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Taxing Risk and the Optimal Regulation of Financial Institutions

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Narayana Kocherlakota
President
Federal Reserve Bank of Minneapolis

ABSTRACT

Knowing that bailouts are inevitable because governments will rescue firms whose collapse may cause systemic failure, financial institutions fail to internalize risks their investments impose on society, thereby creating a "risk externality." This paper proposes that just as taxes are imposed to deal with pollution externalities, taxes can also address risk externalities.

The size of the optimal tax depends on risk-related attributes and may be difficult for supervisors to calculate and implement. A market-based method can estimate its appropriate magnitude. For a particular financial institution, the government should sell "rescue bonds" paying a variable coupon linked to the size of the bailouts or other government assistance received by the institution or its owners. Coupon prices will reflect the market's judgment of an institution's risk profile and can therefore be used to set the tax.

A well-designed tax system can entirely eliminate the risk externality generated by inevitable government bailouts.

Taxing Risk and the Optimal Regulation of Financial Institutions[1]

Narayana Kocherlakota

In the mid-2000s, we—as investors, home buyers and bank lenders—collectively bet that house prices would not fall by 30 percent in most major metropolitan areas in three years. We were wrong. This mismatch between our expectations and our realizations was the ultimate source of the financial crisis of 2007-09.

The Congress of the United States is currently considering legislation to restructure financial regulation. However, no matter how well-written or how well-intentioned the legislation may be, no law can completely eliminate the kinds of collective investor and regulator mistakes that lead to financial crises. These mistakes have taken place periodically for centuries. They will certainly do so again. And once these crises happen, there are strong economic forces that lead policymakers—for the best of reasons—to bail out financial firms. In other words, no legislation can completely eliminate bailouts. Any new financial regulatory structure must keep this reality in mind.

In this paper, I describe an approach to financial regulation that takes as given the inevitability of bailouts. The basis of the approach is that the magnitude of bailouts can be limited by taxes on financial institutions. I arrive at this conclusion about the usefulness of taxes by thinking through an analogy that I'll develop at some length. I will argue that, knowing bailouts are inevitable, financial institutions fail to internalize all the risks that their investment decisions impose on society. Economists would say that bailouts thereby create a risk "externality." There is nearly a century of economic thought about how to deal with externalities of various sorts—and the usual answer is through taxation. I will suggest that the logic that argues for taxation to deal with other externalities is exactly applicable in this case as well. The views expressed here are mine, and not necessarily those of others in the Federal Reserve System.

The size of the optimal tax for any given financial institution may depend on a host of risk-related attributes, and so may be difficult for supervisors to calculate and implement. I suggest a possible alternative: a market-based method to compute the appropriate magnitude of the tax. Roughly speaking, for a particular institution, the government should sell bonds that pay a variable coupon linked to the size of the transfers (that is, bailouts or other government assistance) received by the institution or its owners. The prices of these coupons will reflect the market's judgment of that institution's risk profile and can therefore be used to set the size of the tax that should be imposed.

It is important to distinguish my notion of a risk externality from two other types of externalities that are mentioned in discussions of bank regulation. One of these is a *systemic* externality. The failure of a given Bank X may affect the profitability of many other firms in the economy even though Bank X has no direct contracts with those firms. In this sense, any decision by Bank X

[1] This policy paper is an elaboration of "Taxing Risk," a speech given in Minneapolis, Minn., on May 10, 2010 (Kocherlakota, 2010). The author thanks Andrew Atkeson, V. V. Chari, Harold Cole, Ron Feldman, Chris Phelan and especially Doug Clement for many helpful comments.

that increases its probability of failure has a systemic implication, because it also increases the expected losses by the entire financial—and indeed economic—system.[2]

My notion of a risk externality is also distinct from what might be termed a *fire sale* externality. During financial crises, many financial institutions may have to sell assets or collateral at the same time. These simultaneous sales will put downward pressures on the assets' prices. A given financial institution will not internalize the impact of its sales on the price of other institutions' assets.[3]

I downplay these two externalities because governments typically eliminate their effects through targeted interventions during financial crises. Governments can correct a systemic externality by preventing the failures of financial firms through bailouts.[4] Governments can stop fire sales of assets by purchasing the assets or being willing to treat them as collateral in loans to the relevant firms. Indeed, in the recent financial crisis, the United States government and the Federal Reserve System intervened precisely to address externalities of these kinds (although admittedly not in the case of Lehman Brothers).[5]

The inevitability of bailouts

In the crisis of 2007-09, governments made large transfers to claimants of financial institutions. Some onlookers have argued that future legislation should seek to eliminate these payments. In my view, many such payments are unavoidable in the context of a financial crisis. These payments assure depositors and debt holders that their financial interests in the relevant financial institutions will be backed by the government. Why does government provide such assurance? There are several reasons, but I believe that the most important concerns the prevention of "runs."

Imagine that Bank X needs $100 billion of one-day loans to survive. This means that for a given lender to be willing to make a $1 billion, one-day loan to Bank X, that lender has to believe that Bank X will get another $99 billion in one-day loans. In this situation, Bank X could fail simply because every possible lender believes correctly that no other lenders are willing to lend to Bank X. Such a crisis of confidence can occur regardless of the true condition of Bank X.

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[2] See Haldane (2010) for a discussion of this kind of externality.

[3] See Brunnermeier and Sannikov (2009), Chari and Kehoe (2009), Jeanne (2008) and Jeanne and Korinek (2010) for discussion of this kind of externality and its impact.

[4] Many observers besides Haldane (2010) discuss the importance of systemic externalities, although his treatment is especially powerful. Nonetheless, I remain skeptical of the very existence of systemic externalities. They seem to be predicated on the failure of two or more parties in a private market to engage in a mutually beneficial transaction. Suppose Firm A's failure will lead Firm B to fail. It would be in B's interest to provide A with extra financial incentives to avoid failure. Indeed, B could simply acquire A. Note that even with these kinds of efficient contracts in place, there may be shocks that would cause both A and B to fail simultaneously.

[5] It is true that the bailouts needed to undo fire sale externalities and systemic externalities do generate risk externalities of the kind emphasized in this paper.

This story is hardly a new one. It's exactly why we have deposit insurance: to prevent runs by reassuring bank depositors that their money is safe. But the story has huge consequences for how governments operate. In a financial crisis, there is a tremendous sense of uncertainty. There are some truly insolvent financial firms out there—but no one knows for sure which they are. And during a crisis, the panic in the air means that any institution—even one with solid fundamentals—may be subjected to a run if its investors lose confidence in its solvency.

In such an atmosphere, contagion effects become extremely powerful. Even a slight loss by one short-term creditor can lead all short-term lenders to rush to the safety of Treasury bills. Such flight would endanger the survival of key financial institutions, even if they are fundamentally sound. Governments cannot risk such systemic collapse, and so during times of crisis, they end up providing debt guarantees for financial institutions. Thus, policymakers inevitably resort to bailouts even when they have explicitly resolved, in the strongest possible terms, to let firms fail.[6]

Many observers of the events of September 2008 have emphasized the need for better resolution mechanisms. Different people mean different things by this, but most want to impose losses on debt holders. I'm not opposed to faster resolutions of bankruptcies. But I do not believe that better resolution mechanisms will end bailouts. No matter what mechanisms we legislate now to impose losses on creditors, Congress, or some agency acting on Congress' behalf, will block them when we next face a financial crisis. And Congress will do so for a very good reason: to forestall a run on the key players in the financial system.[7]

Debt guarantees result in excessively risky, inefficient investment

I have argued above that government concerns about runs make debt guarantees (that is to say, bailouts) inevitable at least in severe financial crises. Here, I argue that these guarantees lead to inefficient investments by financial institutions.

Imagine for a moment that we live in a world without bailouts, so that the government does not provide debt guarantees or deposit insurance. If a financial institution decided to increase the risk level of its investment portfolio, its debt holders and depositors would face a greater risk of loss. By way of compensation for that greater risk, they'd demand a higher yield. As a result, in the absence of government guarantees, financial institutions would find it more costly to obtain debt financing for highly risky investments than for less risky ones. This effect, on the margin, would curb a firm's appetite for risk. It would have an especially powerful effect on highly leveraged financial institutions, because high debt-to-asset levels mean higher risk of being unable to fulfill debt obligations.

But now return to the real world, with deposit insurance and debt guarantees, and the inevitability of government bailouts. Even if they only kick in during financial crises, these

[6] There is no way to eliminate bailouts completely. However, it is both possible and worthwhile to consider mechanisms that will reduce the incentives for government interventions in a financial crisis. Feldman (2010) and Stern and Feldman (2004) discuss some alternatives along these lines.

[7] As mentioned in footnote 5, systemic externalities and fire sale externalities may also lead governments to engage in bailouts.

guarantees change this natural market relationship between risk and cost. The depositors and debt holders are now partially insulated from increases in investment risk, and so they do not demand a sufficiently high yield from riskier firms. Financial institutions are no longer as deterred from undertaking risky ventures by the high costs of debt finance. And this missing deterrence is especially relevant for firms that are highly leveraged, because they should be paying out especially high yields on their debts.

Note that the problem here is created by the expectations of depositors and debt holders, not the expectations of the financial institution itself. Because the depositors and debt holders sometimes expect to receive a bailout, they accept a lower yield on their investments. The financial institution is then able to finance high-risk, high-return investments at low cost. The institution itself does not care *why* the funds are so cheap.

In this way, the expectation of bailouts leads to too much capital being allocated toward overly risky ventures. These misallocations of capital don't create the collective mistakes in predictions that generate financial crises. But the misallocations do mean that society loses a lot from those mistakes—far more than is efficient.

An externality analogy

The problem I've just described of bailout inevitability and the relationship between debt guarantees and inefficient investment is well-known. Less understood, perhaps, is how closely related it is to a standard policy issue in economics: pollution.[8]

Think about a firm with a factory. The firm has to make a decision about how much output to produce at the factory. In doing so, it trades off the revenue gain associated with expanding production against the costs of producing that extra output. Unless required by law, it does not take into account the environmental cost associated with any pollution generated by the factory.

The pollution is an externality: It is a cost borne by society that is *external* to the purely market considerations that shape the firm's decision. The presence of this externality means that the firm will choose to overproduce according to society's standards because the firm's costs are lower than the full societal costs.

Now return to the decision problem of a financial institution that is financed in part with guaranteed debt. As we have seen, the debt guarantee implies that taxpayers absorb some risk of the financial institution's investments, allowing the institution to ignore that risk when choosing among investments. Hence, it is ignoring some portion of the costs of its decisions, and will therefore choose to overproduce high-risk investments.

Notice the analogy between the financial institution and the polluting firm. The firm increases production because it can ignore some costs that are borne by society. Similarly, the financial institution increases the risk level of its investments because the government guarantee allows it to ignore some costs (in the form of risk) that are borne by society. Debt guarantees create a *risk*

[8] Flannery (2010), Haldane (2010) and Jeanne (2008) also make this direct connection between pollution and risk externalities.

externality. This connection is a useful one, because economists know a lot about how to design policies to address externalities like pollution. We can apply those lessons to great effect when thinking about optimal financial regulation.

The externality analogy and a tax solution

In this section, I use the externality analogy to develop an appropriate regulatory response to the risk externality created by government guarantees. Again, consider a firm with a factory that generates pollution. It is reasonable to presume that the firm can influence the pollution level in many different ways, including the following:

1. The amount of time that the firm runs the factory during the workweek.
2. The kinds of antipollution technology used at the factory.
3. The kind of energy used by the firm to run the factory.

Potentially, the government could regulate the firm's pollution levels by controlling any or all of these choices. However, to do so, the government has to choose how to trade off these three (and other) factors against one another. Among other considerations, the government's decision will be influenced by cost. If antipollution technology is cheap, the government may simply require the firm to invest in that. If antipollution technology is expensive, the government may require the firm to switch to using natural gas instead of coal. These trade-offs require the government to acquire a tremendous amount of firm-specific information and perform cost-minimization exercises for each and every factory. Such a task is clearly infeasible for any government to perform on a national level for all relevant industries.

The solution to this difficulty is to regulate the *amount* of pollution produced by the firm, not *how* the firm produces that pollution. The problem is that pollution has a social cost that the firm does not internalize when choosing its level of production. However, the firm *will* choose the efficient level of pollution if it is required to pay for its full social cost. More concretely, suppose that the firm is told, before choosing its level of production, that the government will

1. Measure the amount of pollution that the firm generates.
2. Charge the firm a tax that is exactly equal to the social cost of that quantity of pollution.

This policy generates a tax schedule that translates the amount of pollution generated into an amount paid by the firm. If the firm knows that it faces this tax schedule, its costs of production will include the social cost of pollution. In this way, what was external to the firm becomes internal. As a result, the firm will choose the socially efficient level of production. Just as importantly, it will automatically choose to produce that pollution—and its other outputs—in a cost-minimizing fashion.

This (well-known) solution to the pollution problem has an exact analog in the risk externality problem generated by debt guarantees. Currently, regulators are trying to combat the risk externality by having distinct regulations for financial institution capital, liquidity and incentive compensation.[9] All of these measures are likely to mitigate the inefficiencies created by risk

[9] There are also many proposals to restrict bank size with taxes, asset caps or otherwise. In my view, these will not reduce the risk externality problem. Suppose there is a given financial institution with $300 billion in assets, and we

externalities. Again, though, the optimal trade-off between these various measures is likely to depend on a host of firm-specific information that will be hard to acquire.

For example, regulators are considering requiring financial firms to defer payments of incentive compensation. Such deferrals would make the compensation plans less attractive to employees. Firms will therefore have to increase their average wage bill to retain employees, by amounts that depend on subtle characteristics of both firms and workers.

The pollution analogy suggests how regulators can sidestep these difficult choices. Instead of regulating all of the financial institution's decisions, the government should tax the financial institution for the amount of extra risk that it produces. In this scenario, the financial institution is told that *after* it chooses its investments, the government will

1. Estimate the expected present value[10] of the net payments made by government—the cost of "pollution," if you will—to the financial institution or its stakeholders.
2. Charge the financial institution a tax that is exactly equal to the above estimate.

This policy generates a tax schedule that translates the financial institution's choices into an amount paid by the firm. This amount equals the extra cost borne by the taxpayers, appropriately adjusted for risk and the time value of money. If the financial institution knows that it faces this tax schedule, its private costs of financing an investment are now equalized to the social costs of doing so. Its investment choices will be efficient—as will its choices of capital, liquidity and incentive compensation, factors that current reform proposals address in a less precise manner.

Using markets to compute the right tax

Calculating the appropriate tax for a polluting firm requires measuring the quantity of emissions and then pricing those emissions for the costs they impose on society. The former is beyond my ken, but certainly within the expertise of environmental engineers. The latter can be (and in some cases, is being) accomplished via market mechanisms (such as carbon taxes or "cap and trade" emissions markets).

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split the financial institution exactly in half to form two new institutions. Each half gets an equal share of every asset and an equal share of every liability. Collectively, these two new entities have the same amount of short-term debt and deposits as the original financial institution. They are networked in exactly the same fashion with the financial system. Therefore, even though each financial institution is half as big as the original, the government has the same incentives to guarantee their combined debts. Size, in and of itself, does not change the government's motivation to intervene. Consequently, restricting the size of financial institutions would not eliminate forces that lead them to undertake excessively risky investment. (In fact, I would go further: Breaking up a financial institution may make it harder to track the interconnections among them and increase the magnitude of the systemic externality mentioned earlier.)

[10] The term "expected present value" raises the important question of the appropriate discount rate. Financial institutions are likely to receive transfers from the government when the stock market is performing poorly. In the language of traditional asset pricing models, these transfers have a negative "beta," and so should be discounted at a lower rate than the risk-free rate. Indeed, the appropriate discount rate may actually be much lower, given the rather extreme outcomes that lead to bailouts. This consideration underscores the importance of using market information to compute the right tax, as I propose in the next section of this paper.

Similarly, computing the appropriate tax for a financial institution with debt guarantees requires measuring the quantity of taxpayer risk and then *pricing* that risk. The latter can be accomplished through options markets, which are designed specifically to price risk accurately. But how should the government go about measuring the *quantity* of risk? There are at least two possible methods, one that relies on regulatory monitoring and another that depends on markets.

Quantifying by government

If the government can observe the payoffs of the financial institution's asset portfolio, then this problem is (at least conceptually) straightforward.[11] Good information about how well a financial institution's investments actually do over time, or are likely to do, provides a clear picture of risk levels inherent in the firm's investment decisions.

But good information may not be readily available. Put more technically, the probability distribution of the financial institution's asset portfolio's payoffs may be *private* information, known only to the institution (or its employees), not to government supervisors. In this situation, many different attributes of the financial institution may inform the supervisor about its assets' payoff probability distribution. The supervisory authority should use all of these financial institution attributes to arrive at an estimate of the quantity of risk.

There is a useful analogy in private insurance markets. Consider the pricing of homeowners' insurance. The insurer would like to link the insurance premium to how well the homeowner takes care of the home. But this is impossible without constant monitoring of homeowner behavior, an infeasible task. The pricing of insurance therefore ends up depending on various clues that have proven reliable guides to how homeowners treat their homes. Thus, the insurance price will be based partly on whether the home has a fire extinguisher. More subtly, the premium may also depend on the homeowner's driving record, since good drivers also tend to be good homeowners.

This same logic applies to the regulation of financial institutions. Suppose two financial institutions both use incentive compensation plans for their investment managers. However, one institution defers managerial bonuses and the other does not. It is natural, then, for the government supervisor to presume that managers of the latter institution will choose investment projects with more extreme risk. That presumption should be reflected in the supervisor's judgment about the quantity of taxpayer risk and, ultimately, in the tax paid by the financial institution.[12]

A market-based approach to quantifying risk

This kind of analysis seems daunting however, because it is likely to require monitoring an enormous number of financial institution attributes. For this reason, I believe that a market-based approach is at least complementary and possibly superior.[13]

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[11] The government may end up making transfers to the financial institution that benefit other stakeholders besides debt holders or depositors. Ideally, the option-pricing approach should also account for this possibility.

[12] See Clement and Phelan (2009) and Phelan (2009) for a more detailed discussion.

[13] See Hart and Zingales (2009), Phelan (2009) and Wall (1997) for other ideas about how to use market-based information in conjunction with the supervision and regulation of financial institutions. Hart and Zingales propose

Here's what I have in mind. Suppose that, for every relevant financial institution, the government issues a "rescue bond." The rescue bond pays a variable coupon equal to 1/1,000 of the transfers actually made from the taxpayer to the financial institution or its stakeholders. (I pick 1/1,000 out of the air; any fixed fraction will do.) Much of the time, this coupon will be zero. However, just like the financial institution's stakeholders, the owners of the rescue bond will occasionally receive a large payment. In theory, or in a perfectly functioning market, the price of this bond is exactly equal to the 1/1,000 of the expected discounted value of the transfers to the financial institution's stakeholders. Thus, the government should charge the financial institution a tax equal to 1,000 times the price of the bond.

Notice that this approach could be used for a wide variety of financial institutions, including nonbanks. In principle, the government need not figure out in advance which institutions are systemically important and which are not. Instead, the market would provide this information through the pricing of rescue bonds.

Markets for rescue bonds may prove to be thin and illiquid. In these circumstances, it would be inappropriate to rely only on market measures to compute the appropriate taxes. However, even when they are imperfect, market measures would contain valuable information that should be an input into the supervisory process.[14]

Conclusion

In this note, I've argued that to prevent runs, governments provide debt guarantees to firms in the financial sector. These guarantees create a risk externality, as those firms do not bear the full costs of their investment choices. Regulation should control and, if possible, eliminate that externality, because it leads to inefficiently risky investment.

There are numerous proposals for financial regulatory reform in the wake of the events of 2007-09. Several proposals, such as leverage caps, capital requirements and controls on incentive compensation, can help mitigate the risk externality problem. However, it may well be difficult for a government to figure out the optimal trade-off among these proposals on a firm-by-firm basis. Instead, a well-designed tax system can entirely eliminate the risk externality generated by debt guarantees to financial institutions. Figuring out the right tax may be complicated, but the task can be eased using appropriate information from financial markets.

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using credit default swaps on the underlying institution as a source of market information. Such swaps can provide useful information about the probability of a government bailout. However, in contrast to the "rescue bonds" proposed in this paper, credit default swaps are typically silent about the size of the bailout.

[14] See appendix following references for discussion of possible concerns with the market-based approach.

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Appendix: Three Possible Concerns with the Market-Based Approach

In this appendix, I discuss three possible concerns with the market-based approach.

- Suppose a government makes a transfer to a financial institution, but that transfer is then paid to a given lender to fulfill an obligation. Should that transfer be credited to the lender's rescue bond or to the financial institution's rescue bond?
- How would the market-based approach account for financial institution assets that are transferred to government in exchange for bailout transfers?
- How would the market-based approach deal with the issue of financial institution decisions made over time, rather than the static analysis offered above?

Borrower/lender ambiguity

Suppose Bank A borrows from Bank B, and the government guarantees that B will receive its payments. During a crisis, this guarantee could be implemented in one of two ways: The government could pay A and then A pays B, or the government could simply pay B directly. Under my proposed market-based approach, the different choices would manifest in different outcomes for the owners of rescue bonds. If B is paid indirectly through a government payment to A, then the owners of A's rescue bond receive a coupon payment. If the government pays B directly, then the owners of B's rescue bond receive a coupon payment.

Fortunately, how the government resolves this ambiguity does not affect the efficacy of the rescue bonds. The loan from Bank B to Bank A is a transaction that offers benefits to both banks. The expected transfer from the government—regardless of whether it's made to A or B—is distorting because it increases the joint benefits of the loan transaction. To eliminate the distortion, the government needs to levy a tax that cancels out those joint benefits—and that tax can fall on A, B or both of them. Indeed, in principle, there would be no efficiency losses if the government were to levy the tax on a wholly distinct third party C. The presence of the tax would still undo the distorting effects of the subsidy by providing an incentive for C to pay A and B not to undertake the loan.

Assets in exchange

When governments make transfers to debt holders or depositors, they often receive some of the financial institution's assets in exchange. Rescue bonds should be based on the *net* transfer to debt holders, taking account of those exchanged assets, not the *gross* transfer. However, valuing the assets received by governments in exchange may well be difficult, especially during the heart of the crisis.

This problem can be addressed by keeping track of the payments received from the assets exchanged. Thus, suppose the government receives a bundle of mortgages from a struggling bank. It ends up holding those mortgages for a year before selling them. During the year, it receives payments from the homeowners, and at the end of the year, it receives a final payment.

The financial institution's rescue bond should reflect these payments by paying a *negative* coupon equal to 1/1,000 of these payments.

Of course, bonds with negative coupons do create difficulties. (How should the government collect from bondholders?) To deal with this issue, the government can require the rescue bond to pay a relatively large positive fixed coupon C (instead of a zero coupon) when no transfers are made to or received from the financial institution. The coupon goes up by 1/1,000 of any transfer made to the financial institution or down by 1/1,000 of any transfer received from it. The appropriate tax is then 1,000 times the difference in price between the rescue bond and a bond with fixed coupon C.

Sequential choices

In the earlier discussion, I described how to compute the tax in a *static* context, in which the financial institution is making a single investment choice. How should the tax be adjusted in light of new investment choices or in light of information about past choices?

Here, forward markets can play a useful role. Suppose a rescue bond is issued in 2010, and there is a forward market for 2011 delivery of the bond. When 2011 arrives, the spot price of the rescue bond may be higher or lower than the forward price set in 2010. If the spot price is higher, we can conclude that there has been an unexpected increase in the value of the transfers to be received by the financial institution. If the spot price is lower, there has been an unexpected decrease.

These changes in prices can be used to align the financial institution's private incentives with social ones. Specifically, in 2011, the financial institution should be charged a tax equal to 1,000 times the difference between the 2011 spot price of its rescue bond and the price set in 2010 for 2011 delivery of the rescue bond. This tax will ensure that the financial institution internalizes the impact of new information about its choices and actions on future government transfers.

Note that, as time unfolds, the annual tax may well be negative. In this case, market participants have received information that the financial institution is less exposed to the risk of failure than had been anticipated earlier. The government is implicitly subsidizing the financial institution for reducing its risk profile.