Merton H. Miller: Our Socrates

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ABSTRACT

Myron Scholes called Merton H. Miller our Socrates. He was right. Miller (1923-2000) created the leading breakthroughs of Corporate Finance Economics over the last forty-plus years. The legendary Modigliani-Miller theorems of leverage and dividend policy irrelevance to the aggregate value of the firm, the battles he brought on for the futures markets, his views railing against restrictive regulatory interventions, and the pillars he devised to underlie the mainstreams of "post-Millerian" Corporate Finance Economics are among many other things the revelation of his philosophy. In one word, he was a genius. In this paper, we endeavor to shed some light on his life and the legacy of some of his unparalleled philosophical corollaries he left to academia.

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I.   INTRODUCTION

One of the greatest financial philosophers of the last century is Merton H. Miller, the Robert R. McCormick Distinguished Service Professor of Finance until 2000. He knew how to contrive well-cemented bases for a new scientific and philosophical reasoning in economics. All his life was an uninterrupted array of successes, but also failures, which, in bulk, shaped the directional corollaries of Corporate Finance Economics, and even same those of macro-economics. He won the Nobel Prize in 1990, sharing it with Harry Markowitz and William Sharpe. That was for him a supreme recognition from the Financial Community.

In a succinct note describing how he became an economist, Paul Anthony Samuelson said: "*Harvard made us. But as I have written many times, we made Harvard*". This strong and consistent statement would say that an elite of eminent professors who brought to the world what thousands of people had had in hundreds of universities around the world for the last forty-plus years. Miller was unmistakably one of them. His methodological shadow still affects the theoretical temptations to model financial phenomena.

In this paper, our attention will be directed at emphasizing the track records of Miller on the intellectual side, as well as some insights from his personal life, that's what many people would be interested in. Indeed, all undergraduate and graduate corporate finance curricula around the world must embed compulsorily the MM theorems as the major cornerstone. Hence, we are tremendously motivated to expound the life of Merton Miller, though, maybe, we would add nothing new to theory, but speaking again and again about him turns out to be extremely exciting. We further will endeavor to point out what seems to be salient in his academic life.

II.   THE INTELLECTUAL BIRTH OF A LEGENDARY FINANCIAL ECONOMIST

Miller saw the light in Boston on May 16, 1923, the sole child of Joel and Sylvia Miller, in the same area where William F. Sharpe was born, eleven years later.[1] He followed the footsteps of his father by attending Harvard University, not to get law courses, but economics. At the age of 17, he entered for the first time the lecture hall where he met Robert M. Solow, the 1987 Nobel Prize-winner for his work on growth theory. In 1943, Miller graduated magna cum laude with a B.A. in economics, and then worked during the years of the WW2 as an economist in the Division of Tax Research of the U.S. Treasury Department in Washington D.C. Afterwards, he moved to the Division of Research and Statistics of the Board of Governors of the Federal Reserve System. Prior to that, he worked, while a fellow, for a company advising people about their portfolios selection, though no portfolio theory existed at that time.[2]

In concert with Miller's credentials, unsurprisingly, he gained a striking expertise in taxation because of his work in Public Finances. In addition, Miller turned out to be sharply a great devotee of Corporate Finance and more precisely its tax side. By virtue of that devotion, he earned his doctorate on prices discrimination in the railway industry from Johns Hopkins University by the end of 1952. During 1953, he was appointed as a Visiting Assistant Lecturer at London School of Economics. After that, he moved to the Graduate School of Industrial Administration of then Carnegie

Institute of Technology (now Carnegie-Mellon University), where he met for the first time Franco Modigliani.[3] His seven-year period (1954-1961) he spent at Carnegie Tech was prodigiously fruitful to the extent that it has led to the legendary Modigliani and Miller papers, together with many brilliant economists working in one of most active business schools of the USA.[4]

Modigliani described his meeting with Miller as one of the most productive days of his life. The collaboration between Miller and Modigliani turns out to be the span for the intellectual birth of a great economist, namely Merton H. Miller. It is not eccentric, however, that Richard Roll, a former student of Miller, says he is obviously a great scholar and one of the best economists ever.

III.   MAJOR COROLLARIES OF MILLER'S PHILOSOPHY

William F. Sharpe said Miller never accepted conventional wisdom. Instead, he questioned everything, subjecting every proposition to the power of his phenomenal intellect. It is for this reason that, after failing to prove the existence of an optimal capital structure, he posited, jointly with Modigliani, that there is no optimum. This pattern, however, was not only confessed by data, in the original 1958 paper. It was a theoretical model consisting of a starting-point, and based on a proof—the arbitrage[5] concept—that dealt with the problem from the opposite side. Based on the Fisherian principle,[6] Modigliani and Miller used that proof (sometimes referred to as the homemade leverage argument) to start from a different starting-point looking at why and how the firm sells (not buys) which types of securities, which was unusual. The arbitrage is a constant theme in Miller's intellectual career from his work in Corporate Finance to his analyzes of financial innovation, financial crashes, and crises (Stulz, 2003).

Loads of financial economists hit at the first proposition of capital structure irrelevance to the aggregate firm value such that its consistency is tailed-off. What makes the proposition "dazzling" is not only its implication, but the arbitrage device itself. In fact, in the 1958 paper, it was proven that arbitrageurs grasp arbitrage opportunities that may crop up due to discrepancies between the values of leveraged and unleveraged firms, holding the risk of failure constant.[7] The implemented arbitrage strategy is grounded on a set of conjectures such that the information is symmetrically distributed among security claimants, the market is transaction and contracting-costs free.[8]

A.   The "Nothing Matters" View

Before publishing the 1958 paper, the reigning idea in Wall Street was the positive affect indebtedness would have on the firm's aggregate value. Moreover, since debt financing is cheaper than equity financing (by virtue of the preferential tax treatment of debt), the firm's aggregate value must be positively correlated with leverage, which, accordingly, means that the after-tax cost of capital is inversely related to leverage, as long as its level does not approach the "danger zone".

The central question academics inquired into was what the market effectively capitalized (Miller, 1977), and whether the indebtedness level would really impact the shareholders' wealth. Modigliani and Miller (1958) first supposed the economic

assumptions of rationality, and the perfect market conditions are both met. The major result was: when the market breaks even (i.e., at the equilibrium or when the market clears in the Walrasian language), the aggregate value of the firm is not affected by the modifications in its capital structure. Thereby, different combinations of different financing sources, say shares, bonds, warrants, preferred shares, do not enhance the expected welfare accruing to shareholders. These financing sources just slice up the underlying earnings in different ways (Tanous, 1997), such that the firm's value solely hinges on its stream of expected cash flows and discount factor; that is, on its real investment independently of the liabilities' constituents.

All this is true in the idealized world they assumed. Miller often expounds jokingly the Modigliani-Miller theorem by saying "you may understand it if you know why this is a joke. The pizza delivery man comes to Yogi Berra[9] after the game and says, Yogi, how do you want this pizza cut, into quarters or eights? And Yogi says, cut it in eights pieces, I am feeling hungry tonight."

In concert with this state of affairs, the aggregate values of unleveraged and leveraged firms must be the same, conditionally on the fact that they hold the same set of real assets. The first proposition was thoroughly explained in the seminal book of Fama and Miller (1972) through the addition of another condition to ensure the indifference of securityholders regarding the firm's financing choices. Indeed, the old securityholders need to be protected by the "me-first rules" through the assignment of seniority to their debts, and junior feature to the newly-issued ones. Therefore, equityholders are in turn protected by the me-first rules that, in compliance with Culp (2003), require any early retirements of debt to begin with the most junior issues.

The 1958 original paper embedded two additional, of course irrelevance, propositions. Proposition two states that leverage cannot lower the firm's WACC, in the sense that the debts' tax deductibility favor is tailed-off by the equityholders' required profitability. Indeed, Miller (1990) points out that stockholders require a compensation (a sort of leverage penalty) for the risk of a higher indebtedness, just to nullify the decrease in the WACC brought forth by debt financing.

The third Proposition is important as much as the first two ones, since it was the basis for the development of leading approaches within "post-Millerian" Corporate Finance Economics (e.g., Myers and Majluf (1984) and Myers's (1984) pecking order theory, Stiglitz's work on Information Economics, etc.) It plainly says that the types of securities do not affect the firms choices with respect to investing or such that an investment opportunity is grasped if and only if its expected return exceeds what it costs.

The 1958 paper did contain the first bloc of the constituents of the irrelevance propositions. And that bloc was the most attractive. The irrelevance of dividend policy first appeared in a succinct and implicit manner in Modigliani and Miller (1959) as a response to Durand's (1959) detracting comment. Although Modigliani and Miller knew that something was going wrong with their first bloc, they insisted to formalize the second bloc in Modigliani and Miller (1961) to deflect criticisms of their first proposition (Pagano, 2005), and bolster up the consistency of their proof.
The same arbitrage rationale is used to show that the possibility of constructing homemade dividends on the personal account may be fulfilled by firms, which ensures the same irrelevance result. This second bloc is at odds with the classical finance's view of Gordon-Shapiro asserting the value-enhancing effect of dividend policy on stock

prices. The 1961 paper argues the same conclusion such that only the assets allocation matters.

B.   The Arbitrage: the Staple of Modern Finance

Prior to Miller, no finance curricula did formally exist. Giving undergraduate lectures was a "bothering" chore consisting of a legislative depiction of Harvard law courses like the legal commitments, the description of financial contracts, alongside with the archaic elucidations of financial institutions and marketplaces. The departure of Modigliani and Miller (1958) was not grounded on previous equilibrium models of assets prices (developed later with the CAPM-type models); it was, however, based on an already existing concept that they put in the right place. Modigliani and Miller (1958) skated round the arbitrage reasoning and went directly to its application such that it was supposed to include individual strategies (for instance by households) to replicate the best debt-equity combination of the leveraged firm.

It is, however, thought that the aggregate value of a leveraged firm is higher than the one of an all-equity financed firm. In concert with this, individual investors may conjecturally sell a portion of the leveraged firm's stock, buy another portion of the non-leveraged one, and successively operate an individual issuance of debt such that they replicate the best combination (which is implied to be the one of the leveraged firm.) The arbitrage opportunity springs up from the differential of prices of both firms' securities. The debt and equity markets' equilibria are the sets such that, for the same cash flows' exposure to risk, the (partially) leveraged and all-equity financed firms must have the same aggregate values (i.e., they linearly depend upon their respective expected payoffs.)

The fashion introduced in the Modigliani and Miller's (1958) setting was extended to cover some dynamical arbitrage strategies, particularly with the total diffusion of the pricing of contingent claims. The option pricing formula of Black and Scholes (1973) utilizes the arbitrage argument to show how the payoffs of a given set of securities may be easily replicated. Similarly, the same arbitrage arguments would apply to the Arbitrage Pricing Theory (APT).

In the main, the philosophy underlying these arbitrage arguments serves as the basis for pricing all types of securities. One important insight, however, is how to price, say, warrants irrespective of their owners' behavior in front of risk. The answer is obvious: on the basis of Modigliani-Miller arbitrage argument, the absence of free arbitrage opportunities reflects that the price would amount to the stream of expected cash flows, discounted at a risk-free discount factor.

In the course of more than thirty years, the arbitrage-based proof had became a cornerstone in securities pricing to the extent that Miller (1988) considers humorously that the Fisher-Black's "familiar put-call parity theorem is really nothing more than the Modigliani and Miller (1958) proposition I in only a mildly concealing disguise".

C.   Miller on the Financial Innovations' Usefulness

Miller devoted the last years of his life to market regulation, derivatives, and futures markets that he describes as "an abiding interest of mine" (Miller, 2000). The greatest part of his views was given when he was a Keynote Speaker for successive ten years for

PACAP/FMA annual conferences. His interest in such areas grew up in late 1970s and matured after he was at the head of Chicago Stock Exchange, the marketplace in which financial futures were first traded in the States.

The financial Crash of October 1987, the worst of the last fifty years, had given rise to about 20-25% decrease in stock indexes around the entire world. Professionals in the Finance profession considered the index arbitrage and portfolio insurance as the suspected culprits. Miller was charged by Ronny Reagan's Brady Commission to study the causes and consequences of the Crash. Once more, he was at the right place because he analyzed that practical issue armed with his strong academic knowledge and sense of smell. Indeed, he linked between theory and practice to show the leading usefulness of derivatives, especially the financial futures that he considered in his first Keynote Address of the PACAP/FMA meetings as "the most significant financial innovation". At first sight, the 1987 Crash (as well as the 1989 mini-Crash) would be the natural result of a financial rivalry between traditional Stock Exchanges, like the NYSE and futures markets.

On the strength of Miller's supporting views for derivatives, the direct reason is the inconsistency and worsening effects of restrictive regulatory interventions and government interference[10] with the free working of markets put in place "to brake" the speed of derivatives trading. The facts that were shown to be the culprit are mainly high losses borne by banks due to the erroneous expectations with respect to the dynamics of real estate markets. In contrast, the extreme losses banks experienced are much lower with derivatives deals than without.

On another side, practitioners account for the massive flows of funds and financial innovation's reverberations in terms of financial disasters and macroeconomic instability brought forth by crashes. That factual view is outright rejected by the academic circles, headed by Miller. The flows of funds and financial innovation are the engine secreting future growth opportunities, alleviating individual and systemic risks, and enhancing capital markets efficiency.

However, even though the massive flows of funds still exhibit the disgusting smell of death after late 1990s, East-Asia Crises and financial disasters seen in derivatives markets in mid-1990s, the problem is, in the eyes of Miller, connected with binding regulations and (unlucky) derivatives speculators and not to the nature of financial innovation itself.

D.   The flaws of Miller's Thinking-Machine and the Emergence of the "post-Millerian" Corporate Finance Economics

Miller's "thinking-machine" was not infallible. In fact, the first spark with which began the detection of its flaws was first begot by MM themselves in their 1963 correction. The firm may earn considerable tax shields due to tax deductibility of debt financing allowed by the U.S. Tax Code, as well as by sundry Tax Codes around the world. Since tax savings are conventionally taken as being on the order of fifty cents of each dollar of permanent debt issued (Miller, 1977), the somewhat optimal capital structure may be determined by confronting deadweight bankruptcy costs and tax shields, in compliance with the common classical rule prior to Modigliani and Miller (1958).

The reincarnation of the latter rule coupled with the relaxation of the no-tax hypothesis constituted the first strand of the post-Millerian corporate finance

economics. In effect, that new context put into the picture a convoluted theoretical structure, but closer to the real working of capital markets. The picture embeds hereinafter the differential tax treatment of income and capital gains at the personal level (corporate and individual tax rates[11]) which will increase the full value of real assets.[12] Since the management team is a maximizer of the firm's cash flows, they can seemingly increase the tax shield indefinitely.

In reality, this is not the case. According to Miller's (1977) words, "to reap more of these gains, however, the stockholders incur increasing risks of bankruptcy and the costs, direct and indirect, of falling into that unhappy state". This is the second strand. Bankruptcy matters were not encompassed into financial economics. The benchmark MM framework eludes the explicit consideration of bankruptcy into their equilibria analysis. But the growing alteration of balance sheet ratio (so as to take the advantage of indebtedness tax deductibility) may lead the firm to fall prey to the undesirable state of default. This second flaw is sufficiently important to make the firm's capital structure a determining driver of wealth that accrues to stockholders. However, the MM irrelevance proposition still holds true only when the indebtedness level is very low such that it may not lead the firm to go bankrupt, though bankruptcy costs are calculable. It is only in this case that the bankruptcy costs are of little import, and stockholders' wealth remains depending upon the profitable investment opportunities coming along.

In the wake of the latter discussion, the capital structure is viewed by corporate finance economists up to the 1970s as a result of a pure balancing of tax shields and bankruptcy costs sprung from debt financing. However, Myers(1984) argues that the securities issued by the firm stand unchanged after a fiscal modification by the Tax Department such that setting up a different taxation is somewhat irrelevant to the financing choices. In other words, the financing policy is rigid to tax considerations, at least over the short-run.

The third strand is information. Hereafter what the firm makes impact its value. For instance, selling stocks may be enough informative that the market has overvalued what they must worth. As a matter of course, the average investor mistakenly lowers the stock market value (i.e., the truncation bias) such that the financing choices by the firm become highly relevant through that mis-pricing process. This is the direct and simplest implication that the relaxation of the perfect information premises may have on the firm. Stiglitz's Information Economics is the *sexier* strand that grafted on the old-fashioned competitive equilibrium model and the standard MM's nothing matters world. Indeed, a tremendously large body of the financial economics literature draws on its revolutionary explanation of the nature of equilibria in insurance/monetary markets, the new corporate theory, and political economy. Stiglitz and Weiss (1981) demonstrated that when the information is not symmetrically distributed between business operators and lenders, there may exist a credit rationing and, in the best case, firms get punished with a discount due to problems like the adverse selection, the hidden action, and the costly state verification. The inclusion of equity rationing in a two-dimensional framework shows that rationing is the probable outcome of competition between equity and credit markets.

All entrepreneurs apply for loans (with collateralized assets or without) and the lenders cannot distinguish one type of entrepreneur from another, so limitation of credit availability takes place. This evidence gave rise to the emergence of an old issue,

namely the drivers of business fixed investment. Whilst neoclassical approaches stand for the relevance of expected returns, user cost of capital, besides other fundamentals, approaches based on capital-market imperfections let financial variables, like cash flow and net worth, enter the picture. This new line of research is encompassed into the financing constraints and internal capital-market literatures that started with Fazzari, Hubbard, and Petersen (1988). The short term pertinence of net worth (proxied for by cash flow) is parsed in terms of a mis-allocation of available funds by capital markets. Internal capital markets, through the conglomerates, may ensure better allocation efficiency, however.

On balance, through sizing up the flaws of Miller's "thinking-machine", one may come up with the fact that they reside in the basic conjectures themselves. In effect, the relinquishment of those conjectures turned out to be the source for the emergence of the three aforementioned strands. The transition from the neoclassical setting to the post-Millerian economics was not smooth. However, the transition's stumbling-block was modeling markets equilibria through the inclusion of both contracting parties (e.g., borrower/lender, insurer/insuree, employer/employee), besides other mathematically oriented issues such as the problems of non-existence, brought on by the relaxation of the convexity assumptions.

Alongside with the latter strands, Miller's works gave rise to the re-appearance of corporate governance matters that were let out of interest for many years. The breaking out from the long standing hypothesis of ownership/control nonseparation first appeared in Berle and Means (1932). It was also mentioned in many early papers. For instance, the prophesizing statement in Hurwicz (1946, p. 109) postulating that "the entrepreneur's psychological make-up (somewhat belatedly) enters the picture, and, at least implicitly, profit maximization is replaced by utility maximization [...] The utility maximization principle will yield most, but not all, existing theories of the firm and investment behavior". Hurwicz's (1946) *prophecy* and the appealing study of Berle and Means (1932) were absolutely *à-propos*. Indeed, by all accounts, the corporate governance is one of the most debated problems over the last years. Miller, of course, is behind its development since the entire diffusion of moral hazard models into the post-Millerian Corporate Finance Economics was built on MM's theoretical "relics"[13], inasmuch as they do not say for which reason(s) the management preserves the stakeholders' claims on cash flows.

In essence, the management acts in compliance with the Fisherian model such that, irrespective of being poorly motivated or self-interested, they do not destroy stockholders wealth and strive to pick up value-maximizing choices. In effect, starting with Jensen and Meckling's (1976) risk-shifting analysis, the agency theory dissects problems between shareholders and debt claimants, the management team and equityholders, and between minority and controlling shareholders. The separation of ownership and control leads the firm's business running to be driven by loads of managing genres that have immediate implications for investment. The most cited phenomena in the theory are empire-building behavior (high declination toward gaining benefits from large corporate empires), reputational concerns (related to the enhancement of the management's reputation in the market for labor), and overconfidence (a psychological interpretation of management's actions).

The ineluctable separation of ownership and control is anchored with the real working of capitalism. The corporate governance is the set of devices aiming at

protecting the full claimants' interests—especially those of equity claimants—through the stakeholders' control over management. The corporate governance is better angled through its legal guise. Indeed, in different countries, equity and debt claimants must be protected against high risk of expropriation that may be operated by the controlling shareholders and/or management. This risk is highly probable as long as the management team does not seize (designedly or unwarily) the growth opportunities coming along or lets the incumbents within the industry grasp them costlessly. Such actions may be encompassed into the agency-type problems identified by Jensen and Meckling (1976) such as the non-pecuniary benefits—i.e., the perks—are drawn at the expense of the shareholders' welfare. The goal of the legal facet of corporate governance is protecting outside claimants against the worsening consequences of expropriation risk through promoting surges for the enforceability of acts and legislative procedures for that purpose.

In the light of the latter concise discussion, it turns out that the fallible flaws of Miller's thinking-machine constitute the first departure for the emergence of post-Millerian corporate finance economics, constituting the bulky part of modern corporation finance literature. The flaws are the "footholds" economists needed to shape the academic research schedules over the last forty-plus years. Umpteen approaches, albeit based on MM, come to infirm their irrelevance propositions. Along with the incentives-based approach, the aggregate value of the firm depends upon the managerial actions' outcome. Starting from this factual view, Jensen and Meckling (1976) show that the management may have a taste to enter a gambling game through engaging in highly volatile ventures. This risk-shifting technique is worsening to debt claimants, whilst equity claimants enjoy a bonanza when the venture turns out to be successful. The capital structure, in contrast to MM, is optimal when the marginal benefits arising from hindering the management from enjoying their private benefits (e.g., perks) is balanced by the marginal cost of engaging in risky ventures.

The information-theoretic concerns place special stress upon the private information owned by management. Ignoring the perks, this strand of the moral hazard models analyzes the adverse selection problem in debt and equity markets to come up with the pecking order theory. Costly external finance drives a wedge of cost between internal and external funds. Though both approaches constitute a pioneering analysis, one must concede, however, that the sought question remains a puzzle. It is logical to admit the financial choices relevance, but for which argument[14]?

IV.   CONCLUDING REMARKS

Miller is our Socrates. Though he left the lecture halls forever, his milestone philosophy is daily dealt with inside them around the world forever. That's the prize he wanted and he got. Prior to Miller, it was "prehistory" in Corporate Finance Economics. Based on the standard Fisherian model and the baseline conjectures (e.g., no taxes, no transaction costs, rational expectations-enforced fair pricing of securities), Miller's immense contribution generated the foundational rationalization of modern theories. In this paper, we tried to place special emphasis upon the main traits shaping his academic life. We first shed some light on the major corollaries springing from his philosophical thinking. Albeit the MM theorems are easily understood, their underlying proof is extremely "dazzling". The arbitrage proof served as a solid basis to show that neither

financing choices nor dividend policy matter to the aggregate value of the firm. It is the basis of option pricing formula of Black and Scholes (1973), the most cited paper in finance.

Afterwards, we focussed on Miller's interest in financial innovations and the worsening effects of restrictive regulatory interventions and governmental interference with the free working of capital markets. The Miller's "thinking-machine" was not exempt from flaws, unfortunately. The flaws consisted of the conjectures themselves on which the irrelevances theorems leant. Relaxing these conjectures and rebuilding the framework on that basis was the first step to come up with the leading mainstreams theories after Miller, e.g., moral hazard models, entrenchment theory, and costly external finance literature. These and many other approaches form the post-Millerian Corporate Finance Economics are mostly based on Miller's legacy he left to academia.

Eugene Fama Sr., Miller's first Ph.D. student, said "Merton Miller epitomized the best of the University of Chicago GSB. All who knew him at Chicago and elsewhere recognize him as a path-breaking, world-class scholar, a dedicated teacher who mentioned many of the most famous contributors to finance and a grateful and insightful colleague who enhanced the research of all around him". Fama's quotation is the best depiction of a clear-sighted economist whose imprint is strikingly far-reaching. Now one may understand why Miller said, "you need only to make a big score in finance to be a hero forever".

ENDNOTES

1. In his autobiography, Joseph E. Stiglitz, who was born in Gary, Indiana, said there must have been something in the air of Gary that led one into economics. The Nobel Prize-winner Paul A. Samuelson was also from Gary. One may jokingly say that a special dose of science was reigning in the air of Massachusetts that gave us two great economists, namely Miller and Sharpe.
2. Prior to the Markowitzian tradition, very simple concepts were reigning in the profession like not putting all the eggs in the same basket, or putting many eggs but looking at them very closely.
3. Modigliani is an American economist of Italian origin; we jokingly call him the *Gladiator*, but in the scientific battles not in Arena of the Coliseum, in the same way that Fisher Black called Miller the *warrior*.
4. One of them is Herbert Simon the 1978 Nobel Prize-winner for his innovative work on decision-making within economic organizations.
5. The arbitrage already exists before it was used in the MM framework; to understand it, it suffices to picture that traders may seize the opportunity of prices spread relative to what they would be if markets were perfect.
6. That of uncertainty, separating between real (e.g., production) and financing choices by the firm.
7. Stiglitz (2001) points out that the Modigliani-Miller theorem is far stronger than people had realized, including Modigliani and Miller themselves. In effect, by implying the existence of many risk classes, the number of general equilibria would amount to the number of debt-equity combinations, since no optimal capital structure exists. The Modigliani-Miller concept of risk classes is the departure of competitive market equilibrium with stochastic expected returns.

8. Other conjectures are also used (e.g., the firm may sell for short with no charges) whose most binding is the economy is taxation-free.

9. Yogi Berra is the nickname of Lawrence Peter, a former catcher and manager in Major League Baseball. He spent much of his career for the New York Yankees.

10. The governmental interventions in less-developed countries aim at huge borrowing addressed to financing the public sector, begetting in this way a fragmentation of capital markets, which leads private corporations to count more on their own net worth.

11. This spread in taxation is the main reason behind the Leverage Buyouts (LBOs) wave that occurred in the USA by the end of 1980s. (For a deep dissection, see Miller's (1990) Nobel lecture.)

12. Miller's (1977) challenge was to yield a proof in line with the first bloc of Modigliani and Miller (1958) irrelevance propositions such that the expected streams of discounted cash flows stay independent of the individual and corporate taxation.

13. In MM's equilibrium analysis, the management team is assumed to act on behalf and in the best interests of equity claimants such that only a meaninglessly small amount of hidden information is allowed. This may be covered by the Marshall's dictum "Natura non facit saltum" saying that economies in which information was not too imperfect would look very much like economies in which information was perfect. See Stiglitz (2001) for a profound discussion and disparaging critics of that dictum.

14. The financial contracting literature outdoes the inefficiencies of moral hazard models by letting the relationship between investors and business operators to be dynamical. This line of research focuses on the allocation of decision rights in solvency and bankruptcy states. See Hart (2001).

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