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THE MODIGLIANI AND MILLER THEOREM AND MARKET EFFICIENCY

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The Modigliani and Miller Theorem and Market Efficiency
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ABSTRACT

Most of the recent literature on risk management and capital structure assumes that markets are perfect, i.e., efficient and complete. This paper presents anecdotal evidence that suggests that different capital markets (e.g., debt, equity and warrants markets) may not be perfectly integrated, and discusses the implications of this lack of integration on financing strategies. I argue that although models that assume perfect markets are sufficient to explain cross-sectional differences in financing and risk management choices within an economy, that issues relating to market conditions may be necessary to explain differences in these choices across countries and across time.

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As we all know, the first step in understanding corporate finance theory is the Modigliani and Miller theorem, which specifies conditions under which various corporate financing decisions are irrelevant. When the theorem was first stated, most of us thought of it as a proposition about a firm's debt-equity mix. However, applications of the theorem has since been expanded to discussions of debt maturity, risk management, and even mergers and spinoffs, which, according to the logic of M&M, neither create nor destroy value in the absence of positive or negative synergies. By clearly stating the conditions under which these decisions have no relevance, the theorem provides a basis for focusing on how these choices can create and destroy value for a corporation.

A simple expression of the M&M proposition

Lets start with a simple expression of the proposition, which effectively combines a number of assumptions into what I consider the two core assumptions. This shortened version of the M&M Theorem states the following:

Financing and risk management choices will not affect firm value if the following conditions hold:

- A1) total cash flows to a firm's financial claimants are unaffected by these choices.*
- A2) "efficient markets"*

The first assumption is the no taxes, no bankruptcy cost, and perfect contracting assumption, which is the basis for most of the capital structure literature that has been developed over the past 25 years. Most financial economists have a pretty good understanding of this assumption, so I don't really need to elaborate on it here. The second assumption can be viewed as the complete and perfect markets assumption that was the subject of substantial debate 20 to 30 years ago. I am putting "efficient markets" in quotations to

indicate some ambiguity about what is required for market conditions to have an effect on financing and risk management choices.

The literature that considers the second assumption has received very little attention in the academic literature in the past 20 years.¹ Most of this earlier literature focused on increasing our understanding of the exact conditions under which capital structure is irrelevant when assumption 1 holds. In contrast to the more recent literature that focuses on assumption 1, there is almost no discussion in the literature on how deviations from assumption 2 affect financing patterns, which is the focus of this talk.

The Second Assumption

The second assumption implies that corporations need not be concerned about what I will be calling market conditions and the needs of investors when designing their financial structures. As a first pass, it is useful to consider the capital structure choice in frictionless and complete markets. Under these conditions, investors can create a portfolio with any cash flow pattern that they desire (and which meets their budget constraint) so there is no need for corporations to design their capital structures in ways that tailor their securities to satisfy these desires.

Given assumption 1, frictionless and complete markets are clearly sufficient for capital structure irrelevance. However, the complete markets assumption can be substantially weakened. In particular, if financial intermediaries, like investment banks, can costlessly repackage securities, creating new securities that generate any feasible cash flow pattern that the corporations can create on their own, then there will be no need for corporations to do this tailoring on their own.

¹ There has been a substantial literature on capital structure within setting where managers view the market price of their equity as being incorrectly priced, e.g., Myers and Majluf (1984). Under a variety of conditions, capital structure choices will be affected if prices underreact to the information implicit in capital structure choices. The analysis in this paper ignores information asymmetries and thus does not address this issue.

To understand this repackaging argument, consider an example where there exist two groups of investors that both wish to hold commercial mortgages. The first clientele consists of pension funds that have fixed obligations and want to hold risk-free debt that matches the duration of their liabilities. The second clientele consists of investors who want some exposure to commercial real estate, i.e., they would like a portfolio that performs well when commercial real estate markets are strong, perhaps as a hedge against their own real estate needs.

To satisfy the needs of these two clienteles, there should exist both safe and risky commercial mortgages, and perhaps equity positions in commercial real estate, which we will ignore to keep this story simple. Hence, if all of the commercial property owners choose to finance their properties with identical mortgages with 20% down payments, the needs of the investors will not be met. Of course if Assumption 1 holds, and investors want to hold securities with cash flow patterns that are somewhat different than what is being offered, commercial property owners will have an incentive to redesign their mortgages. Specifically, some will issue mortgages with 70% down payments, which never default and satisfy the first clientele, while others will issue mortgages with 5% down payments, which give the second clientele their desired exposure to commercial real estate markets. Following the logic discussed in a different context by Miller (1977), in equilibrium, competitive property owners will supply the different mortgages to investors in quantities that satisfy investor tastes, however, the individual property owners will be indifferent about their financing choices.

Now, lets assume that for some reason the property owners are constrained to issue identical mortgages with 20% down payments. Perhaps, Assumption 1 is not satisfied and this 80% debt capital structure maximizes the total cash flows created by the commercial property. How do the needs of these two investor clienteles get satisfied in this case?

If we assume perfect markets, with no transaction costs, then financial intermediaries can buy the mortgages and repackage them in a way that satisfies both clienteles. For example, the investment bank can pool groups of mortgages

and use the pools as collateral for commercial mortgage backed securities. Specifically, they can issue a senior debt instrument (generally referred to as the senior tranche), which can be effectively risk free if it is sufficiently collateralized, and a junior security (generally referred to as the junior tranche), which is paid only when the senior security is paid in full, thereby giving its holders a presumably higher expected rate of return and exposure to commercial real estate markets.

Although financial intermediaries do in fact engage in such transactions, the junior securities created by the transactions do not exactly replicate the cash flows of a high-risk mortgage. To exactly replicate the cash flows of a mortgage with a high default probability, a financial intermediary would need to buy a combination of the equity and the debt of a building, and use this combination as collateral for a new bond that is less collateralized than the original bond. For example, suppose the original building was worth \$100 million and had an \$80 million mortgage. To synthetically create higher risk debt on this same building, a financial intermediary could buy \$8 million of the mortgage and \$2 million of the equity and use this combination as collateral for a \$9 million mortgage. In the absence of transaction costs, this new mortgage would offer investors exactly the same cash flow patterns as a 90% mortgage on the building.²

In summary, the M&M theorem does not require complete markets. In my view, the best way to think about assumption 2 is that the process of tailoring or repackaging securities is costless and competitive. When financial intermediaries can create any cash flow stream that can be created by corporations by costlessly repackaging existing securities, in equilibrium, firms cannot achieve rents by creating securities that are tailored to meet the needs of investors.³

² This type of transaction was originally discussed within the context of the Modigliani and Miller theorem by Stiglitz (1969) and Hellwig (1981).

³ It is also interesting to think about value-additivity in this context. Value-additivity essentially states that in the absence of any synergies, that packaging securities together cannot increase or decrease their values. Hence, the value implications of spinoffs and mergers must arise from positive and negative synergies.

How do academics and practitioners view the capital structure problem?

I like presenting the M&M theorem with just these two assumptions because it illustrates what I think is the biggest gulf between how academics and investment bankers and corporate managers think about issues relating to capital structure choice. Specifically, as I mentioned earlier, academics spend most of their time thinking about Assumption 1. Investment bankers and corporate managers, however, tend to think about the capital structure problem from the perspective of Assumption 2.

As I discussed previously, the academic literature has not addressed the second assumption in the last 20 years. This could be because financial economists pretty much figured out the implications of this assumption 20 years ago and there is no need to rehash what we already understand. However, a recent review article by Hart (2001), as well as a more comprehensive capital structure review article by Harris and Raviv (1991), fail to even mention that the Modigliani and Miller theorem requires assumptions about perfect financial markets. My conclusion from this is that the academic community has concluded that thinking about market conditions is unlikely to help us understand observed capital structures.⁴

I think the implicit view of academics is that market imperfections, like transaction costs, are second order effects and that financial intermediaries, rather than corporations, can more efficiently address security design issues. If this is the case, corporations should pretty much ignore investor preferences when determining their capital structures, and choose the capital structures that maximize the after-tax cash flows that can be distributed to their financial claimants, i.e., choose the optimal capital structure assuming assumption 2 holds. The implicit assumption is that if investors do demand specially tailored

⁴ Financial economists have, however, considered the related issue of security design more recently. This literature also considers the tailoring of securities to meet the needs of investors but does not really address the issue of whether the security should be created by corporations, which would make this a capital structure issue, or by financial intermediaries. See for example Ross (1989) and Allen and Gale (1992).

securities, financial intermediaries are better positioned to capture the rents associated with creating them.

Discussions with CEOs, treasurers, and investment bankers provide a very different view. Practitioners tend to talk about whether “market conditions” favor debt versus equity financing. For example, one often hears about “windows of opportunity” in which firms can access either the bond market or the stock market. These discussions of windows of opportunity clearly have nothing to do with Assumption 1, but may be related in some way to Assumption 2.

For example, in a very interesting lecture at UCLA in the late 1980s, Michael Milken made the statement that in the early 1980s firms could create value by increasing leverage, but in the late 1980s, firms would be better off issuing equity and paying down their debt. Basically, he was saying that junk bonds offered financing bargains in the early 1980s because at that time the cost of debt was relatively low and the cost of equity was relatively high. However, by the late 1980s, the cost of equity was less expensive (since stock prices were much higher) but high yield debt provided a very expensive form of financing since there were too many issuers, driving up the cost of debt financing.

Most business people find the Milken argument quite intuitive. As they see it, if you are selling pizza, and your customers want small pieces, you give them small pieces and if they change their minds and want big pieces you give them big pieces. Academics find this argument somewhat confusing because we think it is quite easy to cut big pieces into little pieces and vice versa. In addition, we have not developed a lot of intuition about why the investors who supply the capital are particularly concerned about the characteristics of the securities that they buy.⁵

Capital structure from the perspective of the capital suppliers

As I mentioned earlier, for the most part, the recent development of the theory of capital structure was developed from the perspective of a corporation in

⁵ Again, the exception to this is the security design literature cited earlier.

a setting with perfect financial markets but with other constraints arising, for example, from taxes and imperfect contracting opportunities. While I would find it less intuitive, one might imagine an alternative development of the capital structure theory that ignores taxes and contracting costs within the corporate sector and instead focuses on constraints faced by the investors who supply the capital. In other words, a capital structure theory that focuses on the suppliers of capital, where assumption 1 holds but assumption 2 does not.

Such a theory would require transaction costs, which would make it impractical for financial intermediaries to repackage securities in the manner described earlier. The theory would also require that the suppliers of capital are constrained in various ways. For example, there may exist restrictions that force some investors to hold only investment grade debt, avoid derivatives etc..

If one wanted to delve into this more deeply, constraints may arise endogenously in a setting where delegated portfolio managers who, because of agency and evaluation reasons, are forced to specialize in the specific securities in which they have expertise. This could lead to segmented markets where separate institutions manage equity portfolios and fixed income portfolios. The fixed income managers may be further segmented into those that manage investment grade debt and those that manage riskier debt, and may also be segmented into groups according to the duration of their portfolios. Equity managers may also be segmented into, for example, growth and value portfolios. If these portfolio managers are evaluated relative to specific benchmarks that are tailored for their investment styles (e.g., growth investors are evaluated relative to other growth investors), these investors will find it risky to deviate from their styles.

Consider now a hypothetical world where these different investors have fixed amounts of money to invest and no flexibility to deviate from their proscribed investment styles. In such a world, the corporations, who would otherwise be indifferent about their capital structure choice because Assumption 1 is assumed to hold, would supply securities in the forms that the different investor clienteles prefer to hold. If low quality debt is too risky for one investor clientele

and too safe for the others, it simply will not be supplied. Similarly, if there are groups of investors with strong demands for portfolios with strong positive skewness, i.e., a portfolio that generates high returns when the market returns are high, but with a limited downside, then firms will have an incentive to issue convertible bonds and warrants.

Outlining a model

I'm not sure how useful it would be to actually model this story, but sketching out how one might develop a model could provide some clarity. What I have in mind is a three-date model, where in the first date, financial institutions design various investment vehicles, such as bond and stock funds, anticipating the needs of corporations as well as investors. On the second date, individuals allocate their savings to the various vehicles. These allocations have a stochastic component that the institutions cannot anticipate perfectly when the vehicles are designed. Finally, on the third date, corporations issue securities and the investment vehicles by the securities that the firms issue. The model would not allow financial institutions the opportunity to repackage securities.

Within this setting, the securities that corporations would issue, under the perfect markets assumption, will not necessarily correspond to the allocations made by investors at date 2. This suggests that there will be an incentive for the financial intermediaries to design some flexibility into their investment vehicles, i.e., allowing them to state their objectives somewhat broadly, allowing long-term bond funds to shorten the duration of their portfolios if corporations tend to issue debt that has shorter than anticipated duration. However, if this flexibility is not costless, there will also be an incentive for corporations to account for market conditions when determining their financing strategy. In other words, if rigidities in the investment environment result in too little demand for long-term debt, corporations will be induced to issue debt with shorter duration.

An additional issue that one might want to consider within this setting is possible impediments to financial innovation. What happens when financial

intermediaries fail to offer an investment vehicle that corresponds to a financing alternative that corporation's desire?

Michael Milken and the High Yield Debt Market

The above model provides a very different perspective than the tradeoff models we have become accustomed to. Michael Milken, however, would probably find this to be a rather intuitive description of the capital structure problem. In the late 1970s he found himself in a world where there was virtually no market for high yield long-term debt. In this world, firms did not really *choose* capital structures without these instruments. Rather, they were unable to issue high yield debt because investors were unwilling to hold it.

It is somewhat surprising that we haven't seen a lot of theoretical work that tries to explain why there was virtually no high yield debt market before the late 1970s and a thriving high yield debt market by the mid 1980s. One possibility, which is consistent with our traditional view of capital structure tradeoffs, is that contracting costs fell in the 1980s, allowing firms to take on more debt. While contracting costs did probably fall, it is unlikely that they fell abruptly enough to explain what looks like a regime shift in the debt markets.

My own favorite explanation for this phenomenon was that the high yield debt market may have been slow to develop because of a coordination failure that can be understood if we view the market as consisting of segmented investor clienteles. Prior to the late 1970s there simply was not an investor clientele for public high yield debt. As a result, corporations were not able to use these instruments to raise capital.

To understand this chicken and egg problem, note first that high yield debt markets require analysts that have specific skills for evaluating credit risk. In the absence of good analysts, these markets are subject to a substantial amount of asymmetric information, which is likely to adversely affect their liquidity. If the market for these instruments is relatively small, it is likely to attract very few investors and analysts with the requisite skills, which will in turn cause the market

to be relatively inefficient and illiquid. The inefficiency and illiquidity of this market will, in turn, make it less attractive for corporations to issue the debt.

The above arguments suggest that there can potentially be two equilibria. The first, which I have just described, is a bad equilibrium, where very little resources are devoted to evaluating high yield debt, and as a result, issuers find these instruments relatively unattractive for raising capital. As a result, corporations that could potentially improve their values by increasing leverage choose to be more conservatively financed. The second is a good equilibria, which can be characterized by a liquid and efficient high yield bond market that attracts plenty of highly skilled credit analysts, and a substantial number of high yield debt issuers, which find it attractive to raise capital in such an environment.⁶

The genius of Michael Milken was to figure out how to move the high yield market from the bad equilibria to the good equilibria.⁷ To do this he needed to simultaneously develop both sides of the market. He needed to hire smart credit analysts and traders who could efficiently price and make markets in these bonds, and in order to profit from this trading infrastructure he created, he needed to attract corporations who would issue the debt. He also needed to attract a clientele of investors who would buy the bonds. From the perspective of the corporations, how this was actually done was immaterial. What was relevant to them was that this effort changed market conditions, and as a result, their optimal capital structures were altered.

⁶My argument here is similar to the coordination problem in equity markets discussed in Subrahmanyam and Titman (1999). For example, suppose that traditionally small high tech start up companies do not go public. Then given the small supply of public companies with these characteristics, the market will attract relatively few equity analysts, and as a result, the market for these stocks will be relatively illiquid and inefficient. Given this, it will be less attractive for these companies to go public. However, as Benenviste, Busaba and Wilhelm (2001) emphasize in their recent paper, if taking these firms public creates value, absent the coordination problem, then an investment banker with sufficient market power will have an incentive to solve this coordination problem.

⁷ I am speaking rather loosely here. Economists don't like to think in terms of markets moving from one equilibria to another. There is obviously some stimulus that I am ignoring in my story that triggered the switch. Perhaps, the reduction in contracting costs alluded to earlier triggered the move from one equilibrium to the other.

The introduction of the original issue high yield market provides perhaps the most important example of how a change in market conditions affected financing choices. The following examples involving Hong Kong and Japanese warrants describe what I think are less important innovations, but provide a clearer illustration of the roles played by corporate issuers and financial intermediaries in the introduction of new securities.

The Hong Kong and Japanese Warrant Markets

When I started this presentation, I expressed the second assumption as the efficient markets assumption, which was admittedly fairly vague. I then claimed that this assumption is satisfied if financial intermediaries are able to costlessly repackage securities that exactly track any security that can be issued by a corporation.

I would now like to introduce the concept of *integrated* markets, which provides a more rigorous way to think about Assumption 2. If two markets are integrated, the required return premium associated with any risk is the same in both markets. Hence, investor clienteles may segment investors, for the reasons discussed previously, however, if arbitrage between the segments equates their market prices of risk, the different markets will be integrated.⁸

In the hopes of partially clarifying how this all fits together I will present some anecdotal evidence about the Hong Kong and Japanese warrant markets. Warrants provide a good setting for understanding these issues because these instruments are relatively straightforward to value when warrant and stock markets are integrated. As I will discuss, existing evidence suggests that Hong Kong and Japanese warrant markets and stock markets were not *integrated* in the late 1980s. In other words, warrants were mispriced relative to stocks, which created potential opportunities for corporations and financial intermediaries.

In Hong Kong at this time it was difficult to buy stock on margin and there was no options market. As a result, warrants offered the only means by which

⁸ Specifically, the same pricing kernel prices all securities.

Hong Kong investors could place a levered bet on a firm's stock. Given the demand for this type of bet, and the limited supply, warrants were initially overpriced relative to their Black-Scholes values.

There were two market responses to this apparent "arbitrage" opportunity. First, firms increased their issuance of warrants to take advantage of this financing bargain. Second, investment banks bought blocks of stock in particular companies and issued what they called covered or derivative warrants. The first is an example where the financing choices of firms are influenced by market conditions. The second illustrates the tendency of financial intermediaries to create securities with the payoff patterns that investors want. Over time, the investment banks, rather than the firms, became the dominant issuers of warrants. This evidence is consistent with the intuitive idea that it is more efficient for investment banks and other market participants to create the securities that investors prefer rather than to have corporations alter their capital structures to create the securities.⁹

At about the same time, perhaps because of an imagined financing bargain or because of accounting considerations, Japanese firms issued substantial amounts of debt with attached warrants. Because of the resulting glut of warrants, the market prices of these instruments were substantially less than their Black-Scholes values. In response to the apparent mispricing, U.S. investment banks bought the underpriced warrants and tried to hedge them by shorting Nikkei futures contracts.¹⁰

⁹ The only argument that I am aware of for why corporations may have a comparative advantage relative to investment banks in creating the securities has to do with default risk. Investment banks generally do not have pristine credit ratings and often take large risks that leave them open to the possibility of default. Indeed, Peregrine, a Hong Kong investment bank that issued a number of warrants, went bankrupt during the Asian crisis and did default on some of their warrant obligations. This issue also was raised in the context of swap contracts offered by U.S. investment banks. To address this problem a number of investment banks formed well-capitalized AAA subsidiaries to offer the contracts. See Grinblatt and Titman (2001) for a discussion of Swapco, the subsidiary formed by Solomon Brothers.

¹⁰ As it turned out, the investment banks lost money with this "arbitrage" trade because the Nikkei futures contract turned out to be a bad hedge for the warrants. This is briefly discussed in Grinblatt and Titman (2001).

It should be noted that in both Hong Kong and Japan there was a window in which the supply of warrants issued by firms was either greater or less than the amount that investors were willing to hold at Black-Scholes prices. In both cases there was the potential to improve firm values by either increasing or decreasing the amount of warrants outstanding. In Hong Kong, firms could increase firm values by issuing more warrants and in Japan they could improve values by issuing fewer warrants. In both cases, we observed investment banks take actions to eliminate the supply/demand imbalance. In Hong Kong, investment banks issued warrants that they hedged by buying the underlying stocks and in Japan investment banks bought warrants that they hedged in the futures market.

Comparisons of yield spreads, default rates and risk premia

Although it is not as straightforward, we can also ask whether equity markets and debt markets are integrated. For example, the spread between AAA and BBB bonds average about 120 basis points per year, but this spread changes substantially over time. From the observed default probabilities on BBB bonds, the volatilities of their underlying assets (i.e., collateral), and the observed spreads, one can apply various contingent claims models to derive an implied risk premium on the underlying asset. The implied risk premium on the bonds can then be compared to the historical risk premia in the equity markets.

For example, suppose the observed default spread on BBB bonds is consistent with a risk premium on common stock of 14% per year, but the historical risk premium on common stock is only 9% per year. This difference, which suggests that risk is priced differently in the bond market and the stock market, suggests that the bond market and the stock market are not integrated. This observation is, of course, inconsistent with bond pricing models as well as with the assumptions of the Modigliani and Miller theorem.

A recent paper by Huang and Huang (2001) suggests that corporate bond and stock markets are not integrated. As in the above example, their analysis suggests that corporate bond default spreads are too wide relative to observed risk

premia in the equity markets. What this means is that corporations are paying more for each unit of risk when they raise capital from the debt market rather than the equity market.¹¹

Although I have not seen much work on this, one might expect the Huang and Huang results to vary substantially over time as conditions in the bond and stock market vary. Depending on changes in the supply and demand conditions in the bond and stock markets, and the costs of arbitraging between these markets, the extent to which the markets are integrated should vary. Huang and Huang suggest that given average spreads, the risk premium on debt is too high relative to the risk premium on equity. Perhaps, this difference in risk premia is further amplified in those situations when spreads are especially wide.

Many things can potentially cause market conditions to change in ways that generate changes in spreads that cannot be completely explained by changes in risk. For example, when Russia defaulted on some of their debt in 1998, spreads between high and low quality bonds widened considerably. While this widening of spreads can be partially attributed to increased risk, there were also changes in market conditions that may have also contributed to an increased risk premia in the bond market. Specifically, anecdotal evidence suggests that the decline in the price of emerging market debt forced a number of investors, e.g., banks and insurance companies, who were subject to regulatory constraints to liquidate their riskier bonds. Others, e.g., hedge funds, were subject to margin calls that forced them to liquidate bonds. Given this supply response, one might view the increase in spreads as an indication that the market price of risk in the bond market had increased.

In the absence of all other market imperfections, situations where bond spreads are too wide relative to equity risk premia have two implications:

¹¹ The extent to which their results are model specific is not really clear. For example Titman, Tsyplakov, and Tompaidis (2001) develop a structural model that they apply to the commercial mortgage market and conclude that commercial mortgage default spreads are consistent with historical risk premia in the commercial real estate market.

1. A BBB firm can improve its value by issuing more equity and paying down its debt.
2. On the margin, investors can increase the returns of their portfolios without increasing risk by selling some of the firm's stock and buying some of its bonds.

Traditionally, we like to think in terms of investors taking actions that allow them to exploit mispricing. Hence, if market conditions forced one group of investors to sell bonds, another group of investors would be expected to step up to the plate and take the bonds at a price that reflects a risk premium that is not too different from what is offered in other markets. However, if investors are more constrained than corporations, we might expect to see this sort of arbitrage activity initiated by the corporations rather than investors. Specifically, corporations will tend to issue less debt when yield spreads widen.

Corporate bond issues and variation in the shape of the term structure

The slope of the risk-free term structure also tends to vary over time. Sometimes the term structure is flat and even downward sloping, while at other times it is strongly upward sloping. The expectations hypothesis suggests that the slope of the term structure measures expectations of changes in future short-term interest rates. In addition, Fama (1984) and others find that the slope is also associated with the return premia for longer bonds; steeper slopes are associated with higher spreads between the returns of long-term and short-term bonds.

There is a substantial literature that examines why the slope of the term structure changes, in particular, why expected return premia change. One possibility is that the volatility of future interest rates change. When interest rates become more volatile, long-term bonds become riskier, and thus require a higher risk premium. Another possibility is that the market price of interest rate risk changes. For example, there is evidence that during recessions, investors act as though they are very risk averse and require high rates of return on both stocks

and long bonds. Finally, there might be demand and supply shocks that affect the slope of the term structure. For example, if Japan runs a huge trade surplus, which it invests in long-term Treasury Bonds, the price of the bonds will increase, driving their yields down. If the U.S. government runs a huge deficit, which it finances with long bonds, it might drive up long rates.

One question that has been raised is how should corporations respond to changes in the term structure? There is a tax argument (Brick and Ravid (1991)) that suggests that firms should borrow long when the spread is large to maximize the tax benefits of debt. Offsetting this is the possibility that firms tend to borrow short-term when the term structure is steep as a way of increasing their current earnings.¹² This timing strategy will also lower the firm's average cost of debt if a wider spread represents a higher return on long bonds.

There is substantial evidence that firms do in fact lower the maturity of their liabilities when the term structure is steeper. Graham and Harvey (2001) report that CFOs explicitly state that this is an important consideration, and Barclay and Smith (1995), Guedes and Opler (1996) and Stohs and Mauer (1996) find that firms tilt their borrowing towards long bonds when the term structure is flatter. In addition, I am aware of a major investment bank that developed a quantitative model to advise corporate clients on their debt choices. The model included a trade off between the higher risk associated with short-term debt and the higher capital costs associated with long-term debt. Since the incremental cost of long-term debt over short-term debt in the model was determined by the term structure, the model generally advised clients to issue long-term debt when the term structure is not too steep.

The above-mentioned evidence suggests that corporate treasurers attempt to lower their average funding costs by timing the debt markets. A recent working paper by Baker, Greenwood and Wurgler (2001) examines the timing

¹² Hovakimian, Opler and Titman (2001) find that firms tend to issue shorter-term debt when they are in financial difficulty, which is when they have the greatest incentive to increase their earnings. Perhaps, the incentive to do this is greatest in recessions when the term structure is steepest.

performance of corporate financing choices in more detail and provides strong evidence that corporations do in fact successfully time the term structure. Moreover, the Baker, Greenwood and Wurgler evidence suggests that corporate treasurers seem to be using information in addition to the term structure to successfully time their corporate bond issues. Specifically, they find that changes in the aggregate duration of corporate debt predicts future long bond returns, even after controlling for the term structure.

Although the Baker, Greenwood and Wurgler evidence indicates that corporate treasurers successfully reduce their costs of capital by timing the debt market, the analysis does not necessarily imply that firm value is enhanced by this activity. It should be stressed that the Modigliani and Miller theorem does not require that return premia on long and short bonds be constant over time --- it only requires that the rewards for bearing the relevant sources of risk (like interest rate risk) be the same in the bond market as it is in the stock market. Hence, the observed timing choices create value, only if the equity and debt markets are not integrated, and corporate treasurers time the differences between the premiums associated with interest rate risk in the stock market and in the bond market. Unfortunately, I don't think there is a straightforward way to test this.

While it is difficult to test whether corporate treasurers can create value by timing the bond market, the evidence is sufficiently suggestive that this should be given further thought. Although it is not implausible that the bond market is inefficient, I don't think this provides a sufficient explanation for what we observe. In particular, one needs to explain why an inefficient bond market can be exploited by corporate treasurers rather than by fixed income portfolio managers. I don't think that it is because the corporate treasurers are better informed. It's more likely to be because they face different constraints.

Some thoughts on risk management

The Modigliani and Miller theorem, as well as the framework that has evolved from this line of research, applies to more than just the debt-equity

choice. Indeed, the issues raised here also apply to issues raised in the risk management literature. For the most part, academics view risk management from the perspective of a manager who operates in an efficient and complete capital market. In other words, we have ignored issues relating to the suppliers of capital and market conditions.

There is evidence that suggests, however, that market conditions do influence corporate risk management choices. For example, the 1998 Wharton risk management survey reported that 32% of the respondents actively take positions in currency derivatives based on their views about future currency movements. While some have argued that these views are misguided, there is substantial evidence that currency movements are in fact predictable so it is possible that corporations do in fact lower their average funding costs by switching between currencies in the same way that they decrease average funding costs by switching between long and short-term debt.

Market conditions may also affect commodity hedging choices. For example, I personally think that value would be created in the oil and gas industry if the firms simultaneously increased their leverage and hedged most of their exposure to oil and gas prices.¹³ However, Haushalter (2000) found that most oil and gas producers hedge only a small percentage of their future production. Specifically, only a quarter of the firms in his sample hedge more than 28% of their production.

I have asked people in this industry why they do not hedge and the answers I general receive have almost nothing to do with the current risk management literature. Specifically, I've been told that oil companies generally hedge very little of their oil and gas exposure because their shareholders don't want them to hedge. Oil company executives claim that shareholders buy oil stocks because they want exposure to oil and gas prices.

My rather naïve response to this claim is that while it makes sense that a well-diversified portfolio should include exposure to this source of risk, the stock

¹³ Doing this is likely to reduce taxes and improve incentives.

market is not necessarily the best place to obtain this exposure. Following the logic from the “homemade leverage” discussions of the Modigliani and Miller theorem, I’ve suggested that if oil companies hedge their exposure to oil price risk by selling their forward contracts on their oil, their shareholders can effectively undo the transaction taking an offsetting position in the same contracts, leaving their total exposure unchanged.

Most investors, however, are unable to transact in the derivative markets either because of the previously mentioned institutional restrictions (for pension funds and mutual funds) or because of a lack of experience dealing with these instruments (for individuals). If there is in fact a lack of demand for obtaining oil price exposure in the derivative markets, the stock and derivative markets will not be integrated, i.e., the return premium associated with oil price risk will be higher in derivatives market than in the stock market. If this is indeed the case, then there will in fact be a cost associated with hedging.¹⁴

Limits to arbitrage and coordination failures

Before concluding, I would like to discuss possible solutions to these institutional restrictions and why these solutions may not work in reality. The first is the hedge fund repackaging solution and the second is the investment banker repackaging solution.

The hedge fund solution is the most straightforward. If markets are in fact segmented in the way that I have just described, there can exist what may look like an arbitrage opportunity. In theory, if oil price risk has a lower rate of return in the stock market than in the derivatives market, a hedge fund should be able to profit by buying oil price exposure in the derivatives market and selling exposure by short selling oil stocks. This, of course, is much more difficult in practice than

¹⁴ The argument against hedging requires oil and gas stocks to be somewhat overpriced relative to the oil and gas prices in the derivative market. However, I’ve seen analyst reports that make the opposite argument --- that investors can earn high returns by buying the stocks and hedging the exposure in the forward market. One answer to this is that the markets are small and illiquid. If a major oil company did in fact decide to sell a sizable amount of oil forward, the prices would change dramatically.

in theory, given the costs of short selling, margin requirements, and most importantly, because oil and gas stocks are not all that highly correlated.¹⁵ As I mentioned earlier, in theory, hedge funds should have been able to arbitrage the mispricing in the Japanese warrants market. However, they actually lost a substantial amount of money attempting to do so.

The investment banker solution is to create a market for an instrument that in some way gets around the institutional restrictions. For example, the investment bankers may try to stimulate the market for oil-linked bonds.¹⁶ Alternatively, they might try to get oil companies to lower their exposure to commodity risk by securitizing the cash flows from their producing properties. One might imagine ExxonMobil spinning off the cash flows of a diversified portfolio of producing properties and dividing the pool into a number of tranches in the same way that mortgage backed securities are subdivided.

Both of these investment banker solutions face the same coordination problem that I discussed earlier in the context of the development of the high yield debt market. To interest corporations in these ideas you would need to demonstrate that there exist a group of investors who are interested in buying the product. However, to interest investors, you need to demonstrate that there will be a sufficient supply of the investment to insure a reasonably liquid market. Michael Milken has demonstrated that similar coordination problems can be overcome, but it is not particularly easy. Perhaps, this will provide an opportunity for the next Milken.

Summary and Potential Avenues for New Research

In this talk my intention was not to develop any new theoretical results or provide new evidence. Rather, my intention was to stimulate further research on

¹⁵ My argument here is similar to the Shleifer and Vishny (1997) argument about the limits of arbitrage.

¹⁶ Oil-linked bonds have been issued in the past but never really caught on. Some banks, and companies like Enron, offer loans with payments that are tied to the price of oil and gas. Small, relatively constrained companies have taken such loans, but I am not aware of any major oil company that has raised substantial capital in this way.

an aspect of the Modigliani and Miller theorem that has largely been ignored in the past 20 years; specifically, the supply-side effects that arise when imperfections exist in the capital markets. For a variety of reasons, researchers are likely to give more consideration to these supply-side effects in the future.

The first reason is that we would like to have more insights on what corporate treasurers and CFOs do and think about on a day-to-day basis. Corporate treasurers do occasionally think about the kind of tradeoffs between tax savings and financial distress costs that we teach in our corporate finance classes. However, since this tradeoff does not change much over time, the balancing of the costs and benefits of debt financing that we emphasize so much in our textbooks is not their major concern. They spend much more time thinking about changes in market conditions and the implications of these changes on how firms should be financed.

The broadening of the corporate finance research agenda should also lead financial economists to think more carefully about supply-side effects. In particular, most empirical studies have considered the cross-sectional implications of capital structure theories within countries and have found, for example, that high tech companies tend to be less levered than firms in commodity businesses. These studies can safely ignore supply side effects since these effects are likely to affect each firm within an economy approximately the same. Future research, however, is likely to be more focused on how capital structures change over time and differ across economies. I expect consideration of the suppliers of capital will play a much more important role in this research.

To test how the suppliers of capital affect capital structure choices, it will be useful to identify exogenous shocks that directly affect the suppliers of capital without directly affecting the tradeoffs that directly influence this choice. I have argued, for example, that the development of the high yield debt market affected capital structure choice. A skeptic, however, would argue that the high yield debt market developed in response to a shift in optimal debt ratios caused by

something else, such as a need for restructuring. In other words, the development of the high yield debt market cannot be viewed as an exogenous shock.

Since I have based this entire talk on anecdotal evidence, I will conclude with one last example of an event that we can comfortably say is exogenous. In 1999 European currencies were effectively merged into a single currency, the Euro. Prior to conversion, there were illiquid and inactive bond markets in the individual currencies in Europe. Basically, the markets were small and illiquid so investors did not want to hold French Franc and DM bonds. By creating the Euro, European corporations can issue corporate bonds in a single currency, which is likely to result in a single more active and more efficient market. It will be interesting to see whether this change has a material effect on how European firms are financed. One prediction is that medium size European companies will increase the proportion of their funding raised with corporate bonds. I would expect this change to be strongest in the smaller countries that originally had the least liquid bond markets.

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