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**The Modigliani-Miller Theorem at 60:
The Long-Overlooked Legal Applications of Finance's Foundational Theorem**

Michael S. Knoll¹

Abstract

2018 marks the 60th anniversary of the publication of Franco Modigliani and Merton Miller's *The Cost of Capital, Corporation Finance, and the Theory of Investment*. Widely hailed as the foundation of modern finance, their article, which purports to demonstrate that a firm's value is independent of its capital structure, is little known by lawyers, including legal academics. That is unfortunate because the Modigliani-Miller capital structure irrelevancy proposition (when inverted) provides a framework that can be extremely useful to legal academics, practicing attorneys and judges.

Introduction

In June 1958, two young economists at the Carnegie Institute of Technology,² Franco Modigliani and Merton Miller, published an article, *The Cost of Capital, Corporation Finance, and The Theory of Investment* in the American Economic Review.³ That article, which directly challenged then-conventional financial orthodoxy, is today widely acknowledged as the foundation of the modern academic discipline of finance.⁴ Yet, the article, which is still read by nearly all economics and finance graduate students, is little known among lawyers and legal academics, many of whom have never heard of or have only a passing acquaintance with the authors' names and their work. Nonetheless, M&M, as both the pair of authors and their joint articles are colloquially referred to by economists,⁵ has long been

¹ Theodore Warner Professor, University of Pennsylvania Law School; Professor of Real Estate, The Wharton School; Co-director, Center for Tax Law and Policy, University of Pennsylvania. Thanks to Alvin Dong for assistance with the research, to my colleagues at the University of Pennsylvania for their comments and suggestions, and to my students for their willingness to grapple with many of these issues. Copyright 2017 by Michael S. Knoll. All rights reserved.

² From 1912 to 1967, when it changed its name to Carnegie Mellon University, the school was known as Carnegie Institute of Technology. Wikipedia (Carnegie Mellon University).

³ Franco Modigliani & Merton H. Miller, *The Cost of Capital, Corporate Finance and the Theory of Investment*, 48 *The American Economic Review* 261 (1958) (hereinafter Modigliani & Miller, *Capital*).

⁴ *Schools Brief: Unlocking Corporate Finance*, *The Economist* 81 (Dec. 8, 1990) (hereinafter *Schools Brief*); J. Fred Weston, *What MM Have Wrought*, 18 *Financial Management* 29, 29 (1989) (hereinafter Weston, *Wrought*).

⁵ Peter L. Bernstein, *Capital Ideas: The Improbable Origins of Modern Wall Street* 174 (1992) (hereinafter Bernstein, *Capital Ideas*). Modigliani and Miller jointly authored two more classic articles on the irrelevancy of capital structure. Franco Modigliani & Merton H. Miller, *Dividend Policy, Growth and the Valuation of Shares*, 34 *Journal of Business* 411 (1961) (hereinafter Modigliani & Miller, *Dividends*) (arguing under certain idealized conditions that dividend policy had no impact on firm value); Franco Modigliani & Merton H. Miller, *Corporate Income Taxes and the Cost of Capital: A Correction*, 53 *American Economic Review* 433 (1963) (hereinafter Modigliani & Miller, *Correction*) (correcting calculations of value of tax shield provided by corporate debt when there is a corporate income tax).

implicitly used throughout the legal profession, although the debt has only been occasionally acknowledged and their work is rarely directly and knowingly applied by legal academics.⁶ That oversight is unfortunate because M&M provides a powerful framework with broad applications throughout the law. As the sixtieth anniversary of the publication of M&M's first article approaches, it is time for the legal profession to add M&M to the lawyer's toolkit,⁷ alongside other well-known economic ideas, such as agency costs, asymmetric information, and the Coase Theorem.⁸

History

Modern business school finance departments are stocked with many quantitatively sophisticated Ph.D.s whose scholarship tends to focus on highly abstract questions with real world applications. Sixty years ago, the situation was different.⁹ Finance departments were much smaller and something of a backwater. The field lacked mathematical precision and conceptual rigor, relying heavily on accounting rules, rules of thumb, and anecdotes, and the academic and consulting efforts of most finance faculty members focused on advising corporations as to their optimal capital structure.¹⁰ The prevailing view at the time was that the impact of leverage on the value of a firm was "complex and convoluted."¹¹ In general, debt was considered preferable to equity because it was cheaper (the stated return on debt was less than the implied return on equity¹²) and because interest could be deducted, whereas dividends could not be deducted; however, there was thought to be some upper limit on value-increasing debt issuance because the risk of corporate bankruptcy increased with leverage as did the interest rate on debt. However, none of these intuitions had been formalized.¹³

⁶ The few explicit references in the legal literature that I am aware of are Michael S. Knoll & Daniel M.G. Raff, *A Comprehensive Theory of Deal Structure: Understanding How Transactional Structure Creates Value*, 69 Texas Law Review See Also 35 (2010) (hereinafter Knoll & Raff, *Comprehensive*); Peter H. Huang & Michael S. Knoll, *Corporate Finance, Corporate Law, and Finance Theory*, 74 Southern California Law Review 175 (2000); Kimberly D. Krawiec, *Derivatives, Corporate Hedging, and Shareholder Wealth: Modigliani-Miller Forty Years Later*, 1998 University of Illinois Law Review 1039, 1058-78; Claire Hill, *Securitization: A Low-Cost Sweetener for Lemons*, 74 Washington University Law Quarterly 1061, 1084-1106 (1996); Michael Knoll, *Taxing Prometheus: How the Corporate Interest Deduction Discourages Innovation and Risk Taking*, 38 Villanova Law Review 1461, 1467 n.24 (1993).

⁷ See, for example, Ward Farnsworth, *The Legal Analyst: A Toolkit for Thinking about the Law* (2007) (listing and explaining more than 30 standard legal moves across economics, philosophy, psychology and other fields, many of which come from economics, but not including M&M).

⁸ Ronald H. Coase, *The Problem of Social Cost*, 3 Journal of Law and Economics 1 (1960).

⁹ The development of the M&M theorems in the context of contemporary practice and academic understanding is colorfully described by Bernstein, *Capital Ideas*, chapter 9.

¹⁰ *Schools Brief: Unlocking Corporate Finance*, *The Economist* 81, 82 (Dec. 8, 1990) (hereinafter *Schools Brief*).

¹¹ Stephen Ross, Randolph Westerfield, Jeffrey Jaffe & Bradford Jordan, *Corporate Finance* 497 (11th ed. 2016) (hereinafter Ross et al., *Corporate Finance*).

¹² The implied return on equity is the inverse of the price-earnings ratio or the earnings-price ratio. According to Miller, at the time they were working on their first article, interest rates on corporate debt were around 3 to 5 percent, whereas the cost of equity capital ran from 15 to 20 percent. Merton H. Miller, *The Modigliani-Miller Propositions After Thirty Years*, 2 Journal of Economic Perspectives 99, 100 (1988) (hereinafter Miller, *Thirty*).

¹³ Bernstein, *Capital Ideas*, at 167.

With their 1958 article, M&M directly challenged the prevailing thinking that debt was cheaper than equity and that each firm had an optimal capital structure. They argued that under certain idealized assumptions the amount of debt had no impact on firm value.¹⁴ Expressed more confrontationally, M&M's original article claimed that their finance colleagues were wasting their time and their clients' money trying to ascertain what a firm's optimal capital structure was because one capital structure was as good as any other.¹⁵ That idea, which is also their principal substantive result and is today known as the capital structure irrelevancy proposition, has been called "the bombshell assertion."¹⁶ Yet, the underlying intuition is extremely simple. In an interview after Modigliani won the Noble Prize in Economics, Miller (who subsequently won the prize too) analogized their irrelevancy proposition to slicing a pizza. A pizza can be cut into as many slices as desired, but doing so does not change the pizza's size.¹⁷

Although M&M's main result is most intuitively expressed by analogy, they presented their argument formally. M&M began their formal argument with a series of idealized assumptions. Although there are different ways to state the M&M assumptions, from a lawyer's perspective, the most intuitive and helpful listing of the M&M assumptions is probably as follows:

Efficient capital markets – All investors have the same information and they all process that information in the same way. As a result, all investors agree on the market value of all cash flow streams.

Frictionless markets – There are no transaction, contracting, bankruptcy or agency costs. Contracts can be costlessly written to cover any and all contingencies and can be costlessly enforced. This assumption implies that the firm's cash flows are independent of its capital structure.

No taxes (or other regulations) – There are no taxes at the firm or the individual investor level. There are also no government regulations, or at least no regulations that relate to capital structure or are affected by capital structure.

Only cash flows matter – Investors care only about the cash flow generated by an investment. There are no direct consumption elements from any investments. This assumption excludes from consideration paintings and owner-occupied real estate among other assets.

Starting with the above four assumptions (and using only those assumptions), M&M then showed that a firm could not change its value by adjusting its leverage. M&M proved their central claim by assuming the contrary result (that the firm could impact its value by changing its leverage) and then

¹⁴ Modigliani & Miller, *Capital*.

¹⁵ M&M's dividends article five years later made a similar claim about dividend policy. Modigliani & Miller, *Dividends*.

¹⁶ James R. Vertin, *Editorial Board Commentary*, 20 CFA Digest 56, 57 (1990) (appended to abstract of Weston, *Wrought* and recommending that article as of interest to subscribers because of Weston's "comprehensive review of the research that flowed from [M&M's] bombshell assertions").

¹⁷ Ross et al., *Corporate Finance*, at 505. In their original article, M&M drew an analogy to milk. Although cream sells for more than whole milk, which in turn sells for more than skim milk, a dairy farmer cannot increase the value of the milk by separating whole milk into cream and skim milk. Modigliani & Miller, *Capital*.

showing that the result could not persist in a market with rational investors.¹⁸ This result, which is often referred to as the capital structure irrelevancy theorem or more succinctly as M&M theorem I or just M&MI, was the central result of M&M's first article.¹⁹

Because M&M's capital structure irrelevancy theorem was so out-of-step with conventional thinking and practice, it was initially met with deep skepticism.²⁰ Many thought the theorem was simply wrong: that the conclusion did not follow from the assumptions. However, after some back and forth and various technical corrections of the original proof, economists concluded that the argument was correct as a matter of theoretical economics. Given the initial assumptions (efficient and frictionless markets, no taxes, and only cash flows matter) the result (a firm's value was independent of its capital structure) held.²¹ Next came questions whether the assumptions were so inaccurate as to render the theorem true as a matter of internal logic, but not very useful. That was the conclusion most practicing finance professionals reached and they largely ignored M&M's work. Academic economists, however, took a different approach. For a time, many took the view that the assumptions were close enough to reality to accept the theorem as fairly accurate and they turned their attention to other issues, but they did not ignore M&M.²² Indeed, they built modern finance upon it.²³

The economists, whether or not they accepted the M&M capital structure irrelevancy result, mined M&M's formal argument. The M&M proof, which appeals directly to the economic principle of one price—the notion that two perfect substitutes will sell for the same price—introduced the idea of arbitrage into financial economics. Since its introduction by M&M, financial economists have been employing arbitrage arguments in order to develop new ideas in financial economics.²⁴ Consider two major examples from the 1960's and 1970's. The first example is the capital asset pricing model (CAPM), which holds that investments are priced according to their market risk (typically measured by β), which cannot be diversified away, not their unique risk, which can be eliminated through diversification.²⁵ The second example is the Black-Scholes option pricing model, which recognizes that a

¹⁸ An example illustrating M&M's formal argument along the lines that can be found in a standard MBA-level textbook is given in an appendix.

¹⁹ M&M derived two more theorems for the stylized world described by their assumptions. M&M theorem II, or M&MII, describes the relationship between leverage and the required return on equity (when debt is riskless the required return on equity increases in proportion to leverage) in order for the value of the firm to be independent of leverage. Debt is not cheaper than equity, in spite of appearing to be so, because the marginal cost of incurring more debt includes the increased cost of outstanding equity. M&M theorem III, or M&MIII, holds that the weighted average cost of capital to the firm is independent of capital structure.

²⁰ The journal that published M&M's original article, the *American Economic Review*, published five critiques of the many that were submitted, including a particularly hostile critique by David Durand, an MIT professor, who had suggested the capital structure irrelevancy proposition several years earlier, but had rejected it. The journal also published a brief sur-reply from M&M that Miller credited with publicizing their methods and results. Bernstein, *Capital Ideas*, at 175.

²¹ Bernstein, *Capital Ideas*, at 174-77.

²² See Bernstein, *Capital Ideas*, at 177-80.

²³ See Bernstein, *Capital Ideas*, chapters 10 through 14.

²⁴ Hal R. Varian, *The Arbitrage Principle in Financial Economics*, 1 *Journal of Economic Perspectives* 55 (1987).

²⁵ The early work here was done by Jack L. Traynor, William F. Sharpe, John Lintner and Jas Mossin. Jack L. Traynor, *Toward a Theory of Market Value of Risky Assets*, in *Asset Pricing and Performance Models, Strategy and Performance Metrics* 15 (Robert A. Korajczyk, ed. 1999) (the original unpublished article was written in 1962); William F. Sharpe, *Capital Asset Prices: A Theory of Market Equilibrium Under Conditions of Risk*, 19 *Journal of*

call option is equivalent to holding a share of the underlying stock and borrowing against that share.²⁶ Using this observation, Black and Scholes derived a partial differential equation that they were able to solve, thus giving a precise value for the call option.²⁷ Today, arbitrage is the cornerstone of financial economics. Indeed, the M&M proof has been called the “watershed between old and new finance.”²⁸

Economists, however, were not finished with capital structure. After a roughly twenty-year hiatus, during which time most financial economists turned their attention to problems besides capital structure, economists began to return to studying capital structure.²⁹ And when they did, they recognized that the M&M capital structure irrelevancy proposition provided them with the key to understanding how capital structure can affect value.

By that time, financial economists had recognized that the M&M capital structure irrelevancy proposition did not only imply that leverage did not have any effect on corporate value, but that the irrelevancy proposition had much wider application. Given the original M&M assumptions, it follows that a broad array of corporate financial activity has no impact on firm value. Indeed, the M&M assumptions imply that value of the firm is determined solely by the firm’s investments or assets (the left side of the balance sheet), not how those investments are financed (the right side of the balance sheet), and that the firm’s investments are determined solely by the opportunities that the firm faces. Thus, for example, the M&M assumptions also imply that hedging activities, leasing versus owning, the legal organization of the firm, the compensation structure, the state of incorporation and the legal rules that follow, and so much more have no impact on value either.³⁰ That suggests a tension, if not an outright conflict, between the M&M capital structure irrelevancy theorem and the goal of understanding capital structure.

The key was to reverse or invert the M&M capital structure irrelevancy theorem. As Miller wrote in 1988, as part of a symposium on the thirtieth anniversary of the publication of the first M&M article, M&M wrote their original article in order to dispel much thinking about how capital structure can affect the total value of the firm.³¹ However, by showing what aspects of capital structure do not

Finance 425 (1964); John Lintner, *The Valuation of Risky Assets and the Selection of Risky Investments in Stock Portfolios and Capital Budgets*, 47 *Review of Economics and Statistics* 13 (1965); Jan Mossin, *Equilibrium in a Capital Asset Market*, 34 *Econometrica* 768 (1966). Their work was built upon the M&M proof and work by Harry Markowitz and James Tobin on risk and portfolio selection. Harry Markowitz, *Portfolio Selection*, 7 *Journal of Finance* 77 (1952); James Tobin, *Liquidity Preference as Behavior Towards Risk*, 25 *Review of Economic Studies* 65 (1958).

²⁶ Fischer Black & Myron Scholes. *The Pricing of Options and Corporate Liabilities*, 81 *Journal of Political Economy* 637 (1973).

²⁷ According to the Black-Scholes formula, the value of a European call option (one that can only be exercised at expiration, not before) is a function of the following five variables: the risk-free interest rate, the time until expiration of the call, the volatility of the underlying stock, the current market price of the underlying asset, and the strike price of the call. Ross et al., *Corporate Finance*, at 694-95.

²⁸ *Schools Brief*, at 82 (quoting Robert Merton).

²⁹ Miller who continued to work on capital structure during the 1960’s and 1970’s was a notable exception to this trend. E.g., Merton H. Miller, *The Corporate Income Tax and Corporate Financial Policies*, in *Stabilization Policies* 381 (1963).

³⁰ M&M’s capital structure irrelevancy proposition also implies that a firm’s dividend policy has no impact on its total value, as they demonstrated in their 1961 article. Modigliani & Miller, *Dividends*.

³¹ Miller, *Thirty*, at 100.

impact firm value, M&M also showed how capital structure can impact value.³² Thus, the power of M&M is that it tells us where to look in order to understand how capital structure can impact firm value, which is through its assumptions. Specifically, if capital structure is to impact value it must operate through the M&M assumptions. This idea is called the reverse M&M theorem, and it holds that capital structure can affect the overall value of the firm only by releasing or withholding information, by decreasing or increasing agency, bankruptcy or contracting costs, by decreasing or increasing taxes (or the costs of other regulations), or through the allocation of assets with consumption elements. According to M&M, the above is an exhaustive list of how capital structure can affect the overall value of the firm.

The reverse M&M theorem, thus, takes the original M&M theorem and turns it on its head. It replaces the idea that under certain assumptions capital structure does not affect the total value of the firm with the idea that capital structure affects firm value only to the extent that it operates through the M&M assumptions. Moreover, the reverse M&M theorem implies that the optimal capital structure, which will maximize the value of the firm, maximizes the value or minimizes the loss across the range of topics spanned by the four assumptions. Thus, capital structure decisions require looking at the effects of various alternative structures across the four M&M assumptions.³³

Starting in the 1970's, economists began to mine the M&M assumptions for important insights into how capital structure affects the total value of the firm. Consider the following two examples from that decade. Michael Jensen and William Meckling argued that the conflicting interests of the managers and the owners of a business firm creates agency costs, which the owners seek to reduce by monitoring and writing contracts that bond their employees with contingent payments. Agency costs are minimized when the sum of monitoring, bonding and residual agency costs are at a minimum.³⁴ Thus, Jensen and Meckling developed a theory that exploits the notion that the second M&M assumption, frictionless markets, is false. Because markets are not frictionless, agency conflicts can reduce the value of the firm. Accordingly, a capital structure should take agency costs into account if it going to maximize the value of the firm.

Around the same time, Stephen Ross recognized that managers are usually better informed about a firm's prospects than are its shareholders. Ross argued that managers could signal to shareholders that a firm's prospects have improved by raising the firm's debt-to-equity ratio. Because managers are likely to lose their jobs if their firm goes bankrupt, they are taking a risk when they pay dividends or repurchase stock (both of which increase a firm's debt-to-equity ratio). Thus, because of the deductibility of corporate interest payments a firm's managers face a tradeoff whenever they adjust

³² Miller, *Thirty*, at 100. See also Bernstein, *Capital Ideas*, at 176-80; Clifford W. Smith, Jr., *The Theory of Corporate Finance: A Historical Overview*, in *The Modern Theory of Corporate Finance* 3, 4 (Clifford W. Smith ed., 2d ed. 1990).

³³ The reverse M&M theorem is the contrapositive of the original M&M theorem. The contrapositive of a theorem of the form "if A, then B," takes the form "if not B, then not A." If a theorem is true, then its contrapositive must be true as a matter of logic. The reverse M&M theorem adds economic content to logic because capital structure must affect value through the M&M assumptions (not merely because not all of the assumptions hold).

³⁴ Michael C. Jensen & William H. Meckling, *Theory of the Firm: Managerial Behavior, Agency Costs, and Ownership Structure*, 3 *Journal of Financial Economics* 305 (1976).

leverage. When managers increase leverage, they increase after-tax cash flow, thereby increasing the value of their holdings, and possibly their salaries as well, but at the cost of increasing the risk of bankruptcy and of losing their jobs. Alternatively, when managers decrease leverage, they improve their chances of avoiding bankruptcy and losing their jobs, but at the cost of reducing after-tax cash flow. Ross argued that investors can easily read these signals, which are credible because it is costly for managers to send them.³⁵ Ross's article, which was the first article to apply signaling theory to finance, relates to the first assumption of informationally perfect markets. Because markets are informationally imperfect, informational asymmetries exist, and capital structures can increase the value of the firm by alleviating the asymmetry. Thus, if a capital structure is going to internalize firm value, informational effects must also be taken into account

The above are only two ideas – albeit two very important and highly influential ideas – how capital structure can impact value. Over the last forty years, economists have developed many ideas in addition to the two above how capital structure can affect value in situations where the original M&M assumptions do not hold. (Miller himself developed many of the ideas about taxes and value.³⁶) And some of these ideas, including agency costs and signaling, have made their way into the lawyer's toolkit. However, the work of M&M, which gave birth to these ideas, and which in the form of the reverse M&M theorem serves as a framework that organizes these and many other ideas, has not been incorporated. That is unfortunate because the reverse M&M theorem, which calls for firms to optimally trade-off concerns across the four M&M assumptions, is a powerful analytical tool with a range of applications of relevance to lawyers.

The power of the reverse M&M theorem is that it provides a framework to examine and evaluate capital structure decisions. The reverse M&M theorem orders and categorizes a broad range of ideas on how capital structure can affect value into four silos. Within each silo, there are strong similarities across the ideas, which are not always evident. The reverse M&M theorem calls for firms to make trade-offs both within and across the four silos in order to find a capital structure that will maximize the value of the firm. The next three sections describes how the reverse M&M theorem can be used by legal academics, practicing lawyers, and judges. In each section, I provide one or more examples to illustrate how the reverse M&M theorem could be used.

Ivy Halls: Use by Legal Academics and Policy Makers

The first application of the reverse M&M theorem is its use by legal academics to study transactional structures. Scholars can use the reverse M&M theorem for both positive and prescriptive analyses. For example, the theorem can be used to study why a particular transactional structure is being used and how it has developed and changed over time. This would be an example of positive

³⁵ Stephen Ross, *The Determination of Financial Structure: The Incentive Signaling Approach*, 8 Bell Journal of Economics 23 (1977).

³⁶ The most well-known of Miller's solo work on taxation and capital structures is Miller's presidential address to the American Finance Association, which was published as Merton H. Miller, *Debt and Taxes*, 32 Journal of Finance 261 (1977).

analysis using the reverse M&M theorem. Implicit in the analysis is the assumption that practitioners have adopted the value maximizing structure. The theorem is then being used to explain why the observed practice is optimal. Scholars can also use the reverse M&M theorem to criticize existing structures and to develop recommendations for improved structures. This would be an example of using the reverse M&M theorem for prescriptive analysis. In this case, the existing structure is not optimal and the theorem is being used to help develop and defend more value-enhancing structures.

The above uses of the reverse M&M theorem is sometimes explicit in finance scholarship, but it is rarely explicit in legal scholarship.³⁷ Nonetheless, sophisticated legal academics frequently make arguments in the vein of the reverse M&M theorem. Such arguments often take the form that some capital structure is optimal because it solves a particular informational, incentive, or tax problem, which is to say it solves a problem relating to a failure to meet one of the M&M assumptions. Contained within that argument is usually a nod to the notion that the structure does not create or amplify other problems, which is to say it does not increase costs relating to a failure to meet the other assumptions.

Consider, for example, the practice of aircraft leasing, which can be readily understood through the reverse M&M theorem. Airlines can fund the purchase of new aircraft through equity, debt, or a capital lease.³⁸ A capital lease is a long-term lease.³⁹ Among the three long-term financing alternatives, airlines rarely pay for new aircraft by issuing equity or out of retained earnings. That is in large part because equity financing is subject to two levels of taxation – first at the corporate level and then at the investor level – whereas borrowing and lease financing incur only one level of taxation.

If the airline were to borrow to purchase the aircraft, the airline could depreciate the aircraft because the owner of property is entitled to the depreciation deductions on the property it owns. Depreciation reduces income, and thus provides the owner of property with a tax benefit. However, if an airline (or any U.S. taxpayer) has a net operating loss for the year, the government does not typically provide a tax refund. Instead, the taxpayer pays no income tax and receives a net operating loss (NOL) carryforward. NOLs are not worth as much as current deductions that offset taxable income because they are deferred and might not be fully utilized.⁴⁰

Moreover, aircraft are subject to attractive depreciation rules that allow the owner to depreciate the aircraft much faster than the aircraft's expected decline in value.⁴¹ These favorable depreciation rules make commercial aircraft a tax-advantaged asset. Such assets are worth most to

³⁷ For examples in the legal literature where the reverse M&M theorem is explicitly drawn upon, see note [], supra.

³⁸ The present value of the payments on a capital lease cover the cost of the equipment less the expected present value of the equipment's residual value at the end of the lease plus the return to the lessor.

³⁹ A capital lease, which is a financing technique, stands in contrast to a short-term or operating lease, such as renting a car while on vacation. Operating leases are typically entered into for convenience. They too can be understood through the reverse M&M theorem. An operating lease avoids the transaction costs that would be incurred in buying and selling the leased item.

⁴⁰ The NOL carryforward allows the taxpayer to offset taxable income, but only if the taxpayer has positive income in the future against which the loss can be used. NOLs can be carried forward for twenty years, without interest, after which they expire. Internal Revenue Code (26 U.S.C.) § 172(b)(1)(A).

⁴¹ The aircraft frame is considered to have an economically useful life of 12 years. As a result, the owner can depreciate the frame over 7 years using the declining balance method. See IRS, How to Depreciate Property, IRS Publication 946, at 106 (2016) (Class 45).

high-bracket taxpayers confident that they will have the income in the future to take full advantage of the deductions. Airlines, however, are not such taxpayers. The airline industry is capital intensive (aircraft are expensive), volatile, and of low profitability. Accordingly, if the airlines took all of the depreciation deductions from the aircraft they operated, they would frequently realize little or no value from doing so. Thus, the aircraft lease and its close cousin the leveraged aircraft lease were created in order to transfer the depreciation deductions from the airlines to other taxpayers that value them more.

In an aircraft lease, a third party takes title to the aircraft and leases the aircraft to the airline. The lessor as the owner of the aircraft takes the depreciation deductions, which the lessor uses to offset other income. The airline benefits from the lease through a lower cost of operating the aircraft because the lessor is willing to accept a reduced lease rate in exchange for the tax benefits. In effect, the airline transfers the depreciation tax benefits from owning the aircraft to the lessor, and the lessor compensates the lessee for the transfer through a lower lease rate. In a simple lease, the lessor would use its own cash to purchase the aircraft. That means tying up capital in a long-term investment in an aircraft and a lessee. Because it is the lessor's tax attributes – and only those tax attributes – that make it the preferred owner, most aircraft leases are leveraged leases. In a leveraged lease, a lender provides most of the capital required to purchase the aircraft. Thus, the lessor receives the tax benefits from owning the aircraft without having to finance the airlines' acquisition of the aircraft. Instead, the financing is provided by a lender with long-term capital to invest and with expertise in evaluating and making loans.

For a brief period during the early 1980's, there was a practice called safe harbor leasing under which any transaction that was called a lease would be respected as such, even if it closely resembled a sale.⁴² In this environment, lessors would transfer all of the risk of ownership to lessees by requiring lessees to purchase the aircraft at the end of the lease for a predetermined price. Because lessors had no residual risk from the aircraft (which was insured during the lease), nearly all of the tax benefits were passed through to lessees through lower lease rates. Later in the 1980's, the safe harbor leasing provisions were eliminated. The Internal Revenue Service (IRS or Service) would then challenge parties' characterization of transactions as leases if the purported lessors had too little residual risk. (Under the tax law, ownership is not determined by who holds title, but rather by who has the benefits and burdens of ownership.) If the Service were successful, it would treat the nominal lessee as owner (and hence the lessee, not the lessor, would be entitled to the depreciation deductions). Accordingly, aircraft leasing changed. Leasing remained, but lessors took on more residual risk, which created agency problems because lessees controlled the aircraft during the lease. The lease documentation became longer, end of lease purchase agreements at predetermined prices were eliminated, and the parties and their lawyers carefully negotiated and executed the lease so as to ensure that the lessor retained the requisite amount of risk and that the resulting agency costs were controlled. In this environment, lease payments increased in order to compensate lessors for their increased risk and their increased

⁴² The safe harbor was found in § 168(f)(8) of the Internal Revenue Code and was enacted in title II, § 20r(a) of the Economic Recovery Tax Act of 1981, Pub. L. No. 97-34, 95 Stat. 172, 203. Safe harbor leasing was repealed in 1982 as part of the Tax Equity and Fiscal Responsibility Act of 1982. For a critical, contemporary discussion of safe harbor leasing, see Alvin C. Warren & Alan J. Auerbach, *Transferability of Tax Incentives and the Fiction of Safe Harbor Leasing*, 95 Harvard Law Review 1752 (1982).

contracting and monitoring costs.⁴³ Thus, the safe harbor leasing rules allowed the parties to avoid agency costs by placing the full risk of a decline in the value of an aircraft on the airline that operated and controlled the aircraft. Once safe harbor leasing was eliminated, the lessor had to take on some of that risk, which reintroduced agency costs. The parties sought to minimize those risks as permitted by law, and compensated the lessor for its remaining risk. In other words, legal changes led to changes in the optimal capital structure because they changed the trade-offs across the M&M assumptions.

Although aircraft leasing and its development can be understood without reference to the reverse M&M theorem, by describing the agency cost and tax issues with leasing, the theorem makes it easier to see what are the relevant issues and to follow how the optimal balance among them changed as the legal regime changed. Used in this way, the reverse M&M theorem operates as a template scholars can use to comprehend alternative transactional structures and their development over time. Because it covers all of the different ways that capital structure can impact value, partitions those ideas into silos where the related ideas are grouped together, and excludes from consideration other elements that do not affect the total value of the firm, the reverse M&M theorem provides academics with a roadmap of the relevant issues when evaluating the efficiency of a transactional structure.

In the above example, the reverse M&M theorem was used to understand the form aircraft leasing takes and how that form changed over time. The reverse M&M theorem can also be used to develop criticisms of inefficient capital structures and to suggest how capital structures might be improved. The reverse M&M theorem can be used prescriptively because it asks the right question from an economic efficiency perspective – what structure maximizes the total value of the firm – and provides a roadmap that can be used to answer that question. In corporate law, the principal issue of debate has long been the division of control rights among corporate managers, directors, and shareholders. Because directors are typically seen as relatively passive, the debate over corporate governance is usually binary: one side argues that shareholders should have greater control rights and concomitantly that managers should have lesser control rights. The other side makes the opposite argument: managers should have greater control rights and shareholders should have lesser rights. The supporting arguments are often anecdotal, but they are increasingly econometric. These two views of the relative power that managers and shareholders should have play out across one issue after another, such as staggered boards, waiting periods, the poison pill, and the proper role of corporate directors.

The first view, the shareholder primacy position, is often described as the agency model and it emphasizes the agency costs from having managers make decisions on behalf of shareholders. As such, the agency model is a straightforward example of a violation of the second M&M assumption of frictionless markets. The latter view, the management primacy position, is sometimes described as the commitment view. Under that view, activist investors deter firms from making long-term, positive net present value investments that cannot be valued by the market. Thus, the latter view is an example of a violation of the first M&M assumption of informationally perfect markets. The debate usually takes the

⁴³ Accordingly, lease rates today also reflect airlines' reputations for maintenance, and the agreed upon use of the aircraft because how the aircraft is used—length of flight, altitude, etc.—impacts the aircraft's and its engines' residual values.

form of which approach is better—favoring managers or shareholders—which is to say whether the agency costs from manager control are greater than the costs resulting from imperfect information with shareholder control.

The reverse M&M theorem suggests a different approach: it suggests looking for a governance structure that maximizes the total value of the firm. A third alternative that mediates between the two polar positions above is to appoint stronger, more independent directors who can identify and value investments that cannot be publicly disclosed (without losing value). Hiring and empowering such directors has the potential to increase firm value above that from either polar position because it takes seriously the concerns expressed by both sides and looks to alleviate each side's concerns without exacerbating the other side's concerns. This suggestion, in essence, is Ira Millstein's proposal for activist directors who partner with management, but who also take responsibility for the corporation's strategy.⁴⁴ As Millstein writes, he favors

“a board-centric approach to corporate governance by placing more *activist directors* in the boardroom – people who will ask the tough questions, challenge management practices, and resist those who put their own agendas ahead of those of the corporation and investors like you. Choosing directors will require new diligence and care.”⁴⁵

Millstein developed his proposal for more activist directors without appeal to the reverse M&M theorem, but by drawing upon his lengthy and highly successful legal career. For those who lack the in-depth knowledge and experience that comes from decades of working at the pinnacle of the legal profession, the reverse M&M theorem provides a framework that should make it easier to develop and defend efficient new forms of corporate governance and capital structure because the theorem focuses inquiry on the relevant issues and provides a lens through which those issues can be examined and weighed.

Moreover, the observation or recommendation that directors should have more power is only the beginning of the analysis. A more thorough and detailed response would describe the additional duties directors take on, the powers they should have, and the limitations there should be on their powers. In addition, a more thorough analysis would describe how directors should be compensated and how much effort they should apply to each firm. Although I do not know what the correct answers are to those questions, the path to finding the value-maximizing answers runs through the reverse M&M theorem.

To sum up, the reverse M&M theorem categorizes and partitions the various ways that capital structure, which includes corporate governance, can affect the total value of the firm through the M&M assumptions. The M&M assumptions take a collection of seemingly unrelated economics concepts and organize them into categories of closely-related ideas. Once so organized, these economic concepts can be used and applied more easily and effectively. Accordingly, the reverse M&M theorem can improve analysis and criticism of alternative capital structures because the theorem forces existing practices and innovations to be examined from a comprehensive perspective that considers all of the ways that

⁴⁴ See Ira M. Millstein, *The Activist Director* (2017) (hereinafter Millstein, *Director*).

⁴⁵ Millstein, *Director*, at ix (italics in original).

structure can affect the total value of the firm and explicitly invites thinking about the trade-offs across those ways. Such thinking should aid scholars in understanding and evaluating exiting practices and in the search for efficiency enhancing innovations. The above examples only scratch the surface of questions where the reverse M&M theorem can be used to understand capital structure.⁴⁶

Wall Street: Use by Practitioners

For nearly a century, transactional lawyers have been trained through the Cravath method, named for Paul Cravath, one of the name partners of the New York law firm Cravath, Swaine and Moore. Under the Cravath method, a junior associate would start by working on a small piece of a transaction under the supervision of a more senior associate. As the lawyer gained more experience, he (and more recently she as well) would move up the pyramid taking responsibility for successively larger and larger portions of the transaction and seeing closely at each stage how a more senior lawyer handled the next stage. The rationale for such a method of training was that good transactional lawyering was more art than science, that almost everything there was to learn (beyond the directly applicable law) had to be learned through experience, by working with other lawyers, and could not be taught in the traditional fashion of most academic subjects.⁴⁷

Slightly more than thirty years ago, Ronald Gilson suggested that important aspects of the professional education of transactional lawyers did not have to be learned through an apprenticeship, but could be taught in a more traditional academic way.⁴⁸ Gilson asked the questions why do smart, sophisticated business people hire business lawyers and what is it that business lawyers do that makes them valuable to clients? Gilson suggested that much of the work of transactional lawyers could be thought of as business or transactional engineering. Moreover, lawyers face the same types of fundamentally economic problems, dealing with incentives and imperfect information, over and over again. Although these economics-based problems arise in different situations and present themselves in different forms, ultimately there are only a small number of basic economic concepts that underlie the core of the work that transactional lawyers spend the vast majority of their time addressing. Gilson further believed that lawyers would benefit from studying these basic economic concepts, such as the economics of information and agency costs, which give rise to the problems lawyers regularly address. In Gilson's view, such an economically trained lawyer would be better able to recognize one of these problems and would have a deeper understanding of the issue. Also, by identifying and understanding the problem's nature, such a lawyer could more quickly and easily draw upon previously seen transactions in order to find a solution that could address the problem at hand, modify that solution to fit the situation, and even develop new solutions when the situation demands it. Gilson then put that

⁴⁶ Also, when a structure is adopted in whole or in part for non-efficiency reasons, the reverse M&M theorem can be used to estimate the efficiency cost of not choosing the most efficient solution.

⁴⁷ For a description of the Cravath model and a view of its economic rationale, see William D. Henderson, *The "Cravath" System: Excerpts from the Legal Profession Blog*, available at www.teachinglegalethics.org/sites/default/files/Henderson-CravathSystem.pdf

⁴⁸ See Ronald J. Gilson, *Value Creation by Business Lawyers: Legal Skills and Asset Pricing*, 94 Yale Law Journal 239 (1984) (hereinafter Gilson, *Value*).

thought into practice by teaming with two Columbia colleagues, Victor Goldberg and Daniel Raff, and offering the first Deals course at the Columbia law and business schools.

Deals courses typically begin by introducing the students to the relevant economic concepts through the use of highly stylized examples that present some basic and fundamentally economic challenges that lawyers and their clients face. The course then progresses through increasingly less stylized case studies that illustrate how these challenges present themselves in different contexts as well as some standard techniques that address those challenges. The course typically concludes with presentations by professionals of actual transactions, which are then analyzed by the students. The students' task is to explain why the transaction was structured as it was using the concepts covered in class. The presentations by professionals of actual transactions and their analysis by the students can be an effective way to conclude a Deals course because the appearance in actual transactions of the theoretical economic concepts covered in class reinforces the importance of those issues, challenges the students to find and identify those issues, and shows the student how those issues were addressed (or not) by the professionals who faced them. The practitioners' presentations, however, are less successful pedagogically when the structure is driven by one or more concepts that were not among the specific concepts covered in class. In that case, there is an uncomfortable disconnect between the classroom pedagogy and the final presentations. Accordingly, Raff and I, after Raff left Columbia for Penn and recruited me to teach Deals with him, began using the reverse M&M theorem to organize the ideas presented in the course. Because the M&M assumptions span the ways transactional structures can affect the total value of a firm (and partition those ways into silos, the reverse M&M theorem ensures that the full range of ways in which structure can affect value are at least introduced (and covered at a high level of generality) even though not all of the ways can be explored at length. Thus, even if a structure is largely driven by a particular issue that we did not explicitly cover in class, the driver can be placed in one of the four M&M silos and its similarities to other ideas in that silo can be drawn upon to understand the issue and its resolution.⁴⁹

Raff and I have found that there are other additional pedagogical advantages from using the reverse M&M theorem to organize a Deals course. Lawyers (and other transaction professionals) structure and execute transactions. Each step of the way there are choices to be made. These choices involve tradeoffs, which operate within and across the M&M assumptions. The reverse M&M theorem makes those tradeoffs explicit. Because the reverse M&M theorem provides a framework that organizes the full range of ways in which structure can affect firm value, the reverse M&M theorem lies at the heart of the work that corporate lawyers do. A lawyer who knows the reverse M&M theorem and is familiar with the main ideas in each silo is better able to understand the issues driving a transaction. In addition, the same young lawyer can more quickly acquire knowledge because she is building out a framework (using the reverse M&M theorem as a skeleton), and she is better able to retain knowledge because she can store it systematically, not just as a series of one-off examples. Such a lawyer can also more readily recall and employ her knowledge when the situation arises because once she has identified and categorized the problem she can focus her search for a solution among solutions to structurally

⁴⁹ Knoll & Raff, *Comprehensive*.

similar problems across various practice areas rather than gravitating towards what has been done before in the same practice area.⁵⁰

The teaching of the reverse M&M theorem is, thus, an example of the kind of reform for which the 2007 Carnegie Report on Legal Education called. The Carnegie Report criticized law schools for relying too heavily on post-graduation apprenticeships in order to train lawyers and recommended that law school faculty seek to identify powerful analytical frameworks that lawyers can use to accelerate their transition from law students to successful practitioners.⁵¹ The reverse M&M theorem is precisely such a framework because it captures much of what transactional lawyers do in practice, albeit at a high level of generality.⁵²

The applicability of the reverse M&M theorem can be illustrated through some common examples from mergers and acquisitions. There are what might seem to be (especially to a new associate) a bewildering array of methods whereby one corporation (Purchaser) can acquire another corporation (Target). The basic possibilities include:⁵³ Purchaser acquires Target's assets; Purchaser acquires Target's stock; Target merges into Purchaser;⁵⁴ Purchaser merges into Target;⁵⁵ Target merges into Purchaser's subsidiary;⁵⁶ or Purchaser's subsidiary merges into Target.⁵⁷ The main result of all of these transactions is the same – Purchaser ends up owning Target's assets – but there can be very different legal and economic consequences depending upon the method chosen. The reverse M&M theorem can help attorneys (especially beginning attorneys) to navigate the rough waters of mergers and acquisitions practice by giving them a better and deeper understanding of the issues that drive the choice of structure, which come down to the M&M assumptions. By recognizing the trade-offs across incentives, informational asymmetries and taxes that arise with the different structuring choices, the reverse M&M theorem can help lawyers to choose an acquisition method. Indeed, as one reads sophisticated treatments by practitioners of the various options and their advantages and disadvantages, their reasons regularly relate back to and can be catalogued under the M&M assumptions.⁵⁸ A lawyer who has internalized the reverse M&M theorem should find it easier to

⁵⁰ Knoll & Raff, *Comprehensive*, at 48. Such a lawyer would also be less likely to fall into the trap of selecting a solution that resolves a particular problem within one silo, but that inadvertently causes another problem within another silo. Because the reverse M&M theorem explicitly invites users to make tradeoffs across silos, practitioners are encouraged to examine the impact of a structure across all four silos before adopting any particular structure.

⁵¹ Educating Lawyers: Preparation for the Profession of Law chapter 4 (2007) (hereinafter Carnegie Report)

⁵² Knoll & Raff, *Comprehensive*, at 48.

⁵³ There are more complex methods as well.

⁵⁴ This is called a forward direct merger. It is a forward merger because Purchaser survives and Target is extinguished. It is a direct merger because it involves only two parties, Purchaser and Target.

⁵⁵ This is called a reverse direct merger. It is a reverse merger because Target survives and Purchaser is extinguished.

⁵⁶ This is called a forward triangular merger. It is a triangular merger because it involves three parties: Purchaser, Purchaser's subsidiary, and Target.

⁵⁷ This is called a reverse triangular merger.

⁵⁸ James Freund, *Anatomy of a Merger: Strategies and Techniques for Negotiating Corporate Acquisitions* (1975) (hereinafter Freund, *Anatomy*); Christopher S. Harrison, *Make the Deal: Negotiating Mergers and Acquisitions* (2016) (hereinafter Harrison, *Deal*).

acquire, store, retrieve and apply the relevant knowledge and the young lawyer can more quickly acquire the knowledge and skills required to progress.

As another example where the reverse M&M theorem can be useful, consider an example Gilson emphasized in his original article, the negotiation of representations and warranties.⁵⁹ Representations and warranties are statements of fact to which a party to a contract is attesting. Many of Target's typical representations and warranties concern Target's assets and liabilities. For example, Target usually represents to Purchaser that Target owns or has the rights to the assets that it uses in its business and shows on its financial statements. Also, Target commonly represents to Purchaser that Target does not have liabilities beyond those it has disclosed. James Freund, a retired Skadden Arps mergers and acquisition partner and the author of a classic book on mergers and acquisitions, describes the process of negotiating representations and warranties as competitive, with each attorney trying to capture more value for her client.⁶⁰ In contrast, Gilson describes the process as cooperative (or argues that it should be cooperative) because the less well informed party (typically, the Purchaser with the above representations and warranties) wants assurances that it is receiving what it is paying for and sellers have the incentive to provide this information in order to encourage buyers to pay more.⁶¹ Thus, Gilson's view of representations and warranties fits nicely within the reverse M&M theorem framework. The negotiation of representations and warranties is a response to a violation of the first M&M assumption, the perfect information assumption. The representations give Purchaser useful information about Target and assurances as to the accuracy of that information.

What about Freund's competitive view of negotiating representations and warranties? Recall that the reverse M&M theorem holds that capital structure can affect the value of the firm only through the M&M assumptions and hence the capital structure that maximizes the overall value of the firm minimizes the total cost from falling short of the assumptions. However, the lawyers negotiating a merger or acquisition (and their clients) are not only interested in maximizing the value of the deal. Each side also has an interest in receiving as much value as it can. Familiarity with the reverse M&M theorem can help to explain the disagreement between Freund and Gilson.⁶² Each side likely believes that both sides expect to receive some surplus from entering into the deal, and the representations and warranties are one place in the negotiation where each side can try to seize more of the surplus (and is at risk of losing some of its surplus). The challenge in these negotiations for more experienced negotiators is to ascertain how much value they can extract for their side without causing the other side

⁵⁹ Gilson, *Value*, at 267-94.

⁶⁰ Freund, *Anatomy*, at 229 ("I'll bet my briefcase that lawyers spend more time negotiating "Representations and Warranties of the Seller" than any other single article in the typical acquisition agreement").

⁶¹ Gilson, *Value*, at 271-73.

⁶² The reverse M&M theorem is a statement about value creation, and the total value of a transaction can be increased by providing information and assurance. The reverse M&M theorem says nothing about how that value is distributed. My conjecture is that among experienced mergers and acquisitions lawyers, such as Freund, little time and energy is spent negotiating the representations and warranties that cover what the parties understand each needs. That, however, leaves more time and energy to spend fighting over the division of (expected) surplus that characterizes the rest of the negotiation. Thus, a scholar reading the final document could conclude it is mostly cooperative, but the lawyer who negotiated it would say more of the time was spent in competitive negotiations.

to walk.⁶³ For the new associate, however, the challenge is often figuring out what is going on and following the negotiations. Understanding both the value creation and value distribution exercise taking place and the role the reverse M&M theorem plays with the former as well as the conflict that often arises between value creation and value distribution can help the less experienced associate to be a more effective advocate and negotiator.

The Court Room: Use by Judges and Litigants

Finally, one area where to the best of my knowledge that reverse M&M theorem has yet to be explicitly applied is in the court room. The reverse M&M theorem can assist courts in drafting common law rules.

Consider, for example, the calculation in civil litigation of prejudgment interest. Prejudgment interest is interest that the defendant pays to the plaintiff on the judgment award. Prejudgment interest accrues from the date of injury until the date of judgment.⁶⁴ Federal law does not provide for a particular fixed or floating prejudgment interest rate. Instead, the federal courts have sought to award prejudgment interest at a rate that will compensate the successful plaintiff for the delay in receiving relief. According to the economics-based coerced loan theory, a successful plaintiff should receive prejudgment interest at the defendant's unsecured borrowing rate. The rationale is that the defendant through its wrongful action has forced the plaintiff to make a loan to the defendant, which debt would be treated as an unsecured debt in the event of defendant's bankruptcy. Accordingly, in order to compensate the successful plaintiff for the risk of winning its case, but not being able to collect its judgment, the defendant should pay the plaintiff interest at the defendant's unsecured borrowing rate.⁶⁵ Moreover, because the risk to the plaintiff of the defendant defaulting increases with the loan term, compensating the plaintiff requires taking the duration of the loan into account.

⁶³ The competitive aspect of negotiating representations and warranties is exacerbated by the usual practice of negotiating the representations and warranties only after the price and acquisition method are set.

⁶⁴ Interest that accrues from the date of judgment until payment is post-judgment interest. Jurisdictions often have different rules for prejudgment and post-judgment interest and it is common to have affixed statutory rate or formula for post-judgment interest even if there is not a similar rule for prejudgment interest.

⁶⁵ *Gorenstein Enterprises v. Quality Care*, 874 F.2d 431 (7th Cir. 1989); James M. Patel, Roman L. Weil & Mark A. Wolfson, *Accumulating Damages in Litigation: The Roles of Uncertainty and Interest Rates*, 11 *Journal of Legal Studies* 341 (1982) (hereinafter, Patel et al., *Accumulating*); Michael S. Knoll, *A Primer on Prejudgment Interest*, 75 *Texas Law Review* 293 (1996) (hereinafter Knoll, *Primer*); Jeffrey Colon & Michael S. Knoll, *Prejudgment Interest*, chapter 16 in in Roman L. Weil, Daniel G. Lentz & Elizabeth A. Evans, *Litigation Services Handbook: The Role of the Financial Expert* (6th ed. 2017) (hereinafter Colon & Knoll, *Prejudgment*). Most proponents of the coerced loan theory recognize that defendant's unsecured borrowing rate will not fully compensate the plaintiff if the plaintiff is an individual and the debt is a large portion of the plaintiff's wealth. If the plaintiff cannot readily insure against or sell the claim, then the nonpayment might impact the plaintiff's consumption. In such cases, the defendant's borrowing rate will not fully compensate the plaintiff for having funds tied up with the defendant. Conversely, when the plaintiff is a public corporation, or the claim is small relative to wealth, the defendant's unsecured borrowing rate is sufficient to compensate the plaintiff. Patel et al., *Accumulating*; at 354-62; Knoll, *Primer*, at 345-47; Colon & Knoll, *Prejudgment*, at 16-17. The above can be understood as applications of the reverse M&M theorem. Informationally imperfect markets and market frictions can make it impossible to sell a

However, recognizing that the court should award the plaintiff prejudgment interest at defendant's cost of unsecured borrowing from the date of injury to the date of judgment does not provide the court with all of the direction that it needs to calculate a prejudgment interest award. That is because it does not determine a unique and unambiguous interest rate. In principle, the defendant could have borrowed unsecured from plaintiff at a fixed interest rate or at an array of floating interest rates. The coerced loan theory cannot resolve this matter as there can be multiple market-based interest rates that can compensate the plaintiff. In such circumstances, the reverse M&M theorem provides an approach to resolve the issue. The reverse M&M theorem suggests that the court should adopt a rule that will minimize the combined cost to the parties from failures of the M&M assumptions. In most circumstances involving prejudgment interest, the only assumption implicated by a different choice of interest rate is the assumption of frictionless markets. Litigants have some control over the pace of litigation. Accordingly, because it is easier to delay litigation than to accelerate it, and because a non-market interest rate gives one party an incentive to delay (and the other to accelerate), a fixed rate obligation is likely to lead to delay (which is costly). If interest rates have gone up (so the original fixed interest rate is below market), the defendant will have incentive to delay; alternatively, if interest rates have gone down (so the original rate is above market), the plaintiff will have incentive to delay. In contrast, with a floating interest rate, neither party has an incentive to delay based on a non-market prejudgment interest rate.

More generally, there is a broad class of cases that involve choosing among multiple remedies that could in principle compensate a successful plaintiff. Many of these examples involve whether to make ex-ante or ex-post calculations of damages.⁶⁶ The reverse M&M theorem provides an economic approach to resolving these issues efficiently.⁶⁷

Why the Oversight?

The question, "if you're so smart, why aren't you rich?" has been a cliché since at least the time of Aristotle.⁶⁸ The variant here is if the reverse M&M theorem is such a useful framework for the law, why hasn't it already been adopted? One answer is that it has in that so many of the ideas that have

claim for its expected value. Thus, because an individual plaintiff might not be able to sell her claim for its expected value, she might require extra compensation to compensate her for delay.

⁶⁶ See generally Elizabeth A. Evans & Roman L. Weil, *Ex Ante Versus Ex Post Damages Calculations*, chapter 5 in Roman L. Weil, Daniel G. Lentz & Elizabeth A. Evans, *Litigation Services Handbook: The Role of the Financial Expert* (6th ed. 2007).

⁶⁷ The reverse M&M theorem can also help to design the contours of the prejudgment interest rule, such as whether there should be a firm, universal rule for the index, or whether the index should be chosen on a case-by-case basis, or some combination thereof. Of course, the reverse M&M theorem is about economic value or efficiency; it says nothing about non-economic values, such as distributional fairness. Accordingly, if the prejudgment interest rate calculation is made not to maximize efficiency, but with a nod towards other values, such as distributional fairness, the reverse M&M theorem provides a framework through which to examine the efficiency costs, which can be traded off against other values.

⁶⁸ Aristotle, *Politics*, Bk. I, ch. 11 (sec. 1259a) (describing how the philosopher Thales when reproached for his poverty used his knowledge of meteorology to predict a bumper olive crop; Thales then rented all of the olive presses at a reduced rate months before the harvest; when the harvest came in as Thales anticipated, Thales rented out those presses at a substantial profit).

developed out of the reverse M&M theorem, such as asymmetric information and agency costs, have been incorporated into the law. However, the reverse M&M theorem itself has not been generally and widely adopted as an ordering principle, which is its incremental value after six decades of scholars building out its main insight. Of course, as an intellectual framework or ordering principle, its exclusion does not withhold any specific idea or preclude any specific analysis. What is lost is a more effective way of ordering and drawing upon knowledge, which still leaves the question.

As for the failure of transactional lawyers to adopt the reverse M&M theorem a possible partial explanation is that the theorem would often apply in an environment where both value creation and value distribution are taking place simultaneously. As described above, mergers and acquisition negotiations, including negotiations of representations and warranties and choosing a particular acquisition or merger structure, are simultaneously both cooperative and competitive.⁶⁹ In such circumstances, the competitive aspects often receive the most attention and frequently overshadow the cooperative aspects.⁷⁰ The reverse M&M theorem addresses only the cooperative aspects and so it does not address all aspects of the negotiations, yet alone the most confrontational, which could make it easy to overlook. Nonetheless, as negotiation experts regularly emphasize, understanding the relevant issues and the potential value they have to all parties will make one a better negotiator.⁷¹

Another possible reason for the oversight is suggested by an important recent working paper by Professors Lee Anne Fennell and Richard H. McAdams, entitled *Inverted Theories*.⁷² Fennell and McAdams argue that some of the most well-known ideas in law, including the Coase theorem, the Tiebout hypothesis, and Kaplow and Shavell's theory of tax superiority, are commonly understood in their original form, in which they yield negative or impossibility results.⁷³ Fennell and McAdams further argue that the heavy emphasis on the original form of the theorem and the near total avoidance of its inverse or reverse form is a major error that calls for correction.⁷⁴ According to Fennell and McAdams, the above theorems are better understood in their inverted form, which takes the focus off of the negative or impossibility result and puts the focus on the assumptions.⁷⁵ Moreover, Fennell and McAdams attribute the emphasis on the original form of the theorem as connected with the political valence of such negative or impossibility result, which they believe is more appealing to conservatives,

⁶⁹ Freund, *Anatomy*, chapter 7 (representations and warranties); Martin D. Ginsburg & Jack S. Levin, *Mergers, Acquisitions and Buyouts*, ¶104 (2001) (deal structuring).

⁷⁰ The major insight from *Getting to Yes* is the importance of the cooperative aspects of negotiation. See Roger Fisher, William L. Ury and Bruce Patton, *Getting to Yes: Negotiating Agreement Without Giving In* (2011). Although some other authors view the *Getting to Yes* authors as having gone too far in the cooperative direction, the authors of *Getting to Yes* were early writers on negotiation to recognize the importance of the cooperative aspect.

⁷¹ E.g., James C. Freund, *Smart Negotiating: How to Make Good Deals in the Real World* chapter 3 (1992); G. Richard Shell, *Bargaining for Advantage* chapter 7.

⁷² Lee Anne Fennell & Richard H. McAdams, *Inverted Theories*, August 11, 2017 working paper, available at <https://ssrn.com/abstract=3017437> (hereinafter Fennell & McAdams, *Theories*). If a theorem is of the form “if A, then B,” the inverse of the theorem holds “if not A, then not B.” In contrast with the contrapositive, which is true if the theorem is true, the inverse is not true simply because the original theorem is true.

⁷³ Fennell & McAdams, *Theories*, at 4-5.

⁷⁴ Fennell & McAdams, *Theories*, at 5-7.

⁷⁵ Fennell & McAdams, *Theories*, at 1-2.

as opposed to the inverse, which invites an inquiry into situations where the assumptions behind the theorem do not hold, which they argue is an inquiry more appealing to liberals.⁷⁶

Thus, as applied to the reverse M&M theorem, Fennell and McAdams' analysis suggests several reasons why the reverse M&M theorem might not have caught on. First, they find that reverse theorems or inverted theorems are very uncommon if not completely unknown in the law. The reverse M&M theorem is, of course, just such an inverted theorem. Moreover, the reverse M&M theorem in its original forms says little about law – or at least little about law that is likely to appeal to lawyers – since it implies that transactional lawyers are wasting their time and their clients' money. If the M&M theorem in its original form is accurate, then lawyers are just transactions costs and add no value for their clients. That is not a theorem that lawyers (or legal academics) are likely to embrace. Finally, the original M&M theorem (as well as the reverse M&M theorem) would seem to have little political valance, which would eliminate the ideological motivations that Fennell and McAdams credit for raising the profiles of their original examples.

Conclusion

Sixty years ago, Professors Modigliani and Miller unveiled their capital structure irrelevancy theorem and revolutionized financial economics with their “bombshell assertion” that under certain idealized assumptions the total value of a firm was independent of its capital structure. Although their theorem has made little inroad into law, many ideas that have developed out of their fundamental insight – that capital structure can affect firm value only through the original M&M theorem's assumptions – are today part of the canon of foundational legal ideas (such as informational asymmetries and agency costs). However, the failure to recognize the many legal setting where the reverse M&M theorem can be applied and the numerous issues it can illuminate has deprived legions of lawyers of a powerful analytical framework. Explicitly incorporating the reverse M&M theorem into legal analysis and giving it a prominent place in the legal canon will help legal academics, practicing lawyers, and judges all perform their work better.

⁷⁶ Fennell & McAdams, *Theories*, at 30.

Appendix: An Example Illustrating MM's Proof

Consider two otherwise identical firms that differ only in their capital structure. One firm (Unlevered) has no debt and issues 100 shares at \$10 each, and so Unlevered is worth \$1000; the other firm (Levered) has \$500 of outstanding debt and issues 50 shares. Assume initially that Levered is worth more than \$1000, as the then-conventional wisdom suggested, in which case each share of Levered would sell for more than \$10. It would cost an investor who wanted to purchase, say, ten percent of the shares of Levered more than \$50 to acquire the desired investment. Such an investor would receive a return equal to ten percent of Levered's before interest return less ten percent of Levered's interest payments. Alternatively, rather than buying ten percent of Levered's shares, the investor could borrow \$50 and with \$50 of the investor's own money purchase ten percent of Unlevered's shares for \$100. This alternative investment will yield one tenth of the return on the equity of Unlevered less interest on \$50 debt.⁷⁷ Such an investment would yield ten percent of Unlevered's return after paying interest on debt of \$50. Similarly, the investor who holds ten percent of Levered's stock receives ten percent of Levered's return less interest on \$50 debt. Because Levered and Unlevered are assumed to be identical except for their capital structure, the firms earn the same return before payment of interest. Hence, because the interest rate on the inside debt issued by Levered and the outside debt issued by the investor and secured by Unlevered's stock are also the same,⁷⁸ the investment in Levered and the leveraged investment in Unlevered, yield the same return. However, it would cost the investor only \$50 to make the investment through Unlevered by borrowing on personal account rather than through the firm, not the higher amount it would cost the investor to buy ten percent of Levered's shares. Thus, Levered cannot be worth more than Unlevered because investors could lever up their investment in Unlevered using "homemade leverage."

Conversely, if Levered were worth less than Unlevered, investors could undo Levered's leverage themselves. An investor who wanted to hold five percent of Unlevered could instead of purchasing five percent of Unlevered's shares for \$50 purchase five percent of Levered's debt for \$25 and five percent of Levered's equity for less than \$25. Such an investor would receive the same return as an investor who held five percent of Unlevered's shares, but it would have cost the investor less than \$50 instead of \$50 to establish that position through Levered. Thus, Levered cannot be worth less than Unlevered because investors can deleverage Levered by purchasing both its equity and debt. Accordingly, because Levered cannot be worth less than Unlevered nor can it be worth more than Unlevered, Levered and Unlevered must be worth the same amount, which is to say that leverage has no impact on the overall value of the firm.

⁷⁷ If the \$50 debt was without recourse and secured by the unlevered stock, the risk and hence the interest rate on the debt would be the same whether the borrowing was through the corporation or by the individual investors directly.

⁷⁸ That the individual investor can borrow at the same rate as the firm follows from the first two assumptions of perfect knowledge and frictionless markets. Because the security is the same with the individual borrowing nonrecourse and using the equity to secure the loan and the firm borrowing unsecured with limited liability, the interest rates are the same. In their original article, M&M explicitly assumed equal borrowing rates as one of their assumptions. Modigliani & Miller, *Capital*, at 268.