to a general collapse of the economy.

Neither economics generally nor finance in particular offers much support for this notion of a leverage-induced "bankruptcy multiplier" or contagion effect. Bankrupt firms do not vanish from the earth. They often continue operating pretty much as before, though with different ownership and possibly on a reduced scale. Even when they do liquidate and close down, their inventory, furniture and fixtures, and employees and customers' flow of transactions with the firm elsewhere in the economy. Profitable investment opportunities that one failing firm passes up will be assumed by others—if not immediately, then later when economic conditions become more favorable. 20

Given the events of the past ten years, Miller's words now seem prophetic. The remarkable growth of the last decade has laid to rest the concerns about high leverage that were so prevalent in the early 1990s. Eventually, economic historians will conclude that the 1980s cannot be seen as a period of financial innovation but as a period of financial capital flows as leading to crashes and general instability. Political and regulatory attacks on financial innovation were particularly fierce in the wake of the junk bond market collapse of 1987 and the junk bond losses in 1989. The same "anti-force" campaigns mounted during the spate of derivatives disasters in the mid-1990s and the emerging-market crises in the second half of the '90s.

Whenever market forces and financial innovations were blamed for problems in financial markets, market makers were there to provide the microeconomic analysis. For example, when portfolio insurance and index arbitrage were widely blamed for the stock market crash in October 1987, Miller chaired a blue ribbon commission set up by the Chicago exchanges to look into the causes of the crash. And the
commission contributed a number of important points to the politically charged debate that took place after the crash. For example, critics of the futures markets invariably argued that prices first fell in the futures markets in Chicago, with the effect then spreading to the stock markets in New York. But, as Miller pointed out, this by no means proves that the futures markets caused the crash. Noting that many NYSE stocks had delayed openings on October 19, Miller said that a plausible interpretation of the day’s events was that the futures market prices simply reflected the true state of the market that was hidden on the NYSE because of the delayed openings. In addition to emphasizing the valuable role of futures markets in “price discovery,” Miller also observed that the size of portfolio insurance programs was far too small to account for the volume of selling on October 19.

The debate over portfolio insurance was recently reopened with the publication of a book by Bruce Jacobs, a professional portfolio manager. The main thesis of Jacobs’s book is that portfolio insurance programs caused the crash of 1987 by setting off a “massive liquidation” in response to the price declines before the peak of the crash. According to Jacobs, the result of this massive liquidation attempt was “a tremendous explosion—selling, understandable reluctance to buy, prices gapping down, investor panic.” As the book explains, “What the participants in these strategies apparently don’t realize is that, as their investments become concentrated, so does their need for liquidity. When they need to get out, they find they are stuck in illiquid positions that can be unmaintained.”

But Miller himself never argued that markets always move continuously, nor did he hold that portfolio insurance was not a necessary condition for market efficiency. In fact, in May of 1987 (and thus just five months before the crash), he gave a paper at the Mid-American Institute that proved to be remarkably prescient about the possibility of price gaps. In that paper, he pointed out that although greater liquidity in markets makes it possible for individuals separately to withdraw their capital whenever they wish, it is not possible for society as a whole to withdraw its investment. In normal times, individuals who sell and buy largely balance each other out. But, on occasion, there are imbalances in which many more individuals want to sell than buy. In such situations, there is a possibility that the buffer stocks of the market makers and the resources of liquidity providers will be exhausted. This creates the equivalent of a bank run in which those investors who get to sell first are the lucky winners, while those who come last cannot sell because there are no buyers.

Having acknowledged that possibility, Miller went on to explore its implications for the organization of markets. His main prescription was the importance of putting in place mechanisms that expand the capacity of exchanges to absorb the demand for transactions. But, as he warned in closing, “No economically feasible amount of added capacity will guarantee against any recurrence of market brown-outs, of course; but it can at least make them even rarer events.”

More recently, a number of financial economists have argued that the level and volatility of stock prices experienced in the past few years are clear evidence of a “bubble.” The recent debates on the level of the stock market have made extensive use of the findings of a new branch of finance known as “behavioral finance.” For example, in a book published in 2000, Robert Shiller uses behavioral models based on various forms of investor irrationality to explain how market prices are carried away by theories supporting high stock prices. According to Shiller, the late 1990s represent the fourth period in the 20th century in which investors have become enthralled by some version of the idea of a “new economy.” The first such period was at the turn of the century, the second one led up to the crash of 1929, and the third took place in the 1960s. As Shiller points out, the previous three periods in which dramatic increases in stock prices were fueled by visions of a new economy did not end well. But if Miller believed that prices might change with dramatic speed because of the limited capacity of financial markets to provide liquidity, he did not believe that such price gaps were necessarily evidence of bubbles. In his keynote address to the Pacific Basin Finance Association in 1989, he pointed out that stocks are securities with “theoretically infinite durations.” This means that, especially in the case of long-lived assets, much of their value resides in cash flows that will not be produced until years into the future. And this is turn means that small changes in expectations about growth rates, interest rates, or risk premiums can lead to large changes in prices. To illustrate this point, Miller used an example in which the firm begins with a dividend yield of 3%, a discount rate of 10%, and a growth rate of dividends of 7%. Plugging these assumptions into the Gordon dividend growth model widely used by practitioners, Miller shows that the share price would be worth $35 times the current dividend. He then goes on to show that if the growth rate falls by a half a percentage point to 6.5%, and the discount rate increases by the same amount to 10.5%, the stock price falls to 25 times the dividends, a drop of 28%. As Miller’s example was meant to suggest, it does not take much of a change in expectations to generate a fall in the stock prices of the magnitude of what took place on October 19, 1987.

In choosing these numbers, Miller made it clear that all he was doing was providing a set of numbers that would be consistent with a fundamental explanation of the crash. He did not believe it would be possible for economists to devise empirical tests capable of distinguishing between the two main hypotheses—that the crash represented (1) investor irrationality and the bursting of a bubble or (2) a rational investor response to a sudden shift in fundamentals. In summing up his position, Miller said, “We are faced with competing theories that can seemingly account for the same facts and we have no way of conducting decisive experiments that can distinguish between them and the policies based thereon. And in response to this ambiguity, Miller’s recommendations for policymakers concluded with the suggestion that the “wisest and ultimately more conservative policy, even for those who still believe in bubbles, is not to seek to prevent stock market crashes at all costs, but if one does occur, to localize any damage and keep it from spreading to other sectors of the economy.”

In the aftermath of the October 19, 1987, stock market crash, the forces of arbitrage were broadly understood, eventually prevail. If the random or poorly understood actions of a mass of individual investors were to lead them to exit the markets in a hurry, this should create profit opportunities for other investors; and the act of exploiting such opportunities should move prices back to their proper levels. This mechanism assumes that arbitrageurs will always be there in force to prevent overshooting and systematic biases in prices relative to what they should be based on fundamentals alone.

But how can we be sure that the free fall of October 19, 1987 stopped just where it should have? How can we be sure that the collapses of emerging markets, or the recent drop in the value of the Nasdaq, were not excessive? Perhaps we will never know. Such drops or gaps in markets will turn out to be consistent with rational efficiency only if there are enough investors who do not succumb to panic to step in and start buying. This means that such investors must have enough capital at their disposal.

Is there enough capital for arbitrage?: The case of LTCM

Investors can now trade markets more quickly, and with lower transactions costs, than ever before. Although this increase in liquidity is unquestionably a great benefit for both investors and the companies in whose stocks they trade, it also creates the potential for investors to herd in ways that were not possible before. We have seen dramatic reversals in investor sentiment in the last few years. For instance, capital flows to East Asian countries experienced a swing of more than $100 billion from 1996 to 1997. When such events take place, trades by a group of investors can end up destabilizing markets unless Miller’s arbitrageurs stand up to the herd and profit from their behavior. While market arbitrageurs may now be needed to allow other investors to exit from the markets at a moment’s notice, developments in the last few years suggest that we may actually have less of such capital—or a least not enough.

Among recent events that seem to indicate the limitations of the arbitrage mechanism, the fall of Long-Term Capital Management (LTCM) in the fall of 1998 stands out prominently engaged in transactions that would qualify as M&M-type arbitrage transactions. A typical example of such a transaction was to go long in an agency bond

23. Miller observed that sales of stocks unsold to portfolio insurance were three to five times as great as sales driven by portfolio insurance.
28. Ibid., p. 16.
and go short in a similar Treasury bond. Although bonds issued by government agencies typically have yields fairly close to those of Treasury bonds of the same maturity, there are times when the yield of agency bonds is considerably higher. And since the coupon payments of the agency bond exceed those of the bonds held short, a long position in an agency bond trading at par and a short position in a comparable Treasury bond will earn a positive cash flow provided (1) the federal guarantee to the agencies is strong enough that there is no default risk on the agency bonds and (2) the positions are held to maturity.

In the real world, there are difficulties with this strategy. First, there might be some default risk on the agency bond, although this problem could be eliminated by using a credit derivative to construct a default-free synthetic agency bond. (In this fashion, financial engineering has removed one obstacle to arbitrage.) A second difficulty is transactions costs that increase the yield differential between agency and Treasury bonds at which an arbitrage trade becomes profitable. Such costs would be increased by any restrictions on full use of the proceeds on short sales, which would tend to make it difficult for an investor to use some of his own capital to implement the trade. Third, and most important, this would be a true arbitrage trade only if it were certain that the position could be held to the bond's maturity, at which time the values of the long position and the short position must converge (since both bonds are at par). To see why this condition is important, imagine for a moment that the trade in place is put, the yield on agency bonds increases sharply relative to the yield on Treasury bonds. In that case, the value of the position begins to change because the price of the bond held long falls by more than the increase in the value of the bond held short. And if the investor could for some reason be forced to liquidate the position after its value has fallen, then the arbitrage is no longer riskless—and hence it is no longer an arbitrage.

The situation of LTCM in August of 1998 is well represented by this simple example of an arbitrage trade. LTCM had positions that were generating positive cash flows with a high degree of certainty, but changes in yield spreads had sharply reduced the net worth of those positions through their effect on prices. In terms of our above example, the difference between the yield spreads on agency bonds and those on more liquid Treasuries, which was large enough to attract investors like LTCM in the first place, suddenly became even larger, reflecting investors' heightened desire for liquidity. And as a result of this marketwide preference for liquidity, the values of the securities LTCM was holding long fell by more than the values of the more liquid securities they were shorting, causing a drop in the net worth of their combined position.

Arbitrageurs with sufficient capital to allow them to hold positions for long periods of time can close the gaps created by increases in the premium for liquidity. In fact, one of the important economic functions of arbitrageurs is to provide liquidity to the markets. But, in August of 1998, many if not most such arbitrageurs stayed on the sidelines. Although still puzzling in some ways, perhaps the most important cause of the failure of arbitrage on this occasion was the major constraints faced by many of the firms and investors capable of playing such an arbitrage role. Financial institutions that could have provided liquidity and thereby earned arbitrage profits are subject to regulations that car discourage them from doing so. A good example of such regulation is the new capital requirements for the trading activities of major banks that were put in place at the beginning of 1998. That change in regulation created a situation in which any significant increase in volatility in global capital markets would force banks to choose between increasing the capital used to back their trading activities and cutting back the scope of those activities.

And in August of 1998, the extreme volatility of global financial markets prompted many firms that normally function as market makers to reduce their positions instead of providing liquidity.29 As a result, LTCM was in fact unable to satisfy the all-important third condition of arbitrage: the ability to hold the combined positions to maturity. As LTCM's net worth plummeted, it found itself unable to continue financing its positions (even though many of them would still have been profitable arbitrages if carried to maturity). The fact that Warren Buffet, arguably the world's most famous arbitrageur, teamed up with Goldman Sachs to offer to lend the fund for $250 million (as well as committing $3 billion of Berkshire Hathaway's capital to stabilize the fund after the acquisition) suggests that even when the net worth of the fund was plummeting, outsiders continued to see value in the portfolio. But Buffet's offer was not accepted and, with some prompting from the New York Federal Reserve, investment banks provided LTCM with enough new capital to continue the operation. The banks ended up making a modest profit—about 10%—on their investments when LTCM was liquidated early in 2000.

Building Liquidity into the Model

Given its role in the collapse of LTCM and the failure of portfolio insurance during the crash of '87, liquidity may well prove to be the Achilles heel of the theory of finance built on perfect market assumptions. Nevertheless, as Miller himself showed us, liquidity can be studied. In a paper published in the Journal of Finance in 1989,30 Miller and Sanford Grossman offered an explanation for why liquidity can suddenly disappear even in an efficient market. The explanation is straightforward: investors want to sell a security because they experience a "liquidity event"—some unexpected need to raise cash—the price of that security will drop to attract buyers even though the underlying expected flows of the security are unchanged. This temporally low price should make it attractive for other investors to step in and buy the security, causing its price to return to its previous level. Thus, in markets with a large supply of capital, a large number of investors selling for liquidity reasons would have little or no impact on price. But, as Miller and Grossman also showed in their model, if the suppliers of liquidity have limited capital, or their actions are restricted by regulations, then market makers—particularly when hit with a series of liquidity events—may exhaust their ability to provide liquidity, leading to a free fall in prices.

Miller was acutely aware of the importance of liquidity in markets. But in all his writings on the subject, his focus was on the assurance that regulators or bureaucrats could allocate capital more efficiently than the private sector under the discipline of financial markets.

Of course, he saw a fairly limited role for commercial banks in the capital allocation process. During the 1980s, when Japanese industrial companies seemed to be outperforming their U.S. and European counterparts, some financial economists began to develop theoretical models that purported to explain why bank-financed economies like Japan and Germany function more efficiently than market-based systems like the U.S. and U.K. But Miller remained squarely in the camp of those who argued that the U.S.-U.K. model of market capitalism is the most reliable way of producing consistent economic growth.

In an article published in this journal in the wake of the Asian crisis,31 Miller argued that the problems of the Japanese economy (still very much in evidence today) stemmed from the same fundamental source as those afflicting the countries in Southeast Asia of the 1990s. In a summer of 1997 a banking-driven disaster struck in East Asia, just as it had struck so many times before in U.S. history. In the 20th century, as Miller pointed out, the U.S. economy steadily reduced its dependence on banks by developing "dispersed and decentralized" financial markets and institutions. By so doing, it has significantly reduced the "credit crunches" (for example, non-bank sources of capital were an important reason why the U.S. recession of
Figure 1.1996-1997

Winner of the Nobel Prize in Economics, Miller has brought the influence of financial economics and the commodity price discovery process in the University of Chicago during his tenure. The Chicago Econometrics Club, which Miller joined in 1994, is a regular number of finance students from 1998 to 2000, as well as a regular number of finance professors at the University of Chicago during his tenure. Miller is also a Research Associate at the National Bureau of Economic Research, and is also a Research Associate at the National Bureau of Economic Research. Miller holds the Jay C. Banker Chair of Banking and Money.