The theory of mechanism design teaches us how the right financial contracts and intermediaries can give borrowers and lenders a helping hand

BY VANESSA SUMO

In his influential 1937 article, "The Nature of the Firm," economics Nobel Prize winner Ronald Coase asked why firms exist. Firms typically combine different activities such as production, marketing, inventory, or human resources management under one roof. But these activities could also be produced independently by subcontractors, for instance. Transactions between these different units could take place in markets, and price movements would ensure that resources are allocated efficiently. So, why do we need firms? Why do some transactions take place within firms and others between firms or people in markets?

Coase's answer was that there may be certain limitations to relying entirely on the market's invisible hand. Such constraints might make the price tag of obtaining a commodity or service higher than its actual cost. For instance, there can be significant costs to searching and bargaining with each supplier. But certain costs may be avoided if the supply of inputs, especially services, can be guaranteed over a longer period. By bringing various activities under one roof, a firm may be able to substantially reduce these transactions costs. Thus, the size of the firm partly depends on how large these costs are.

The theory of mechanism design — which has received much attention since three of its pioneers (Leonid Hurwicz, Eric Maskin, and Roger Myerson) won last year's Nobel Prize in economics — provides a framework for thinking more generally about how such frictions affect the way a

market, a firm, or any other mechanism works in allocating the economy's resources. A market is a particular type of mechanism, where the amount of a commodity traded and its price are determined by a large number of buyers and sellers without any intervention. Unfettered markets often perform best, because the price signal that comes out of these interactions ensures that no resources are wasted.

However, when one party in a transaction has more information than the other, the invisible hand may not work as well as it should. Problems associated with such information frictions are particularly acute in the market for providers and users of funds, and this is one of the many fields where applications of mechanism design theory have made significant contributions.

Say an investor decides to provide funds to an entrepreneur, and he in turn promises to pay the investor some portion of a project's output. The tricky part is that the investor may not always be able to observe what the entrepreneur is doing, nor can he be sure that the entrepreneur will be truthful in reporting the project's earnings. As such, a substantial amount of effort will have to be spent in trying to overcome this information asymmetry.

But there could be a better way. Mechanism design gives us the tools to design the rules of the game in such a way that it minimizes the costs of limited information, while recognizing that people are always looking out for their own self-interest, a basic constraint of any type of mechanism. This could lead to the emergence of particular contracts and institutions such as financial intermediaries. In the end, the result may not have been guided by the invisible hand, but given the information constraints we face everyday, it is certainly an outcome that makes everyone better off.

Debt as the Optimal Contract

Financial markets offer a rich and complex array of instruments to finance business activities. Broadly speaking, however, one can divide the means to provide funds into two categories: debt, which is an amount of money owed in the form of bank loans or bonds; and equity, which are ownership rights to a firm in the form of shares.

Economists Franco Modigliani and Merton Miller, both Nobel Prize winners, are well-known for showing that the market value of a firm is unaffected by the way a company chooses to fund its operations. "The cream plus the skim milk would bring the same price as the whole milk," explained Miller in *Financial Innovations and Market Volatility*, a book that was published in 1991. For instance, a company may prefer to issue more debt if the cost of borrowing through issuing bonds is lower than the required return on issuing stocks. However, as the amount of leverage increases, the return on equity demanded by investors will go up as well, because the company is now perceived to be a riskier bet. Thus, the overall cost of capital of the new debt and equity mix turns out to be the same. A company's choice of a capital structure should be irrelevant.

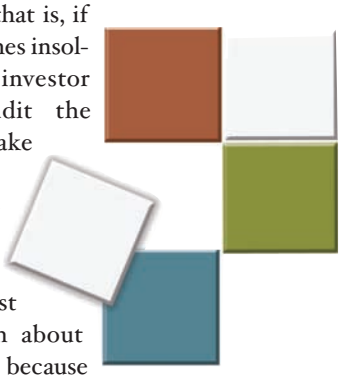
But while the logic of Miller and Modigliani's proposition is certainly true, there is something about the real world that weakens this insight. Companies and financial markets do seem to care about a company's mix of debt and equity. The choice of financing matters.

This has prompted some economists to think about how entering one type of contract could affect a borrower's behavior, particularly when he has more information about his project than the person financing it. The theory of mechanism design is helpful in answering this question.

In certain situations, the optimal contract design will look like a debt contract, according to economist Robert Townsend of the University of Chicago. To understand his 1979 analysis, one can think of an entrepreneur who has an idea for a project but doesn't have enough funds to start the business. The entrepreneur predicts that the endeavor will generate a certain stream of income. In order to finance this project, he can offer investors a contract that pays a portion of its earnings. The difficult part is that investors will not be able to observe how well the business is doing as accurately as the entrepreneur can. Thus, investors will naturally want to verify the entrepreneur's output because they will be reluctant to finance the project otherwise.

But auditing entails an extra expense, and if the investor incurs this cost then he will likely demand a higher return on his investment. So, while the entrepreneur may be able to secure the funds he needs, the cost of undertaking the project will become more expensive than if there were some other way for investors to avoid what Townsend calls "costly state verification." One way to do this is to design a contract that helps the investor avoid auditing the project to the fullest extent possible but will still be willing to finance the project.

What would such a contract look like? Townsend finds that it resembles what we commonly know as debt. In return for providing funds, an entrepreneur agrees to pay the investor a fixed amount of money, which includes some return on his investment. Because he's receiving a flat sum, the investor does not need to verify the entrepreneur's output under all circumstances, as he would have if his pay depended on a share of the entrepreneur's earnings. However, if the entrepreneur cannot meet this payment — that is, if the project becomes insolvent—then the investor will go in, audit the project, and take whatever is left.



In this mechanism, it is always in the entrepreneur's best interest to tell the truth about what he's earned because he knows that if he pretends to have a lower output, the investor will be forced to audit him. Townsend

suggests this contract is optimal because the investor doesn't need to evaluate the entrepreneur all the time, nor does he have to worry too much about getting less than he bargained for. The entrepreneur is actually much happier too. Because the investor saves on the costs of verification, the entrepreneur can obtain funds for his project at a lower price.

When Equity is Better than Debt

An entrepreneur may have two reasons why he would want to raise funds from an outsider. First, he may not have enough money to fund the project himself. Second, he probably doesn't like uncertainty (most people don't) and would prefer to share the risk of running the business. If all parties had equal information — that is, if an outsider could see perfectly at all times what the entrepreneur is doing — then the best thing that the entrepreneur can do is offload all of the risk of the project. He could sell all the ownership shares of the business to as many people as possible, eliminate his risk entirely, and simply receive a fixed salary. Investors would happily buy these shares because they could perfectly observe the project's results.

The problem again is that, in the real world, the entrepreneur will typically have better information than his investors. This prevents the entrepreneur from shedding all of the risk of the project, because investors know that he will have an incentive to lie about his results. Thus, in order to encourage investors to finance his project, an entrepreneur will have to assume some of the risk by owning part of the business. How much risk-sharing would be stipulated in the contract depends on how strong the entrepreneur's incentives are to fudge the books, according to a 1989 analysis by a pair of economists at the Richmond Fed, President Jeff Lacker and John Weinberg. "That split between inside and outside ownership is determined by the cost of manipulating information," Weinberg says.

Manipulating information, or "falsification," can exist in a number of forms. In sharecropping, a landowner lets a tenant farm his land in exchange for a share of the crops, giving the tenant an opportunity to hide some of the crop before the landowner comes to collect his share. In medieval Venice, risky long-distance trade voyages were financed by investors on land, allowing the traveling merchant to unload valuable goods at another location. The opportunity to falsify results is present in modern contractual settings as well, such as when a manager might be tempted to cook the company accounts.

But falsification comes at a cost. "Falsifying records that are made available to the public, if nothing else, results in the cost of keeping two sets of records," wrote Lacker and Weinberg. Even the sheer effort of planning the logistics of hiding stolen goods can be costly, as it might be for someone who has to remain discrete after diverting company funds. In a world where falsification is tempting but costly, investors would only be willing to finance the entrepreneur's project if the risk of the project can be shared between them. Thus, the optimal contract is an equity contract.

The cheaper it is to cheat, the larger the share of the risk that the entrepreneur will need to hold. So, ownership shares in an equity contract would be based on how costly it is to falsify results. A larger share held by the entrepreneur will discourage him from diverting a chunk of the project's output because his total income depends not only on his "unofficial" spoils but also on his "official" share of the output. While he may be more tempted to cheat when falsification is easy, he would have to weigh this decision against the larger loss of income from reporting a low official output.

So what is the best contract between borrowers and lenders: debt or equity? In Townsend's model, debt is the optimal contract because the output cannot be publicly observed, so the investors have to take a costly action to verify the entrepreneur's results. In Lacker and Weinberg's analysis, the output is publicly observed but can be altered by the entrepreneur. It is the entrepreneur who takes the costly action to falsify results, such that the investors require entrepreneurs to share some of the risk of the project. "You might speculate that if the information structure is yet more complicated where there are aspects of both costly verification and costly falsification, you might have a combination of debt and equity," Weinberg explains.

That might illustrate the real world more accurately. Companies do seem to hold a mix of both types of contracts. But the question of how to divide up the company's cash flows between its lenders and shareholders is only one aspect of the company's choice of a capital structure. Another important consideration has to do with more complicated concerns of what the chosen mix of debt and equity implies for the right to govern or make decisions in an organization. Indeed, the distinction between debt and equity encompasses all these issues and continues to be a topic of active research interest among financial economists.

The Rise of the Intermediary

Borrowers and lenders can turn to a financial intermediary, such as a bank, whenever they have a hard time finding each other. A lender puts money in a bank, which will use these funds to finance an entrepreneur's project. Without an intermediary, the lender would need to figure out whether a borrower is creditworthy. If many lenders are involved, perhaps to spread the risk of financing a big project, then each lender would have to perform the same task of monitoring the entrepreneur. This is clearly a wasteful duplication of effort. Thus, an intermediary that makes it its business to know what the entrepreneur is doing may be the best arrangement for everybody.

Intermediaries have the law of large numbers on their side, according to a 1984 analysis by economist Douglas Diamond of the Graduate School of Business at the University of Chicago, and visiting scholar at the Richmond Fed. Not all borrowers are alike. Lending to a large number of borrowers drives down the uncertainty of the investment return. Thus, the presence of intermediaries not only minimizes the cost of monitoring but it also reduces the costs of signaling to the lender that it can be trusted. If the lender has to make a decision between entrusting his funds to an entrepreneur or through an intermediary, he will choose the intermediary because diversification assures him of getting his money back.

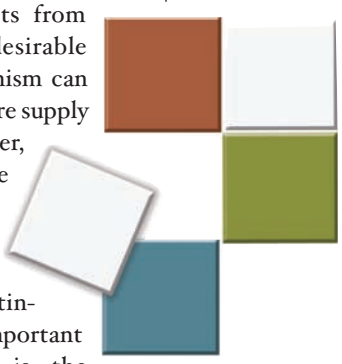
But intermediaries also play an important role in addressing the problem of adverse selection — what happens when borrowers with low-grade projects are inadvertently chosen over those with high-quality projects because a project's true quality may be known only to the entrepreneur. Intermediaries guide the allocation of resources by making sure that good projects get funding first. Intermediaries can achieve this by designing so-called "incentive compatible" contracts, according to a 1986 paper by economist John Boyd of the University of Minnesota and Nobel Prize winner Edward C. Prescott of Arizona State University and the Minneapolis Fed.

Incentive compatible contracts are at the heart of mechanism design theory. Entrepreneurs can be offered contracts based on the project's quality and realized returns. The contract for good projects is designed so that entrepreneurs with bad projects have no incentive to pretend they have good projects. Faking it would be more costly to this entrepreneur. He may be better off simply investing his money in someone else's project through an intermediary.

With the intermediary at the center of the transaction offering the right menu of contracts, the result is an effective separation of good and bad projects. This outcome is efficient in that the economy's resources are put to the best use possible. The intermediary does not have to waste time and money checking on those who are pretending to have projects that are better than they really are.

Another paper by Lacker and Weinberg published in 1993 likewise finds that an intermediary is essential to an arrangement that allows funds to be distributed to potential users in the best possible way. Similar to Boyd and Prescott, they conclude that the optimal result would be hard to achieve in a bond market where borrowers issue bonds directly to lenders. While an intermediary can offer a menu of loan contracts at different prices, which is a key element in separating project types, competition in bond markets would force those prices to converge. This would lead to a less desirable outcome since the bad projects would crowd out the good ones. "A [bond market] would lead to setting that threshold too low so people with less productive projects actually get funding," explains Weinberg. "An intermediary can actually set the threshold higher and screen off those less productive projects."

All of these contributions have increased economists' understanding of how market outcomes can be improved whenever the lack of information prevents markets from achieving the most desirable result. A market mechanism can find the equilibrium where supply equals demand. However, as in bond markets, the market outcome doesn't differentiate between good and bad types. And being able to distinguish between types is important for efficiency, which is the ultimate objective of a well-functioning economic mechanism.



But economists are still hard at work trying to figure out all the consequences of information frictions. "Even to the extent of knowing what we mean by equilibrium in a setting with adverse selection is a harder question to answer than it is in the simpler case of symmetric information," says Weinberg. Fortunately, the theory mechanism design has enriched the way economists think about these problems. **RF**

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