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EXAMINING THE GAO REPORT ON GOVERNMENT SUPPORT FOR BANK HOLDING COMPANIES

HEARING

BEFORE THE

SUBCOMMITTEE ON
FINANCIAL INSTITUTIONS AND CONSUMER
PROTECTION

OF THE

COMMITTEE ON
BANKING, HOUSING, AND URBAN AFFAIRS
UNITED STATES SENATE

ONE HUNDRED THIRTEENTH CONGRESS

SECOND SESSION

ON

EXAMINING THE GAO'S REPORT ON THE GOVERNMENT'S EXTRAORDINARY ASSISTANCE TO LARGE BANK HOLDING COMPANIES AND EXPLORING THE AUTHORITIES FEDERAL FINANCIAL REGULATORS HAVE TO PREVENT FUTURE ASSISTANCE AT THE COST TO TAXPAYERS

JANUARY 8, 2014

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EXAMINING THE GAO REPORT ON GOVERNMENT SUPPORT FOR BANK HOLDING COMPANIES

WEDNESDAY, JANUARY 8, 2014

U.S. SENATE,
SUBCOMMITTEE ON FINANCIAL INSTITUTIONS AND CONSUMER PROTECTION,
COMMITTEE ON BANKING, HOUSING, AND URBAN AFFAIRS,
Washington, DC.

The Subcommittee met at 10:04 a.m., in room SD–538, Dirksen Senate Office Building, Hon. Sherrod Brown, Chairman of the Subcommittee, presiding.

OPENING STATEMENT OF CHAIRMAN SHERROD BROWN

Chairman BROWN. This hearing will come to order. Thank you for joining us, Senator Toomey. I particularly appreciate your cooperation in working with this. Senator Reed, I appreciate his being here. He has to go to the floor to manage the unemployment insurance legislation and will return for questioning.

Today's topic is how Government policies support too-big-to-fail megabanks. I often said my vote in 2008 for the TARP, for the Trouble Asset Relief Program, was both the best vote of my career and the worst vote of my career. It was the best vote because we simply could not allow the economy to be destroyed, and most of us, I think, in the House and Senate thought that is what would have happened. It was the worst vote because we allowed Wall Street to run wild for too long, and the only option presented to us was a $700 billion bailout, with few instructions, frankly.

Five years later, according to the firm SNL Financial, the four largest banks control more than 40 percent of the banking industry, up from less than 10 percent in 1990. What happened? Between 1990 and 2009, 37 financial institutions merged 33 times to become the Nation's four largest bank holding companies. Three of 1990's top five banks are now part of our Nation's largest bank. In 1995, the top six banks had assets equal to 17 percent of GDP. Today they are more than 60—six-zero—percent of GDP.

While many megabank supporters point out the benefits of large banks, a 2011 IMF report also shows that Governments bail out bigger banks. So it should come as no surprise that the Congressional Oversight Panel for TARP found that the six biggest Wall Street banks received a total of $1.27 trillion—1.27 thousand billion dollars—in Government support, including accounting for 63 percent of the Fed's average daily lending.

There are important lessons in this first Government Accountability Office report. First, megabanks borrowed at a discounted rate against assets that the market was not accepting. The result is a subsidy for the megabanks. CEOs of the largest banks understood this. According to Secretary Paulson, the Treasury Secretary under President Bush, two of these bank CEOs called it "cheap capital." In 2011, Bloomberg estimated that the terms of the Fed loans provided the six largest banks with a $4.8 billion profit, an amount equal to 23 percent of their combined net during the life of the loans. The GAO report we will discuss today also confirms that Treasury paid substantially more than market value for the assets that it purchased. The Congressional Oversight Panel estimated this provided the six biggest megabanks with a subsidy of $25 billion. These are only small parts of the benefits they have gotten because of their size.

Second, megabanks borrowed more than small banks because they used more volatile and short-term funding sources, not just deposits that community banks tend to rely upon. Support for the three largest banks averaged more than 10 percent of their total assets, much higher than their capital ratios at the time.

Finally, we see that walls that were supposed to separate and protect traditional banking were ignored, and the safety net was stretched as far as possible. With all these benefits, it is no wonder the CEO of our Nation's largest banks said that 2008 was "the finest year ever."

Since then, our banking industry has become even more consolidated, not less consolidated. Today the four largest bank holding companies are about $2 trillion larger—$2 trillion larger—than they were before the financial crisis. The four most complex institutions each have more than 2,000 subsidiaries, only 12 of which are commercial banks. More than 11,000—several thousand are nonbanks. The first report shows that the largest Wall Street banks borrow on favorable terms directly from the Federal Government during turbulent times. I expect the second report will show that the Government's implicit support enables Wall Street banks to borrow on favorable terms from the market in ordinary times.

Two things are clear: The largest Wall Street banks are so much larger and more concentrated than they have ever been, and because of their size, both their economic clout and their political clout are enhanced. And because of their size, they receive financial benefits that are not available to regional and community banks like Huntington Bank in Columbus and the First National Bank of Sycamore, Ohio.

There is broad agreement that this is unacceptable. Senator Vitter and I offered an amendment to the Senate budget calling on Congress to eliminate this subsidy. It was approved 99–0. However, it was stripped from the recent budget deal without explanation. If we agree that no institution should be too big to fail, if we agree that all bailouts must end, then we must agree that we must do something about this. I look forward to hearing the witnesses' views on what that should be.

Senator Toomey, thank you.

STATEMENT OF SENATOR PATRICK J. TOOMEY

Senator TOOMEY. Thanks, Mr. Chairman, and thanks for holding this hearing. I cannot help but comment briefly on one observation that you made, which is the concentration within the banking sector, and I think any such observation should include a really extraordinary fact, which is the complete—essentially the end of the creation of new community banks in America which we are recently living through. After many, many years in which it was common to have dozens or scores, sometimes even hundreds of community banks launched across the country, we went 5 years without a single new community bank. I am happy to report that a bank in Lancaster County, Pennsylvania, broke that trend just a few months ago, but the massive, excessive overregulation, including on the smallest banks that have absolutely no systemic importance really to the economy, are nevertheless burdened so much that it is just not feasible to launch a community bank and provide the credit that communities need. And I think that is a terrible development that we need to address.

But I digress, Mr. Chairman. The point of this hearing, of course, is to consider especially the GAO report on the Government support that occurred during the financial crisis, and I do think that is a very important topic. We need to understand that. I think it would be helpful to understand and quantify the Government support for other industries as well. It would be interesting to look at the cost to taxpayers, for instance, of the automakers' bailout. Some of that, of course, the taxpayer never recovered and never will.

And it is important that we understand that, but it is also important to remember that is historical. As you point out, we have got a report coming out soon that will look at whether or not and to what extent there is an ongoing subsidy, whether it is implied or not.

I am really looking forward to that report. I think we do not yet know the answer. I am looking forward to what light the GAO study will shed on this. But I want to talk a little bit about this because that is what we can still address. We cannot change history, but we could address this.

So if there is an ongoing subsidy to big banks, the first question is how is it manifested, and presumably it is manifested in a lower cost of funding. So if that is the case, it will be interesting to see how GAO attempts to quantify that, because funding costs are, of course, a function of many, many things, and it will be interesting to see how those various factors are separated out. Size itself confers benefits like an economy of scale that has nothing to do with the Government, and all industries tend to have lower funding costs for larger institutions than smaller institutions across different sectors. The quality of management affects the perception of creditworthiness, and so that affects funding costs. The amount of capital obviously affects funding costs. So there are a lot of factors, and it will be interesting to see the analysis as to what their relative contributions are to different funding costs.

But I am going to suggest, Mr. Chairman, that if there is an ongoing subsidy to the big banks, I think there is a very significant likelihood that it arises mostly from Title II of Dodd-Frank. And

the reason I say that is because Title II of Dodd-Frank, the Orderly Liquidation Authority, explicitly grants the power to the FDIC to go to the Treasury and to take taxpayer money and use it for the support of the creditors of the failing institution. And whether or not the purpose of the Orderly Liquidation Authority is to ultimately execute the failing financial institution, the fact that there is money made available explicitly in Title II of Dodd-Frank to support creditors, it seems to me, creates some of the moral hazard and some of the dangers of the subsidies that we would want to avoid.

In addition, Title II of Dodd-Frank gives the FDIC authority in how similarly situated creditors will be treated. Depending on whether or not the FDIC determines that some of the creditors may have somehow contributed to the failure of the institution more than other creditors, how they would determine that is not at all clear.

This I think is very, very problematic, and it is one of the biggest flaws, in my view, with Dodd-Frank, the mechanism by which the legislation contemplates the liquidation of a failed financial institution. And so I know you have got a bill that addresses this in one way. I have got a bill that repeals Title II of Dodd-Frank and make the necessary amendments to the Bankruptcy Code so that if a large, complex financial institution were to fail, we could manage the resolution through a legal process that would be transparent, based on clear laws, that would be objective rather than subject, and creditors would know exactly what their risks were and would not be subject to the discretion of some potentially politically influenced organization. And you could do it with an absolute prohibition on using taxpayer funds, which is what my bill would do.

So I think that is one way to address a number of problems, not the least of which is the possibility that there is some ongoing subsidy.

So, with that, Mr. Chairman, I appreciate your having this hearing and look forward to hearing from our witnesses.

Chairman BROWN. Thank you, Senator Toomey.

Senator Manchin.

STATEMENT OF SENATOR JOE MANCHIN

Senator MANCHIN. Mr. Chairman, thank you very much. I am not a Member of the Subcommittee, but I am a Member of the Committee on Banking, and I am very interested in the health and wellness of the banking system in this country but, most importantly, in West Virginia. We are a small State made up mostly of community banks. We did not suffer through the mortgage crisis, and we had strong banking laws in our State, and still do.

With that being said, I am just trying to learn as much as possible to understand how we could subsidize some of the largest banks that cause the problems that we have in this country and be able to be subsidized by the banks or the people that were not affected and are being affected now because of the laws that are coming down with Dodd-Frank. So we are just trying to find that balance, and I am here anxiously to try to learn, so thank you.

Chairman BROWN. Thank you, Senator Manchin.

Let me just begin by introducing the panel. Then we will hear from each of them, and then I will begin the questions, then Senator Toomey, and we will work our way through the panel.

Lawrance Evans, Jr., is Director of Financial Markets and Community Investment for the Government Accountability Office, the GAO. Mr. Evans, thanks for your service. Thanks for joining us.

Luigi Zingales is the Robert C. McCormack Professor of Entrepreneurship and Finance and the David Booth Faculty Fellow at the University of Chicago Booth School of Business. Dr. Zingales, welcome.

Simon Johnson is the former chief economist at the International Monetary Fund, currently the Ronald Kurtz Professor of Entrepreneurship at MIT Sloan School of Management. Dr. Johnson, welcome.

Harvey Rosenblum is an adjunct professor at Southern Methodist University's Cox School of Business. He is the former executive vice president and director of research at the Federal Reserve Bank of Dallas, where he worked for some 40 years. Dr. Rosenblum, welcome.

And Allan H. Meltzer is, appropriately, the Allan Meltzer University Professor of Political Economy, quite a coincidence, at Carnegie Mellon University Tepper School of Business. Welcome, Dr. Meltzer.

And, Mr. Evans, if you would begin.

STATEMENT OF LAWRANCE L. EVANS, JR., DIRECTOR, FINANCIAL MARKETS AND COMMUNITY INVESTMENT, GOVERNMENT ACCOUNTABILITY OFFICE

Mr. EVANS. Chairman Brown, Ranking Member Toomey, and Members of the Subcommittee, it is my pleasure to be here today to discuss Government support for financial institutions.

During the most recent crisis, that support included more than $1 trillion in loans and hundreds of billions of dollars in capital and guarantees. While these actions were credited with stabilizing the financial system, they also raised concerns about moral hazard and the weakening of market discipline. Specifically, such interventions could create expectations of future support that may reduce investors' incentives to monitor and price risk taking appropriately.

Whether firms receive benefits due to investor perceptions of loss protection is largely an empirical question. To those ends, GAO will conduct an empirical analysis of any funding costs or other economic advantages large banks may enjoy as a result of expectations of public support. Those results will be included in the report to be released later this year.

My remarks today are based on GAO's November report, which focused on actual support provided to institutions over the 2007–09 period to address disruptions in important funding markets.

From participation in these crisis-driven programs, bank holding companies and their subsidiaries experienced individual benefits, including liquidity benefits from programs that allowed them to borrow at lower interest rates, in greater quantities, and at longer maturities than potential market alternatives. For example, we found program prices were 22 to 92 basis points lower than market alternatives, depending on the program and market rates exam-

ined. This finding is consistent with the financial stability goals of these programs.

Assistance was generally made available to institutions of various sizes. However, at the end of 2008, program use on average was higher for banking organizations with $50 billion or more in total assets than for smaller firms. The six largest bank organizations were significant participants in emergency programs, particularly those targeting short-term funding markets. Some also benefited from institution-specific actions, including additional capital injections and guarantees.

Additionally, the Federal Reserve granted a number of exemptions to allow banks to channel funding support to subsidiaries and for other purposes. The Fed also granted bank holding company status to several nonbank financial companies to provide those firms greater access to Government support, and also extended a credit to the London subsidiaries of a few of the largest banking organizations.

Government assistance to prevent the failures of large financial institutions like Fannie Mae and AIG also benefited bank holding companies and other firms that had large exposures to these institutions. It is important again to emphasize all these actions were undertaken to promote stability and confidence in the financial system.

While the emergency response may have enhanced investor expectations about public support, the Dodd-Frank Act contained provisions intended to restrict future emergency assistance and prompt other regulatory changes that will alter the landscape for large financial institutions. For example, key provisions of the act are designed to reduce the probability of failure of systemically important firms and the risk they pose to the economy. These include provisions that restrict proprietary trading and swap transactions, among other activities, and require the Federal Reserve to subject the largest financial firms to heightened prudential standards and regulatory oversight. The act places new restrictions on the Federal Reserve and FDIC's emergency authorities. While the act allows the Federal Reserve to use its authority to authorize programs with broad-based eligibility, it sets forth new restrictions and requirements for such programs, including a prohibition on lending to insolvent firms.

As a first step to ensure any future emergency lending complies with Dodd-Frank, the Fed recently issued a draft rule and a request for public comment. The act requires resolution planning by large firms and grants FDIC new resolution authority to resolve a large failing firm outside of the bankruptcy process. FDIC continues to work to implement this authority and has acknowledged a number of challenges to its effectiveness. The viability and credibility of the resolution process is a critical part of removing market expectations of future extraordinary Government assistance.

The effectiveness of many of the relevant provisions of the act will depend in large part on how agencies implement them. As implementation is incomplete, effectiveness is uncertain. Some aspects of the act, such as resolutions through Title I or Title II, may require a market event to fully gauge their efficacy. As such, many observers, some of them here, have continued to debate the merits

of Dodd-Frank in addressing threats to financial stability and market discipline.

Members of the Subcommittee, this concludes my opening statement. I look forward to any questions you might have.

Chairman BROWN. Thank you, Mr. Evans.

Dr. Zingales, welcome.

STATEMENT OF LUIGI ZINGALES, ROBERT C. MCCORMACK PROFESSOR OF ENTREPRENEURSHIP AND FINANCE, UNIVERSITY OF CHICAGO BOOTH SCHOOL OF BUSINESS

Mr. ZINGALES. Chairman Brown, Ranking Member Toomey, Members of the Subcommittee, thank you for inviting me.

I have been asked to comment on the GAO study on the Government support of bank holding companies and in particular on my estimates of the financial benefits enjoyed by the bank holding companies as a result of the extraordinary Government actions during the financial crisis, and on my views of how to address the issues identified in the GAO report using the authorities provided in the Dodd-Frank Act.

Regarding the estimate of the financial benefits, it is important to distinguish two components: pure transfer of value from taxpayers to bank's investors and value created as a result of a reduction in the probability of a costly bankruptcy.

Veronesi and Zingales (2010) calculate the expected Government cost of the two main programs—the CPP and the TLGP—to be roughly $40 billion. By using this estimate and by making reasonable assumptions on the cost of the other programs, I obtain that the total expected cost of these programs was between $60 billion and $90 billion. This represents the pure transfer of value from taxpayers to bank holding companies' financial claim holders.

Veronesi and Zingales also estimate that in case of bankruptcy, 22 percent of the enterprise value of a bank holding company vanishes. Thus, we can assess the value saved by computing the changes in the probability of bankruptcy triggered by the Government interventions. These estimates, however, will depend crucially on what counterfactual hypothesis we are willing to entertain, i.e., what we assume would have happened to the bank holding companies had the Government not intervened.

I present two extreme scenarios. The lower bound, analyzed in Veronesi and Zingales, only considers the differential benefit of the set of interventions announced Columbus Day weekend 2008. Since even before that weekend the market was expecting the Government to intervene, these estimates only capture the effect of an increase in the probability of a Government intervention. Overall, this set of Government interventions saves roughly $100 billion, setting the total financial benefit enjoyed by the bank holding companies at between $158 billion and $188 billion.

To obtain an upper bound, I make the Jamie Dimon's hypothesis that without Government intervention all the top 10 bank holding companies would have failed. In this case the value saved overall would be $1.4 trillion with a total financial benefit by bank holding companies between $1.5 and $1.6 trillion. The wide range of these estimates shows how dependent the results are on the counterfactual used.

On the second issue, I would like to classify the Dodd-Frank's interventions in three groups:

Number one, restrictions to interventions in case a bank holding company is in trouble, such as restrictions on the Federal Reserve 13(3) authority;

Two, reduction in the potential cost in case of bankruptcy, such as living wills;

Three, restrictions to risk taking in normal conditions, such as liquidity requirements and debt to equity ratios.

I regard the first set of tools to be not only useless but also harmful. As the "no bailout clause" of the European Union Maastricht Treaty has shown, these restrictions are routinely bypassed when the need arises. If they are not, it can be dangerous, since by the time a major holding company is in trouble, the cost of not intervening becomes very high. This is exactly the type of tradeoff that Senator Brown was describing when he voted for TARP.

I regard the second set of tools as wishful thinking. A bank holding company's incentive to design a proper "living will" equals the desire of a man, sentenced to death by hanging, to find the right tree at which to be hanged.

The only effective tool to eliminate a subsidy to large bank holding companies is to design a mechanism of prompt intervention, which is triggered much before a bank holding company becomes insolvent. Such mechanism, described in Hart and Zingales (2012), can be implemented using the authorities provided in Dodd-Frank. It is sufficient that, by using its authority to set leverage standards, the Fed imposes a maximum price for the credit default swap of bank holding companies' junior debt. A CDS price subsumes both the leverage position and the riskiness of the underlying assets. Every time the CDS price exceeds the predetermined threshold for, let us say, 30 days, the bank should be required to issue equity. If it does not, it should be taken over by the regulator and liquidated using the Ordinary Liquidation Authority under Dodd-Frank. The system works like a margin loan, which is made safe by the occasional margin calls. This is the most effective way to eradicate the too-big-to-fail problem.

Chairman BROWN. Thank you, Dr. Zingales.

Dr. Johnson, welcome.

STATEMENT OF SIMON JOHNSON, RONALD KURTZ PROFESSOR OF ENTREPRENEURSHIP, MIT SLOAN SCHOOL OF MANAGEMENT

Mr. JOHNSON. Thank you, Senator. Let me make three points.

First of all, I agree, roughly speaking, with the findings of the GAO report. There was a large amount of support provided to bank holding companies, the very largest banks in the country, during the crisis. I have some caveats I would attach to their estimates. I put those in my written testimony, but I think, roughly speaking, the GAO has got this right. It was a huge amount, unprecedented amount of support that was provided.

The second point is building on what you said, Senator, about the cost and the cost to the budget of having a dangerous financial system, which I would emphasize has two components. One is the di-

rect amount of the subsidy, for example, the kinds of numbers that Luigi was talking about, how much are you transferring from the official sector to the private sector. But there is also a much bigger cost, which is what happens to the budget, what is the damage done to public accounts as a result of the crisis.

Now, you can back that out from some of the work that the Congressional Budget Office has done. Roughly speaking, over the cycle, based on their estimates, the severity of this crisis will end up increasing public debt by about 50 percent—five-zero percent—of GDP. So call that $7 or $8 trillion in today's money. And I completely agree with you, Senator Brown, that this should be an integral part of our budget thinking, and we should aim to eliminate not just the direct subsidy along the lines that you identify, but also worry about the broader hit that can potentially come at us through our fiscal accounts again. And I think the Senate and others should call on the Congressional Budget Office to make this kind of analysis much more central to what they present to you when they provide you with their standard analysis, both the baseline scenarios and when they think about various reforms, including the ones that you propose, and including the ones that Senator Toomey is proposing.

And that is my third point, which is I think it is self-evident that the problem of too big to fail was exacerbated by the crisis and by the bailout measures, and I think both of you are acknowledging and recognizing and emphasizing that in a completely appropriate way with the legislation that you are putting forward.

I would also emphasize, at least from my perspective, that you are agreeing—Senator Brown, you are emphasizing the crazy increase in concentration in the financial system we have seen over the past 20 or 30 years. Senator Toomey, I completely agree with you that the independent community banks have had a very rough deal, partly as a result of the increasing concentration, but also as a result of what happened in the crisis and some of the measures that came out of the crisis.

I completely support, for example, the positions of Cam Fine of the Independent Community Bankers of America on this issue, and Mr. Fine emphasizes repeatedly the way in which the biggest banks, these very large bank holding companies, and the forms of implicit Government support they continue to enjoy, the ways that have damaged—and continues to damage community banks.

What should we do about it? Well, I think we have three ideas on the table from the two of you. I completely support Senator Brown's proposed Safe Banking Act that would limit the size of the banks, particularly the size of their nondeposit liabilities as a percentage of GDP. And I am heartened, as I say in my testimony, by indications that Dan Tarullo, a Governor at the Federal Reserve Board, and perhaps some other Federal Reserve staff are coming around to this way of thinking. I think it is a little late. Hopefully they can speed up that process of moving in that direction.

I also fully support the proposal of Senator Brown and Senator Vitter, the TBTF Act, which would impose a more dramatic, drastic sliding scale of capital requirements, increasing beyond what is currently in the Basel framework or currently envisaged by the of-

ficial sector for these very large bank holding companies because they pose very big risks.

Now, I also would like, Senator Toomey, to support you on the point of background, and I do completely agree with the point that what we need in this economy is for every firm to be able to go bankrupt. The idea that somebody is exempt from bankruptcy I think is completely unacceptable.

I also do not find it very appealing that a certain set of firms should have their own piece of the Bankruptcy Code. I would prefer that everyone go through the same Bankruptcy Code. I recognize that the financial sector has built various poison pills into their structures that create some difficulties and some concerns.

I share, by the way, a lot of reservations about the resolution powers of the FDIC, and I am on their Systemic Resolution Advisory Committee. We can talk more about that if you want.

I worry, though, about one piece of your proposal, which is the lack of a debtor-in-possession financing mechanism, a backup. Obviously, you want that provided by the private sector ideally. There is nothing, I think, in your proposal that provides a backup. And when I have talked to people from the Hoover Institution, for example, recently at an FDIC meeting and also at a Richmond Fed meeting, they made it very clear that, without that kind of backup debtor-in-possession financing, they, the Hoover people who are generally supporting this bankruptcy idea, would worry a lot about contagion effects and the way in which a single firm can become a systemic crisis.

Thank you, Senator.

Chairman BROWN. Thank you, Dr. Johnson.

I would like to ask the Subcommittee unanimous consent that the written statement of the Independent Community Bankers of America be included in the report. Dr. Johnson had referred to Cam Fine and the ICBA report's too-big-to-fail subsidies exacerbate regulatory burden. Without objection, thank you, so ordered.

Dr. Rosenblum, thank you. Welcome.

STATEMENT OF HARVEY ROSENBLUM, ADJUNCT PROFESSOR OF FINANCE, COX SCHOOL OF BUSINESS, SOUTHERN METHODIST UNIVERSITY, AND RETIRED DIRECTOR OF RESEARCH, FEDERAL RESERVE BANK OF DALLAS

Mr. ROSENBLUM. Chairman Brown, Ranking Member Toomey, and Members of the Subcommittee, I am pleased to be here to testify on this very important subject.

On the subject of the too-big-to-fail subsidies, let me just say that it is big. Most estimates put it between $50 to $100 billion per year. It is persistent. It will go on in perpetuity if changes are not made in the incentives driving the giant banks. It distorts economic behavior. It is difficult to measure. It is one of the problems we have to face, and mainly because there is no line item on any bank holding company's balance sheet or income statement that says this is a too-big-to-fail subsidy.

But most important, it is a subsidy that is really an expenditure made by the Congress that charges the public taxpayers, and it has never been voted on. I repeat, never been voted on by the Congress, unlike most other subsidies.

Furthermore, the attempt to reduce the subsidy in the Dodd-Frank Act has really not altered the perception that too-big-too-fail banks are any less likely to receive extraordinary governmental assistance in the future. As a result, the subsidy remains. It will be here in perpetuity, as I mentioned before.

To address the subsidy, we have to recognize two principles:

First of all, incentives matter, and Dodd-Frank is putting the incentives in the wrong places. It has not changed the perception of future additional Government assistance, number one, and it has perpetuated the subsidy.

The other principle is that initial conditions matter, and as you have already pointed out, Senator Brown, we have very high concentration in the banking industry, and it has been getting worse. Moreover, the compliance cost of dealing with Dodd-Frank has caused a merger wave among the small to medium-size banks. And as you pointed out, Senator Toomey, there has been virtually no new entry into the banking industry in the last 5 years. So the competitive situation gets worse.

As I think about the subsidy, it relates to something that is even more important to me, and that is, what was the cost of the banking crisis, the financial crisis that we just went through as a Nation? We have been talking about the subsidies here, the too-big-too-fail subsidy, and using the word "billions." When I look at the costs of the crisis to the United States, we have to measure it in trillions, not billions. My own estimates and that of my coauthors at the Dallas Fed put the cost of the crisis somewhere between $15 and $30 trillion per year. That is 1 to 2 years of output down the drain.

To put that into words that the ordinary person on the street can understand, the crisis cost a typical household somewhere between $50,000 and $120,000. That is no small change indeed.

The saddest thing is that, unless the incentives are changed in the banking industry, we are going to repeat this same scenario again. Same tune, second verse. So the issue is: How do we get rid of this distortion called the "too-big-too-fail subsidy"?

President Richard Fisher of the Dallas Fed and I came up with a plan about a year ago, recently labeled the "Dallas Fed Plan," that would put in place a three-part system that would reduce the subsidy, and reduce moral hazard. It would involve restricting the safety net to commercial banks and other depository institutions, traditional commercial banks. It would require counterparties of the nonbank subsidiaries of the financial holding companies to acknowledge in writing that they have no Government guarantee or backstop in their dealings with the nonbank entities. And it would call for Government policies to get management to streamline and right-size the giant institutions. To some extent, the giant institutions have been doing that, but it has been proceeding at a snail's pace. As a result, moral hazard is increasing, not decreasing.

So the issue is, beyond the Dallas Fed Plan, what else can be done? There are two other things I would recommend. One is the Subsidy Reserve Plan, put forward by Professor Hurley at Boston University, which would bottle up the subsidy and not allow management to squander it. My other recommendation is the Brown-Vitter bill, which would put the incentives in the right place and

get the capital of the largest institutions up to where it should be, given their systemic risk.

These three provisions—Brown-Vitter, the Subsidy Reserve Plan, and the Dallas Fed Plan—could probably be written into legislation that would take less than ten pages. The implementing regulations could be written in fewer than ten pages, and I think that would go a long way to driving out some of the complexity that is perverting the way our banking system is distorting economic activity.

Chairman BROWN. Thank you, Dr. Rosenblum.

Dr. Meltzer, welcome. We look forward to your testimony.

STATEMENT OF ALLAN H. MELTZER, THE ALLAN H. MELTZER UNIVERSITY PROFESSOR OF POLITICAL ECONOMY, CARNEGIE MELLON UNIVERSITY TEPPER SCHOOL OF BUSINESS

Mr. MELTZER. Thank you, Senator. I am very happy to be here.

Let me start with two statements, one that I have made many times, which I will repeat: that capitalism without failure is like religion without sin. It does not work.

The second is a disclaimer. I worked with Senator Vitter and his staff when they were writing the Brown-Vitter bill following my testimony here several times in 2008 and 2009.

I am very pleased to testify today. Much has changed since the financial crisis of 2008. I will comment on the adequacy of some of these measures and propose some more effective procedures, including passage by the Congress of the Brown-Vitter legislation.

Let me begin by stating two principles that should, indeed must, guide your efforts if they are going to be successful.

The first principle: Legislation should increase the incentives by bankers and financial firms to act prudently. In an uncertain world, we cannot always know the prudent course. But the owners and managers are most likely to act prudently if they bear the cost of the errors that they make, the mistakes—from mistakes and from unforeseen events. They will be more willing to cushion risks and uncertainties if they bear the cost.

Second principle: Regulation must provide rules that prevent single bank failures from threatening the financial system. More than a century ago, careful analysts understood that the public responsibility was to protect the payments system because a breakdown of the payments system stops all or most economic activity. That is where the heavy costs that Dr. Rosenblum talked about came from. Fear and uncertainty cause banks to refuse to accept payments drawn on other banks.

That is what happened in the Great Depression. That was what started to happen in 2008 after Lehman Brothers failed. Timely, aggressive action by the Federal Reserve prevented the payments breakdown.

The second principle has wrongly devolved—wrongly devolved—into actions to protect banks. There is no economic justification for that as a public responsibility. I repeat: The public responsibility is to protect the payments system, not the banks or bankers. The proper way to separate the two is to impose procedures that prevent a failing bank from threatening the payment system. That requires four or five definite actions.

One, a clearly stated announced rule for the lender of last resort. A well-known rule that has been successfully used calls for the Federal Reserve to lend freely on good collateral at a penalty rate. In its first 100 years, the Federal Reserve has often discussed its lender-of-last-resort policy internally, but it has never announced a policy. Announcement is important, indeed crucial. It tells potential users well in advance how to prepare their balance sheets and to hold collateral against which they can borrow from the Federal Reserve in a crisis. It avoids panic by enforcing its announced rule. I have been around this issue for 30 or 40 years. I can tell you with great certainty there is never a time that a Secretary of the Treasury, as under Article 2 of Dodd-Frank, in the midst of a crisis, is going to decide not to do the bailout. That is the wrong time to be making the decision. The right time is in advance by making rules which tell the banks how they should be prepared to act in a crisis and require them to do so.

Second, it does not wait to choose action until the panic is upon us.

Third, the lender-of-last-resort policy prevents crises from spreading and stopping the payments system. It does not save or help troubled banks that lack acceptable collateral.

Fourth, require equity capital at banks sufficient to absorb all anticipated losses. The Brown-Vitter bill requires a minimum of 15 percent equity capital for all banks that hold $500 billion in assets. Capital is assessed against all assets, no exceptions or adjustments for risk. This avoids circumvention.

Fifth, if a bank's equity percentage falls to 10 percent due to losses, it must cease paying dividends—and, I would add, bonuses—until the 15 percent equity ratio is reached.

Sixth, all money market funds should be marked to market. Recent reform required mark-to-market for institutional funds but exempted individual funds. That does not solve the problem. The problem of runs is not avoided unless all money market funds are covered by a mark-to-market rule. The purpose is to prevent depositor runs against institutions.

Let me add, community banks and all banks with less than $500 billion in assets should hold a lower equity capital percentage, say 8 percent, because they are protected by deposit insurance, which is paid for collectively by bankers.

Thank you.

Chairman BROWN. Thank you, Dr. Meltzer. I remember a conversation back in maybe 2011 with Dr. Johnson prior to the Fed's decision to allow these banks to pay dividends, and your recommendation, similar to what Dr. Meltzer said, so thank you for that.

I will ask Dr. Zingales this question, but after he answers, I would like to just start with Mr. Evans and work your way down and answer this. You know, he estimated the banks' financial benefits conservatively somewhere between $158 billion and $188 billion, the cost to taxpayers somewhere between $59 and $89 billion. So the banks benefited, financially benefited somewhere upwards of $150 billion, the cost to taxpayers somewhere $60, $70, $80 billion.

The Treasury Department says it made a profit of more than $28 billion in its investment of banks. We have heard that a number of times.

How do we reconcile these two positions? And how can a subsidy exist even when the Government profits? If you would clear that up and reconcile that for this Committee, this Subcommittee, and then each of you give us your thoughts.

Mr. ZINGALES. Sure. If you buy a lottery ticket and you win, it is a great investment. But ex ante it is a bad investment. So there is a difference between calculating the cost on an expected basis and looking at the final outcome. So, yes, things turn out the right way, and so the cost might have turned ex post a profit. It depends on the way you properly calculate that. But it was not like a large cost. But on an ex ante basis, if you had to sort of insure that in the market or pay out of your pocket to get that kind of insurance, that would be the cost.

Chairman BROWN. Mr. Evans, the Government made that profit, but the banks got those subsidies. Discuss that.

Mr. EVANS. I agree completely with Professor Zingales. I think some of it is a measure of accounting. If we are looking just at the loans and guarantees that were provided to institutions, then you look at the fees that you generated as a result of that, and the interest, and that gives you an indication of what was received back to the Government. But that is different than a subsidy cost, which is an estimation that is done based on expected benefits and costs. More specifically the subsidy costs reflect the expected lifetime cost of these programs on a present value basis, rather than just the cash flows as they occur. It also reflects an adjustment for market risk—or what the market would have charged for the support.

Chairman BROWN. Dr. Johnson.

Mr. JOHNSON. Just to restate but slightly different words from what Luigi said, when the Treasury says or when the discussion of returns comes from Treasury and from the Fed, they do not discuss risk-adjusted returns. In other words, if you do this 20 times, would you expect to make money 20 times? Or will you make money once or twice out of the 20? And on a forward-looking basis, of course, that is what you care about. There is a lot of risk in this investment, and typically, if you look across a broad cross-section of experiences around the world with financial crises and with capital injections, including into banks, treasuries do not generally make money on those investments.

So we got lucky, congratulations to us, but it should not make us feel at all reassured with regard to the future risks.

Chairman BROWN. Dr. Rosenblum.

Mr. ROSENBLUM. Here we have to distinguish between the micro and the macro. The subsidy drives micro behavior. It makes banks run risky—giant banks run risky balance sheets. They get the profits; the public gets the losses. It drives the behavior of creditors and other counterparties of the giant institutions. That drives micro behavior.

On a macro basis, we have to look at the subsidy in a different way, and we also have to look at the costs that the GAO measured of the rescues during the crisis, and we have to think of the alternative cost or the opportunity cost. What if the bailouts had not

been there and we had gone into another 1930s-style Great Depression?

So the sense in which the Treasury profited is they have tax revenues now that they would not otherwise have if we were still in a Great Depression. So we have to distinguish the micro, which drives individual, personal, and firm behavior, from the macro and the economics versus the accounting identities. They are very different.

Chairman BROWN. Dr. Meltzer.

Mr. MELTZER. I agree with this last statement. The important thing was that we avoided a Great Depression. That was a social benefit. The social cost, quite apart from the accounting, the social cost is we are—you gave the numbers yourself. We are making the banking system much more rigid. We are eliminating the role of community banks. They are very important for American capitalism because that is where little businesses startup. They are being eliminated. Medium-size banks are almost all gone. They have been absorbed by the larger banks. Why were they absorbed by the larger banks? Because the larger banks—the largest banks have an advantage of being too big to fail, so they borrow at lower risk. That is what it is doing to the social structure of the U.S. economy, and that is not a good thing. And that is where the real costs are.

Chairman BROWN. Thank you.

Senator Toomey.

Senator TOOMEY. Thanks, Mr. Chairman.

I am wondering if actually each of you could just comment briefly, maybe we will start with Dr. Meltzer and work back. If you believe that Dodd-Frank perpetuates a perception that these banks are too big to fail, and if you believe that there is any implicit subsidy that is associated with that, do you believe that Title II in Dodd-Frank particularly contributes to that?

Mr. MELTZER. Absolutely. I can honestly say I have been around this problem for a number of times, talked to various Secretaries of the Treasury over the years. Imagine—put yourself in the position, eight Assistant Secretaries or somebody like that are going to come to you and they are going to tell you what the crisis will be if you do not do the bailout. You cannot wait until the last minute to decide whether you are going to do the bailout. You have got to set up a structure which is going to discourage that sort of behavior. If you do not do that, there is not a person in the world—you know, I have been there. When eight Secretaries of the Treasury tell the Secretary all the things that can happen, what can you say to them? "Take the risk"?

Senator TOOMEY. OK. If we could go down real quickly, because I have several other questions I hope to get to. Dr. Rosenblum, do you believe that Title II contributes to this problem?

Mr. ROSENBLUM. The short answer is yes. If you think of the three words—orderly liquidation authority—when I first started reading about that, I asked a person who was trying to write some of the regulations for the Treasury Department at the time, what was the operational word there? Was it "orderly"? Was it "liquidation"? Was it "authority"? I was hoping he would say "liquidation." His answer was the emphasis was on "orderly," the second most

important word was "authority," and the least important word was "liquidation."

Then you think about how it is going to work. The debtor-in-possession financing is going to come from the Government, not from the private sector. That automatically has subsidies implicit in it.

And last of all, the fact that these institutions are going to be labeled "systemically important" financial institutions—in Washington they are called "sif-fees." In Dallas I call them "sci-fis." It is like something out of science fiction. But the fact that they have got that "systemically important" label already tells all of their counterparties that they are special, that there will be extraordinary Government assistance, or at least a good chance of it, should that institution get in trouble. I think it compounds the problem. It does not solve the problem.

Senator TOOMEY. All right. Dr. Johnson.

Mr. JOHNSON. Senator, I think there are some scenarios in which the single point of entry strategy proposed by the FDIC could help. I do not think it will help with the very largest bank holding companies, the subject of today's hearing, because they are inherently cross-border, very global, huge businesses, and we do not have a cross-border resolution authority. We have a specific liquidation authority in the United States.

And, by the way, the last FDIC hearing made it clear that the plans do not call for liquidation in the sense of closing down the business and selling off the assets. It is a legal liquidation in which a failing entity has so-called good assets transferred to a new legal entity. They might well continue the brand name. They might well continue with the management in that scenario. And I share my colleague's concerns that it is possible, particularly for the largest category of megabanks, that Title II will not help and may even, as you are suggesting, create more difficulties.

Senator TOOMEY. Thank you. Dr. Zingales.

Mr. ZINGALES. I agree that Title II contributes to too big to fail. However, I think it is important to understand that the solution to this problem is not to prevent by legislation any possibility of rescue, because when push comes to shove, eventually everybody will do as Senator Brown did in front of TARP. So what we need to do is prevent us from reaching that point. It is like with small kids. We want them to learn from their mistakes, but we do not want them to go into danger, then take away their life. And so in front of a danger, the only way to do it is prevent them from going there, not sort of saying, "I am not going to rescue you if you get on fire."

Senator TOOMEY. So I wanted to follow up with your proposal, which, if I understood it correctly, is intriguing and I had not heard this articulated before. But if I understood what you are suggesting as an alternative, it is a process by which the Fed would monitor the price of credit default swaps or subordinated debt, set a ceiling essentially that would, as you point out, amount to a margin call, right, new capital, and use that as the mechanism by which we judge the creditworthiness of the entity? Do I have that about right?

Mr. ZINGALES. Yes, that is absolutely right.

Senator TOOMEY. OK. Now, you know, the appealing thing about that is that we do not have politicians arbitrarily setting a capital

level. Instead, we have the market telling us something. But we still have the Fed arbitrarily deciding what the ceiling is on the price of the CDS. So you still end up in the same place in terms of, you know, what is the criteria by which you decide what the right capital is. So that is one question.

The second one is: If you have solved the problem with a mechanism like that, then is there a need for all the restrictions on activities? I mean, I find it ironic that, in an interest of presumably reducing risk, we adopt a Volcker Rule that, for instance, forbids banks from engaging in profitable activity. The last time I checked, profitable activity actually enhanced the stability of the institution, and we forbid that.

Would that sort of thing be necessary if you had a mechanism to ensure adequate capital?

Mr. ZINGALES. I think that if this mechanism were implemented, the need for restricting activities would be much, much less, because the riskiness of this activity would be reflected in the measure of capital requirements. So the problem today is that we have a measure of capital requirements that only looks at one aspect of the problem, and we want to look at both. We want to look at leverage, we want to look at riskiness of assets, and the CDS does exactly that. On the level, of course, there is some arbitrariness in that, but we can look at the past and say what would it have taken during the crisis to recapitalize—or when we should have recapitalized these banks enough so that we would not reach the crisis? And so we can easily determine what that threshold should be.

Senator TOOMEY. Thanks, Mr. Chairman.

Chairman BROWN. Thank you, Senator Toomey.

Senator Reed.

Senator REED. Well, thank you very much, Mr. Chairman. I want to commend the Chairman and Senator Toomey for assembling a very impressive panel about a very important topic, and let me ask just a few questions.

Dr. Johnson, again, thank you for not only being here but for your very perceptive commentary constantly, so thanks.

Part of this discussion was about TARP. It has been both assailed and commended for what it did in terms of stabilizing the banking industry. There was one aspect of TARP, though, which I think has to be sort of looked at and emphasized, in my view, and maybe because I was involved and put in a provision, and that is, the warrants, which has resulted in about $9 billion of proceeds going back to taxpayers because they were included in the legislation.

Dr. Johnson, from your perspective can you comment on just the warrant provision and its effect? And, also, was it well managed? Could we have done better? And, frankly, is that something that has to be the template for any other type of sort of public engagement in a financial operation like TARP?

Mr. JOHNSON. Yes, Senator, I think it was entirely sensible and a very good idea to include the warrant provision in TARP. I understand Treasury was not enthusiastic about it initially, and, frankly, subsequently they did not seem to really pursue this, as they could have, as a way to get upside for the taxpayer. And I think, for example, given the discussion that we are having today,

it is entirely reasonable that when the Government provides this sort of backstop support to the financial system in an emergency to prevent a systemic collapse, there should be some upside for the taxpayer, and the warrant program is a good way to do it. And I would recommend everyone go and review the terms that Mr. Buffett got for his support, for example, to Goldman Sachs. If we could have done just as well as Warren Buffett, we would have done much better than under what the Treasury actually chose to do.

Senator REED. No, I think that is an excellent point. In fact, that was one of the things that struck us at the time, is that any serious business person investing in a risky enterprise with a potential upside would have taken warrants and would have—you know, directors on the board would have done a lot of things, and at least we got some of the warrants in. My recollection is like yours, too. It was unenthusiastically embraced, that we probably could have set better terms a la Warren Buffett. And, third, in retrospect, it looks better and better. So I think the more—you know, as President Kennedy said, you know, failure is an orphan, but success has lots of parents. So there is a big collection of parents today about the warrants provision.

Just one other quick question. You know, we are really talking today about emergency assistance, but there is a built-in support system to the Tax Code for assistance to major financial institutions and major institutions in general. We have tried to take some steps in the past. For example, we limited the deductibility of chief executives' compensation. What we found is that they have been very good about getting around that by bonus compensation, and we are putting in legislation. So could you again, Dr. Johnson, comment on the notion of tax supports and tax provisions that really are not helpful to the economy overall and are simply another form of subsidy to these institutions?

Mr. JOHNSON. Senator, I am familiar with your proposal on this topic, and I think it is a good one. I think to the extent that the Tax Code is encouraging either excessive levels of compensation or compensation that encourages too much risk taking, as my colleagues have been talking about, I think that is a bad idea. And it is entirely appropriate, as you suggested, to limit how much of that compensation is deductible because it is a form of subsidy through the Tax Code, as you said.

Senator REED. Well, thank you. Again, just let me open up that line of questions to anyone else who might want to comment, which is that, you know, some of this risk-based behavior is because we incentivize it through the Tax Code and through other provisions, and it would be very helpful for me particularly if there are specific provisions that you think—and you can respond in writing and answer—are not helpful at all but do encourage excessive risk taking, and if we could have a two-fer, if you will, you know, not subsidizing risk and actually raising revenue through a process that helps in other ways. So let me open that question up and ask you perhaps in writing to respond as my time is expiring.

Thank you, gentlemen, for your testimony.

Chairman BROWN. Would anyone care to comment now on that? Or you certainly are free to—Dr. Meltzer, yes?

Mr. MELTZER. Yes, yes. The capital requirements are really crucial. Banks got down to where many of them had 2 percent equity capital or less. They had more capital bonds, and they insured the bonds, so they had no skin in the game. The way to get the change is not by doing it piecemeal on each part of their compensation, because they will find ways to circumvent it. They will get airplanes. They will get cars. They will do other things that you do not regulate.

The way to get it is make them bear the cost of the errors. That is what the Brown-Vitter bill does, and I am convinced that that is—if you do it so that there is no exception, if you hold an asset, you have to hold 15 percent against it if you are of that size. If you do not think it is worth 15 percent, sell it. That is what markets do. And that way you get the incentives on them, and that is what you want to think about. You want to think about what are the procedures which are going to give them the incentives that are hard to circumvent.

Senator REED. Thank you.

Chairman BROWN. Thank you.

Dr. Rosenblum.

Mr. ROSENBLUM. Let me put a slightly different twist on it. I think of Economics 101. If you want more of something, you subsidize it. If you want less of it, you tax it. And when we think about the too-big-too-fail subsidies, it is subsidizing that which we do not want. So we know it is perverse.

But if we want to think about too-big-too-fail subsidies, we want a stable financial system, and we may have to, you know, think about what is the cost of having that stability and what is the backup system you need it for.

The other place where I think you may want a too-big-too-fail subsidy of some kind is for national defense. You know, we cannot have the production lines that are going to be used to produce the material that is going to defend our country go through bankruptcy. And when I think about General Motors' bankruptcy, nobody ever talked about the national defense. And if you go back to World War II, where were the tanks produced? Converted auto production lines, produced airplanes, tanks, boats, and all those sorts of things.

So we have to think about those critical infrastructure needs that we must have—a payments system, a national defense system, et cetera, et cetera. And there may be some need to have some subsidies there and the moral hazard that it engenders. Moral hazard is the cost we pay for living in a civilized society. Anybody who has raised children knows about the moral hazards of raising children and the moral hazard of taking care of our next-door neighbor when our next-door neighbor is out of work. It is just something that we must do, but that is something the United States has done reasonably well.

But getting back to the too-big-to-fail subsidy, it is something we do not want. Yet, it is there. The other subsidies that we ought to have are those which Congress wants and votes on politically. If we want to subsidize food supply or make sure we have a stable food production, maybe a corn subsidy or a sugar subsidy is warranted. Whatever it is, it may be something you want. But at least it ought

to be voted on directly. The problem with the too-big-too-fail subsidy, it happened by happenstance. It was never voted on, and it keeps getting bigger and bigger in a self-reinforcing mechanism. And that I find unconstitutional.

Senator REED. Thank you.

Chairman BROWN. Thank you.

Senator Merkley.

Senator MERKLEY. Thank you very much, Mr. Chair, and thank you to the panel.

One of my colleagues a few minutes ago said, "Why would you ban an activity that is profitable, like proprietary trading?" Mr. Johnson, is proprietary trading always profitable?

Mr. JOHNSON. No, Senator, it is not. Well, perhaps it is profitable to the people undertaking it, so this is the issue of compensation and the issue of incentives. But it is also possible to lose a great deal, and we are obviously talking about companies in this context. When an individual company incurs losses, there are big spillover effects both directly to the Government in terms of various kinds of support provided and, as we are saying, indirectly to the budget and to the real economy. And those costs are huge relative to the amounts of money that people were going to gain in terms of their personal compensation. So I think the Volcker Rule is a very sensible part of our current regulatory approach.

Senator MERKLEY. My memory is the commercial banks lost about half a trillion dollars in proprietary trading, and, of course, you have this complex challenge on repurchase agreements in which a fire sale at one firm can devalue the asset and create a series of dominoes that affects the entire market. One of you spoke to the contagion issue. So I just wanted to go back to that point for a moment and note that if indeed proprietary trading was risk-free or always profitable, we would not have been having that discussion. But it posed such a systemic risk to the entire order.

One of the issues that we have struggled with is cross-border resolution, the complexity of international firms, American firms with foreign subsidiaries, foreign firms with American operations, and that is a key piece of the puzzle. Can anyone who would like speak to how satisfied are we with where we have gotten to? Yes, Mr. Johnson.

Mr. JOHNSON. So cross-border resolution remains a huge problem, both for the existing FDIC approach to a single point of entry, I think it is the Achilles heel of the entire approach. And when we talk about any of the big companies, the subject of today's hearing, they are all so big across borders that this is going to be the entire ball game, and this is what will create the pressure for the Secretary of the Treasury and Congress to provide a bailout in the future.

I would also say—and I am sorry Senator Toomey is not in the room at the moment—that this is a key problem for bankruptcy. And when you talk to the experts, the proponents, the people who would rather get rid of Title II and stick with bankruptcy, for example, at this Richmond Fed conference that I talked about, which is a public conference so people can review the tape, it is very clear that while cross-border issues are a big problem under Title II, the resolution authority, they are an insurmountable obstacle if you

are going through the bankruptcy courts, because bankruptcy courts absolutely cannot and never will cooperate in the fashion that will be necessary to have an orderly liquidation, winding down, unraveling, call it what you want, if you go in through the bankruptcy-only route.

So cross-border is a huge problem that we have not dealt with resolution. It is an insurmountable obstacle for bankruptcy.

Senator MERKLEY. Does anyone else want to chime in? Yes, Mr. Meltzer.

Mr. MELTZER. Senator, let me suggest to you a way to think about that problem. Separate the bank from the holding company. Let the holding company incorporate all its subsidiaries in the countries of origin so they are subject to the rules of the country of origin, not to the U.S. rules, but they are owned by the holding company, not by the bank. So the bank can be structured, restructured here. The holding company is a separate entity subject to whatever laws are applicable in the foreign countries where the subsidiaries are operating.

Senator MERKLEY. Do you feel, Mr. Meltzer, that that creates a sufficient firewall from the risks incurred abroad flowing back into the U.S. economy?

Mr. MELTZER. I have not studied it carefully enough to say definitively, but I believe it certainly moves in that direction; that is, you want to keep the problems of the foreign banks out of the domestic banks so that you can regulate the domestic banks and regulate the holding company separately. And if the holding company is taking sufficiently large risks, then it wants more capital requirement.

Senator MERKLEY. Anyone else want to jump into that? Mr. Rosenblum.

Mr. ROSENBLUM. Yes, I want to underscore what Professor Meltzer said and come back to what I said earlier about the Dallas Fed Plan, which hives off the safety net to the commercial bank and legitimate traditional commercial banking activities. Everything else in these holding companies is separate, and every counterparty of those nonbank institutions has to sign off and say there is no Government guarantee. I get it. Two simple sentences. That puts the onus of responsibility on the marketplace and on these counterparties to worry about what happens if this company gets into trouble. Our deposit insurance system and the lender of last resort is really there for the bank, the domestic company, and that is where it should be, and everything else, the market, has to have incentives to watch over and regulate in its own way with threat of losses, be it domestic or be it foreign. But we have to let market forces reinforce the limited effectiveness of regulations that we have.

Senator MERKLEY. Thank you all very much.

Chairman BROWN. Thank you, Senator Merkley.

Senator Warren.

Senator WARREN. Thank you very much, Mr. Chairman. Thank you, Mr. Evans, for the work you and your staff have put in to put this report together.

The GAO report concludes that it is too early to declare victory on the too-big-too-fail problem, and I agree. The four largest banks

are nearly 40 percent bigger today than they were just 5 years ago. The six largest banks now control two-thirds of the banking assets in this country, a 37-percent increase over where they were just in the last 5 years. These banks, in other words, are a whole lot bigger now than they were when we bailed them out in 2008 because they were too big to fail.

So I get it. Size is not everything, but basically the bigger these banks get, the harder it is for the U.S. Government to declare with any credibility that it will not bail them out if they get into trouble again.

Now, the GAO report does not consider the impact of the Volcker Rule because it was not passed until after the report was issued. I think the Volcker Rule is an important step in the right direction if it is strongly enforced. But I am interested in your take, Dr. Johnson. Does the Volcker Rule solve the too-big-too-fail problem?

Mr. JOHNSON. The Volcker Rule is helpful in the current context, steps in the right direction, as you said, Senator Warren. It, unfortunately, by itself or even if implemented in the most forceful fashion possible, I think is not going to completely end too big to fail. Those problems, those subsidies, the systemic risk and the way it can damage the budget and the economy, that is going to remain.

Senator WARREN. So let me just see if I can do this as maybe yes/no so we can get on to other questions. Would you agree with that, Dr. Zingales?

Mr. ZINGALES. Yes.

Senator WARREN. And, Dr. Rosenblum, do you think that the Volcker Rule solves the too-big-too-fail problem?

Mr. ROSENBLUM. No.

Senator WARREN. And, Dr. Meltzer.

Mr. MELTZER. No, and I think it has the added difficulty that you will never find a clear-cut definition of what is a hedge and what is a speculation.

Senator WARREN. Good. All right.

Mr. ZINGALES. Sorry. To be precise, I said no, I do not—you understood.

Senator WARREN. I had asked the question backwards. That was entirely my fault, Dr. Zingales. I should have been consistent in how I asked it.

But let me put it this way. The four of you agree the Volcker Rule does not solve the too-big-too-fail problem even if it is vigorously enforced. So let me do the next question on that. Even if the regulatory agencies issue all of the Dodd-Frank rules that remain and then rigorously enforce all of those rules, do you believe that would solve the too-big-too-fail problem? And perhaps I could start with you, Dr. Rosenblum.

Mr. ROSENBLUM. So let me be blunt and do something I should never do here when the TV is going. I am going to answer your question by saying, "No," and, "Hell, no."

Senator WARREN. And tell me about if you feel strongly about this.

[Laughter.]

Mr. ROSENBLUM. Well, if we have 14,000 pages of proposed regulations written to implement less than half of the Dodd-Frank provisions, we do not have anything going on that can be enforced. It

is mind-boggling. It is unenforceable. It is inscrutable. It does more harm than good. We need rules that are simple, straightforward. If they are to be enforced, they have to be observable. The enforcement has to be observable. As Dr. Meltzer has said, a capital-to-asset ratio is measurable, observable, can be looked at sort of in real time. It is a beginning. We cannot have this Dodd-Frank—which is 850 pages, roughly, probably will be 30,000 pages of regulations to implement it. It is not workable. And when something is not workable, you have to admit it and go back to the drawing board and try to come up with something simpler and better. Complexity is the enemy, as I said in my written testimony, and we have to find some way of addressing it.

Senator WARREN. So——

Mr. ROSENBLUM. Let me add one thing, if I may. When I started in the Federal Reserve System 44 years ago, in 1970, I was hired to help write the Bank Holding Company Act amendment regulations, and we were sat down in a room, and they told us we could write no more than one page of regulations to implement one page of statutes. We were held accountable to that criteria. The legislation itself that we had to work on was only a few pages long, and our regulations were fewer. It is doable, and it was enforceable, and it worked very, very well. And I think we have to get back to the drawing board and realize the social costs of what we are doing. If we cannot understand the rules that we have to follow, nobody is going to follow the rules, whether it is driving at the speed limit or whether it is something else, or getting back to health care, which is another situation, we have to—we cannot write rules this way. And I think if Congress were to give a gift to America for 2014, the greatest New Year's gift they could give would be to write legislation in a few pages, with regulations that were an equal number of pages, so that every Senator and every Congressman can sign off to their constituents and say, "I read every word of this legislation, and I am proud that I signed off on it."

Senator WARREN. From your mouth to God's ears.

Could I have your indulgence for just a minute, Mr. Chairman?

Chairman BROWN. There will be a second round, too.

Senator WARREN. Actually, I will finish up, if that is OK, because I just want to ask—and I will do it the right way, Dr. Zingales. So if all of Dodd-Frank were implemented and if it were vigorously enforced, do you believe that would solve the too-big-too-fail problem? And maybe we can do these with just yes or no answers to the extent possible. Dr. Zingales.

Mr. ZINGALES. No, it would not solve it.

Senator WARREN. Dr. Johnson.

Mr. JOHNSON. Yes. If vigorously enforced, Title I says that the living wills lay out how your firm is going to go bankrupt, and if that plan is not credible—and I am confident those plans are not credible and will not be credible, with the current level of complexity, then the Federal Reserve and other authorities should take remedial actions, including much higher capital requirements, including breaking up the banks, as you proposed, along the new Glass-Steagall lines. All of those possibilities are contained within Dodd-Frank, but I agree that is not the current interpretation of

the law, particularly from the Board of Governors of the Federal Reserve.

Senator WARREN. So if amended my question to be "as currently interpreted," then you answer would be——

Mr. JOHNSON. Then the answer is no.

Senator WARREN. Then the answer would be no. And, Dr. Meltzer.

Mr. MELTZER. No, it certainly does not, and I believe when you said we have not won the battle, I think we have lost the battle against too big to fail because—mainly because we put the burden on the regulators instead of putting it on the people who make the loans and make the mistakes. And if you do that, you know, look what happened before the regulation—before 2008. The SEC cut the requirement for capital in the investment banks to 3 percent, allowed them to leverage 30 times. The Federal Reserve allowed banks to incorporate subsidiaries without capital to hold mortgages. I mean, I had a meeting here——

Senator WARREN. Dr. Meltzer, I am going to have to cut you off. Thank you very much. The Chair has been very indulgent. But if the Chair will indulge me one more minute, I just want to ask one very quick question because I wanted that time, and that is, so does it make sense to wait until all of the Dodd-Frank rules have been put in place and are vigorously enforced before we consider further legislative actions to address the too-big-too-fail problem? And if I could just have a yes or no on that, does it make sense to wait? Dr. Zingales.

Mr. ZINGALES. No.

Senator WARREN. Dr. Johnson.

Mr. JOHNSON. No.

Senator WARREN. Dr. Rosenblum.

Mr. ROSENBLUM. No.

Senator WARREN. Dr. Meltzer.

Mr. MELTZER. No.

Senator WARREN. Good. So I just want to say thank you very much, Mr. Chairman, and conclude with the notion, back in July Secretary of the Treasury Lew said that if we got to the end of 2013 and could not say that we had ended too big to fail, it was time, in his words, "to look at other options to end it." Then in December, he said we had met the test, that existing reforms were enough to address too big to fail.

I think the Secretary laid out the right timeline, but based on this GAO report and the testimony we have heard today, I just do not think we can declare confidence that too big to fail is over. I believe it is time to start looking seriously at other options. Too big to fail is just too dangerous for us to cross our fingers and hope for the best.

So thank you very much for having this hearing, and thank you for your indulgence on the time.

Chairman BROWN. Thank you, Senator Warren.

Let me start a second round. I appreciate the comments. One of the things that has come through in this hearing in so many ways, especially on capital requirements, is the simplicity of your proposals and the simplicity of your explanations, and I thank all five of you for that.

Dr. Rosenblum, I appreciate also the Dallas Fed Plan, Mr. Fisher working with us and his office working with us on Brown-Vitter and a host of other issues, and I want to sort of focus on one of those.

You propose restricting the so-called Government safety net to traditional depository institutions, but rather than narrowing the scope, as you know, the bailouts and Dodd-Frank have expanded that safety net by bringing in nonbanks and companies like clearinghouses into the system. I want to talk for a moment about Section 23A of the Federal Reserve Act. It was supposed to protect insured depositories and prevent institutions from transferring that safety net subsidy to nonbanks. 23A, while perhaps not written as succinctly as you called for from your graduate studies and since, 23A was ineffective during the crisis because of the routine exemption that regulators granted to too many of these institutions. My legislation with Senator Vitter strengthens 23A by enacting legal firewalls between banks and nonbanks and prohibits Federal assistance to those nonbanks.

Give me your views—and then after you answer, Mr. Rosenblum, I will start with Mr. Meltzer and work my way down. What are your views on the importance and the effectiveness of 23A? How do we strengthen those firewalls between banks and nonbanks?

Mr. ROSENBLUM. You hit on a point that I have not written about extensively. When Richard Fisher and I came up with the Dallas Fed Plan, we wanted to keep it down to three points. If we allowed ourselves a fourth point, 23A would have been the fourth point. The ability of a nonbank sub to put bad assets into the bank and, therefore, put it into the FDIC safety net and/or the discount window borrowing provisions I find abhorrent. So that would have been the fourth point that I would have made. So I would toughen up 23A and say that any exception to 23A that is made has to be done in advance with written notice and absolute complete transparency on the part of the Federal Reserve that it is making an exception. Every one of those assets has to be listed in public, and, therefore, I think it is much less likely to happen if you have those kinds of restrictions there.

There may be some cases when an exception needs to be made, but it should be few and far between, extremely rare, and I believe that the General Counsel of the Federal Reserve Board needs to have some restrictions on the ability to grant those special provisions in private.

Chairman BROWN. Could you work with us on what—or let me ask it this way: Are you satisfied with the provisions in Brown-Vitter that the restrictions are tight enough but the discretion is given to the Fed for extraordinary cases but cannot be abused, for want of a better term, or more liberally given by the Fed than we would want?

Mr. ROSENBLUM. I think we have to realize what the Federal Reserve is, and one of the things it was created to be is a lender of last resort, which has taken on new meaning in the 21st century. You need that safety valve there, and people have to recognize that there is a safety valve; otherwise, panic takes over. What the Federal Reserve's job is to do in times like that is when everybody in the private sector is trying to take the sell side, somebody in the

Government or in the Federal Reserve has to take the buy side; otherwise, prices go to zero. That is what the Federal Reserve was created to do. That is what the Bagehot Principle is all about. And I would not like to see the Federal Reserve's hands totally tied from being able to exercise its prerogative to use lending as a means to saving the system at the right time. I would like to see more checks and balances. I agree with Professor Meltzer. We need rules clearly stated in advance that are comprehensible. And I agree that the Federal Reserve has never really put those rules forward on how the lender of last resort is going to work. But if nobody knows what the rules are, that is when panic really can set in. So those rules have to be specified.

My criticism to Professor Meltzer is—he has been advising the Fed to write those rules. Those are tough rules to write, and neither I nor Professor Meltzer have actually written out what that rule should be that would be clearly there in advance. But I think it is something the Federal Reserve does need to work on. But you do need some political checks and balances to make sure that the Federal Reserve is not exceeding its authority, but there can be provisions written in so that would not happen.

Chairman BROWN. Before—Dr. Meltzer, I know you want to answer this, too, and I want you to. Before answering the 23A question, I want to put another part of the safety net in this question and then answer them together, the rest of you, if you would. Section 716 of Dodd-Frank requires banks to move their derivatives out of their insured banks, but the GAO report notes that regulators have given large banks an extension. Right now the four bank holding companies that are most active in derivatives hold more than 90 percent of their derivatives in their insured bank. Two of these companies plan to move more derivatives into their insured banks in response to a credit downgrade, asking taxpayers to subsidize their risk. Clearly that suggests a problem.

So if you would comment on both of those, Dr. Meltzer, and then——

Mr. MELTZER. Sure. Let me step back and say the economics literature is full of things about capture, how the regulator gets captured by the regulated. So you are not going to make effective rules that way. If you think that there is a problem with derivatives or with these loans or subsidiaries, put on a cash requirement for banks. Add to the capital requirement a requirement which says you have to hold cash, negotiable assets, short term, that you can discount at the Fed when you need to. That is a way to go.

Think not about what rules can you put on the regulator to get them to do the right thing, because that does not seem to work. Put the rules on the regulated, which makes them want to do. The essence of regulation, if we strip it way back to simple economics, is there is a social cost and a private cost. You want to drive the private cost up to where it is clearly close to the social cost. That means you want to make them see what the social benefits are, not what the private benefits are. They see the private benefits. You have to make them want to behave in a way, in a simple, direct, observable, transparent, and enforceable way that sees those costs.

Chairman BROWN. And the simplest and most workable is capital requirements on real assets——

Mr. MELTZER. Absolutely.

Chairman BROWN. ——risk weighting and all of that.

Mr. MELTZER. Right. Now, they will say that is going to reduce lending. That is baloney. The Federal Reserve decides how much lending there is in the economy, and they can easily make it more or less, and do. So we do not need banks to decide that. Banks decide who gets the credit. The Federal Reserve decides how much credit there is.

Chairman BROWN. And I have certainly heard that said many times in response to Brown-Vitter, and much we work on here——

Mr. MELTZER. It just is not true.

Chairman BROWN. ——we will not lend, there will not be capital available.

Mr. MELTZER. Baloney.

Chairman BROWN. OK. We will quote you on that. Thank you. Dr. Johnson, your thoughts?

Mr. JOHNSON. Well, I certainly agree, Senator Brown, that 23A has become a problem, and I think the problem is located on the staff of the Federal Reserve Board of Governors, particularly in the Office of the General Counsel. I think they have been allowing these bank holding companies to move risky assets, problematic assets into the bank and, therefore, benefit from the safety——

Chairman BROWN. Does that—sorry to interrupt. Does that follow with Dr. Meltzer's comments about regulatory capture? Is that primarily the reason? Or are there other reasons that these waivers and these exceptions tend to be the matter of course?

Mr. JOHNSON. That is a great question. You should ask the Federal Reserve staff, Senator, not me. Certainly there has been a history of capture in our regulatory agencies with which you are very familiar, and the Board of Governors has not been exempt from that in the past.

Chairman BROWN. People at the Peterson Institute called it—one day we were talking about this with Sheila Bair and some others, and Governor Huntsman called it "cognitive capture," that it is a little bit different but it is sort of the culture of many of these regulatory bodies.

Mr. JOHNSON. Yes, it is exactly in the tradition of George Stigler and the Chicago School. Cognitive capture is just one application of that. You are captivated by the mystique of Wall Street—sorry, not you, Senator, but a lot of other people are captivated by that mystique and, therefore, think that what these large bank holding companies want to do is somehow, if it is good for them, they want to do it, it is good for the economy. I think that that is an extension, very straightforward extension of the Stigler capture idea.

But just also to go on to the point you made about Dodd-Frank and the point about moving derivatives around within the bank holding company structure, I do worry, Senator, that in addition to the 23A problem you are identifying, there is a problem emerging that will emerge from the Title II resolution application of the single point of entry, because through this mechanism the FDIC—if it is believed that this is going to work and that support will be provided, it is ultimately backing up the entire portfolio of the bank holding company, and it is transferring losses that would be incurred, for example, in an operating subsidiary that loses big

money on derivatives. Those losses get pushed up to the holding company level where the FDIC gets involved in deciding who gets the losses, deciding who gets—what kind of debt gets converted to equity or gets wiped out, and also providing backstop financing.

So I think we are in danger of enlarging this problem beyond the scale that already exists, and it is already problematic.

Chairman BROWN. Dr. Zingales, comments?

Mr. ZINGALES. I very much agree with what Meltzer and Rosenblum said. I think that the problem is all these rules are very complex and they give ample space for regulators to do what the regulated want. So I think that we need to simplify these rules to make it more difficult for this to happen and to give less discretion to the regulatory authorities, because I think that they have too much discretion, and this discretion is always used in one direction, and it is generally the wrong one.

Chairman BROWN. Mr. Evans, comments?

Mr. EVANS. I think I will take a little bit of time just to plug our ongoing work, because at the end of the day this is about investor perceptions or investor expectations about how regulators, will behave in the instance of distress. In our work, we will be looking at how any subsidy that we estimate might change over time, because, again, it is, I think, an empirical question to ask whether investors' expectations have been changed as a result of Dodd-Frank. And we will also be talking to large investors and other market participants. So there are a lot of things in Dodd-Frank, including 23A, but our question that we are going to concern ourselves with is whether it changes investor expectations.

Chairman BROWN. OK. Thank you, Mr. Evans.

We talk about capital and leverage. In July, the OCC, FDIC, and the Fed, as you all know, proposed a special higher leverage ratio for the largest banks, not as high as I would have liked, not as high, I assume from my conversations with some of you and my staff's conversation, as some of you would have liked. Even that said, the *New York Times* noted just 3 days ago that the Federal Reserve has said we should not finalize this rule until foreign regulators have finished their capital rules. Give me your comments on what that means to our financial system. Should we finish our supplemental leverage ratio now? Should we wait for other countries? What impact will waiting have? What should we do? Mr. Evans, do you feel free to comment on that?

Mr. EVANS. I will punt mostly to my colleagues here. I think there are pros and cons to both approaches. You know, we are good at laying out those pros and cons. As you noticed, we were only an inch deep in the report. We talk about the intent of the various provisions and the challenges they face, but we do not have an opinion at this time on that.

Chairman BROWN. OK. Dr. Zingales, I bet you do.

Mr. ZINGALES. Yes, I do, and I would like to stress the example of Switzerland. Nobody doubts that Switzerland is a capitalist country and a country that generally has been sort of quite interested in the welfare of banks. But because banks in Switzerland are too big to be saved, because they are bigger than what the fiscal authority of the country can do, the regulatory approach in that country has been much more severe in terms of capital require-

ments. So I think that we should follow the Swiss example as fast as possible because nobody can say that this is not a legislation done against the banks. It is simply a legislation done without banks pressuring to have an implicit guarantee, because in Switzerland they do not bother to pressure because they know that it would not be there. So this is the example to follow.

So if the Fed and Treasury want to follow a lead, they should follow the Swiss lead.

Chairman BROWN. Dr. Johnson.

Mr. JOHNSON. Well, Senator, I am very much disconcerted by the news that we are going to wait for the Basel Committee—and that means most immediately for the Europeans—before we decide on a supplemental leverage ratio. I agree with you that the leverage ratio should be higher, more strict. We should require more equity relative to debt for these large bank holding companies, more than currently proposed. The Basel framework and this entire mechanism through which we there to unify or agree or harmonize with our European friends has not been helpful over the past 30 years, and it is not helpful at the moment. Secretary Lew said back in the summer—and I believe he reiterated this also in the fall—that we are supposedly not going to wait for other countries, that we are going to impose rules that make sense for ourselves. And I do not see how this deferral to the Basel community on the supplemental leverage ratio is helpful in that regard.

Chairman BROWN. It does make you wonder if Secretary Lew's comments in the summer that if we have not fixed too big—about fixing too big to fail, then saying we have by December, if he was including in that these higher capital requirements, which have not been finalized. To be continued.

Dr. Rosenblum, your thoughts?

Mr. ROSENBLUM. Somebody has to be the leader and the exemplar, and in this instance I think the leader and the exemplar should be the United States. We are the largest economy and the most important economy in the world with the financial system that the rest of the world depends upon, and we need the healthiest and safest banking and financial system in the world in order to lead the world. And, therefore, I do not think we should wait on the least common denominator coming up with what they think is right. We ought to do what we think is right, and the others I think will have to follow.

Chairman BROWN. Thank you.

Dr. Meltzer, a comment?

Mr. MELTZER. I agree with what the others have said. The United States should lead and not follow. The argument that the bankers make is that it will put them at a competitive disadvantage. That is hard to accept. They have subsidiaries overseas, so if the rules in the United States are strict and prevent them from making loans overseas, they can make them from their overseas subsidiaries. So it is hard to see how they are going to be—why that should be a critical reason why we should not lead the world toward a better solution. As Professor Zingales said, the Swiss have already taken, I believe, 19 percent capital requirements on assets.

Chairman BROWN. Thank you.

A comment and then I wanted to do two more sort of quick rounds. Dr. Rosenblum's written testimony compared megabanks to semi-trucks that need lower speed limits than passenger vehicles, something we are familiar with. If people would look at the chart to your right, to my left, Government assistance exceeds banks' capital. The Government's investments, loans, and guarantees to the three largest banks were significantly higher than the banks' equity. However, if they had had 15 percent equity, they could have suffered—as Mr. Meltzer has said over and over and over again, to his credit, they could have suffered deep losses and still been solvent. So I think that speaks for itself.

Mr. Evans, Professor Johnson notes that the GAO weights all so-called expert opinion equally regardless of whether the work is being produced in the public interest or Wall Street's behest. You may remember—I think we are all fairly familiar with that—after Dodd-Frank was signed by the President of the United States, one of the leading lobbyist for the financial service industry said, "Now it is half time." So you know the influence that Wall Street has. Their economic power has been enhanced. Their political power has been enhanced.

So the question is—Professor Johnson said we need to sort out sensible analysis from sophisticated lobbying, his words. How is GAO doing that?

Mr. EVANS. Thank you very much. I am happy to be able to address that particular issue. I do not think, first of all, that is a fair criticism based on this report because where we draw from some of the experts is just in identifying some of the challenges to implementing some of the provisions of Dodd-Frank. But how are we doing that? We do it how we typically do it. We are balanced, and fact-based in our approach. We reach out to all stakeholders. We talk to all affected parties. We do speak with banks about how they fund themselves. We speak with investor groups.

And so our objective scope and methodology sections for all of our reports are clear about how we go about doing our work. And at the end of the day, we have to be able to make conclusions that are based on facts. And if we cannot do that, then we do not attach a GAGAS statement to our reports. So, again, we talk to everyone. Now, we are looking at academic research. Our economists are being quite rigorous in terms of which ones would qualify as reasonable estimates or reasonable approaches to estimating any subsidy that exists.

We are aware of lobbying power. We are aware of conflicts of interest. In fact, when we reached out to academics to look at our model and our model specification, one of the things that we explored was conflicts of interest. We wanted to make sure that these individuals were free from those type of influences.

Chairman BROWN. Well, I think some of you saw an article recently, I think a front-page piece in the *New York Times* in the last couple of weeks, about the conflicts of interest so often from academicians who speak with authority——

Mr. EVANS. That is right.

Chairman BROWN. ——but that so often do not disclose their conflicts. And I hope that GAO will be acutely aware of that.

Mr. EVANS. For sure. That is why we did that rigorous exercise. And to be fair, you know, there are folks who believe they know whether a subsidy exists on both sides. In fact, some of the research assumes it and then estimates—or assumed that it does not exist and then comes out with estimates.

Chairman BROWN. Dr. Johnson, a comment on that?

Mr. JOHNSON. Well, just an observation to you, Senator. I have talked to the GAO. They reached out to me. They asked me my opinion and my assessment of the numbers and the work involved. They did not ask me if I have a conflict of interest. They did not ask me who pays for various parts of my activity. I mean, I would be happy to tell them. In fact, I put a lot of disclosures on my Web site. I hope that that was an exception, an aberration. I hope that they are ascertaining this information when they speak to other people. Maybe they will call me up tomorrow and get that part of the record straight. It does worry me that a lot of people work for the industry explicitly. I think that is not so problematic. But I know quite a few people who work for the industry without necessarily fully volunteering in all instances the full extent of the income and other benefits they derive from those interactions.

Chairman BROWN. Some may be setting themselves up for future employment, to be cynical for a moment.

Mr. Evans, you would like to comment on Dr. Johnson's comment?

Mr. EVANS. Yes. To be fair, certain folks we reach out to have an existing large body of work, like Professor Johnson. We do not always, you know, do it ahead of time. But ex post we know where folks are coming from. But, again, that is for our interview purposes. We reach out to a wide range of stakeholders. We are interested in their opinions. Those opinions do not influence what we saw or what we think at the end of the day. And, again, the academic studies have clear methodologies, so you can tell when they are using untoward assumptions or undertaking methodologies that raise questions about the validity of the estimates. So I think that is my response to Dr. Johnson. No, we did not ask him, but he has a body of research that we look at.

Chairman BROWN. I hope that—and, again, thank you for your evenhandedness, Mr. Evans, and your public service and for the report and the report to come. I do hope that you heard loud and clear from me, from Dr. Johnson, and from others—and I think we cannot certainly speak for the public, but I think it is pretty clear that people want to make sure who these people are that are talking to you and who is paying whom and that you work even harder at doing that. But thank you for that.

Mr. EVANS. I think that is fair. Thank you.

Chairman BROWN. The last question to all of you is about investor disclosures. Section 50106C of the SEC's codification of financial reporting policies requires that any financial assistance "that has materially affected or are reasonably likely to have a material future effect upon financial condition or results of operations should provide disclosure of the nature, amounts, and effects of such assistance." It is difficult to argue that loans from the Fed, guarantees from the FDIC, capital injections from Treasury, it is hard to argue that they do not materially affect the future financial

conditions of these institutions. But during the bailouts, many large financial firms made representations about their financial conditions, failing to disclose, or they made vague disclosures regarding assistance provided to them by the Fed or Treasury or FDIC. This appears to be another example of regulatory forbearance, not requiring them to disclose what they should have, the regulatory forbearance that benefited the large banks, this time at investors' expense.

Just give me thoughts on how that needs to be—I assume you all think disclosure—I mean, that kind of goes without saying. How do we build accountability in this so there is not this lack of disclosure for investors? Dr. Zingales, do you want to start?

Mr. ZINGALES. Yes. I think that I can see an argument for delayed disclosure. I can see that in some moments disclosing help in the moment as help takes place might create more financial instability, but I do not see any argument for not disclosing, let us say, 2 years later what the problem is. And I think that this delayed disclosure should be much more pervasive. For example, the Fed rates banks with some internal ratings called CAMELS ratings. Again, I think it is very useful not to disclose them at the time, but I do not see any reason why not disclose to the public subsequently so that we can assess how good the Fed is in disclosing—in measuring the solvency of banks, and we can improve if we find mistakes.

Chairman BROWN. Dr. Johnson.

Mr. JOHNSON. Senator, I think we should be trying to disclose as much as possible, subject to not destabilizing the world's economy, obviously. And in this context, I would flag living wills for you. Now, some of these living wills are reportedly in the tens of thousands of pages—and those are the short ones—and we learn very little about what is in those living wills, either immediately or with some time delay. So I would reinforce Luigi's suggestion just now that, with some time delay, the Fed should make more of that information public so we can go back and look and have some additional assessment of whether those living wills were indeed realistic plans that would lay out a road map through which bankruptcy could take place without causing global financial instability, which is the mandate.

Chairman BROWN. Dr. Rosenblum.

Mr. ROSENBLUM. I would agree with Simon on this accountability issue and a lot of information being disclosed with a lag. In real time, however, it can exacerbate the financial crisis to disclose too much. That is one of the dangers when you have to go to the lender of last resort. It is called the lender of last resort for a reason. Again, we have to take two steps back and put it into everyday language. If one of my children comes to me for help, they usually do not want their sibling knowing about it. They had to go to the Bank of Mom and Dad. That is what the Federal Reserve is, the lender of last resort, or we can think of it as the pawnbroker for the Nation. It is a collateralized loan. Nobody really wants it revealed in real time that they had to go there. But when you do go there, I agree—and the law is now explicit—it does have to be acknowledged and made public, but with a lag.

So there is a delicate balance there, but I come back to what Professor Zingales also said. I think there is a lot of bank examination information that is valuable that should be disclosed with a 2-year lag, maybe a 3-year lag. I am not sure what the right number is, but if the Comptroller of the Currency and the FDIC and the Fed are going to do their job, it has to be—I think disclosure and transparency would make them more accountable and have them do a better job than they are doing now and make capture, which is a word we were using before, less likely.

Chairman BROWN. Dr. Meltzer.

Mr. MELTZER. I will be very brief. I agree with what Professor Zingales said.

Chairman BROWN. Thank you. That was very brief. You were always very brief, Dr. Meltzer. Thank you.

Mr. MELTZER. Thank you.

Chairman BROWN. Thank you all for your testimony and for your candor. Some Subcommittee Members may have written questions for you. Please answer those as quickly as possible. I appreciate the service that all of you have provided.

The Subcommittee is adjourned.

[Whereupon, at 11:48 a.m., the hearing was adjourned.]

[Prepared statements, responses to written questions, and additional material supplied for the record follow:]

PREPARED STATEMENT OF LAWRANCE L. EVANS, JR.

DIRECTOR, FINANCIAL MARKETS AND COMMUNITY INVESTMENT, GOVERNMENT ACCOUNTABILITY OFFICE

JANUARY 8, 2014

United States Government Accountability Office

GAO

Testimony
Before the Subcommittee on Financial Institutions and Consumer Protection, Committee on Banking, Housing and Urban Affairs, U.S. Senate

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GOVERNMENT SUPPORT FOR BANK HOLDING COMPANIES

Statutory Changes to Limit Future Support Are Not Yet Fully Implemented

Statement of Lawrance L. Evans, Jr., Director
Financial Markets and Community Investment

GAO-14-174T

Chairman Brown, Ranking Member Toomey, and Members of the Subcommittee:

I am pleased to be here today as you examine issues related to government support for large bank holding companies. The federal government maintains programs—frequently referred to as safety nets—to reduce the vulnerability of depository institutions to runs that could threaten the health of the banking system and the broader economy.[1] Two programs are generally considered to form the core of these safety nets: the Federal Reserve System's discount window and Federal Deposit Insurance Corporation (FDIC) deposit insurance.[2] By making emergency liquidity available to solvent depository institutions through the discount window and reducing incentives for depositors to withdraw their funds, these safety nets were intended to help ensure that depository institutions could continue to lend and provide other important services, even during turbulent economic conditions. In addition to these safety nets, the federal government extended unprecedented support to financial institutions to stabilize financial markets during the financial crisis.

My remarks today are based on our November 2013 report, entitled *Government Support for Bank Holding Companies: Statutory Changes to Limit Future Support Are Not Yet Fully Implemented* (GAO-14-18). This report was the first of two reports we will issue on the economic benefits that the largest bank holding companies have received as a result of actual or perceived government support.[3]

Our November 2013 report examined (1) actual government support for banks and bank holding companies during the financial crisis, and (2)

[1]This inherent vulnerability arises from the role of banks in using deposits that are available upon demand to fund long-term, illiquid loans.

[2]The Federal Reserve System consists of the Federal Reserve Board—a federal agency—and 12 regional Reserve Banks. The Federal Reserve Board has delegated some of its responsibilities for supervision and regulation to the Reserve Banks. The Federal Reserve Act authorizes the Reserve Banks to make discount window loans to the extent authorized by the Federal Reserve Board. Pub. L. No. 63-43, §§ 10B, 13, 38 Stat. 251 (codified at of 12 U.S.C. §§ 347b(a), 343).

[3]Perceived government support refers to support that market participants may expect the federal government to provide to these institutions in the event that they suffer large losses that threaten them with failure.

recent statutory and regulatory changes related to government support for banks and bank holding companies. To address the objectives for this report, we reviewed relevant statutes, regulations, agency documents, related studies, and prior GAO work; analyzed program transaction data; and interviewed regulators, representatives of financial institutions, academics, trade associations and others. While this report addressed benefits that bank holding companies and their subsidiaries received *during the crisis* from *actual* government support, our ongoing work on this issue includes a consideration of any benefits banks may have received from any *expectations of future* government support. Specifically, in a second report to be issued in 2014, we will examine any funding or other advantages the largest bank holding companies have received as a result of implied government support. Our work for the November 2013 report on which this statement is based was conducted in accordance with generally accepted government auditing standards. Further details on our scope and methodology are included in the November 2013 report.

Government Actions to Stabilize Markets Resulted in Significant Support to Bank Holding Companies

During the financial crisis of 2007-2009, the federal government extended unprecedented amounts of assistance to financial institutions to stabilize financial markets and the broader economy. This support included the creation of temporary programs that extended more than $1 trillion in loans, provided hundreds of billions of dollars of capital, and guaranteed hundreds of billions of dollars of other liabilities for participating financial institutions. While these government interventions helped to avert a more severe crisis, they raised questions about moral hazard and the appropriate scope of government safety nets for financial institutions.[4] In particular, extraordinary support for troubled financial institutions led to debate about how to decrease the likelihood of future rescues of failing institutions and limit the potential for federal safety nets intended for insured depository institutions to provide a backstop for activities conducted outside these institutions.

We found that from 2007 through 2009, the federal government's actions to stabilize the financial system provided significant funding support and other benefits to bank holding companies and their subsidiaries. The

[4]Moral hazard can occur when market participants expect similar emergency actions in future crises, thereby weakening their incentives to properly manage risks.

Board of Governors of the Federal Reserve System (Federal Reserve Board), the Department of the Treasury (Treasury), and FDIC introduced new programs with broad-based eligibility that provided funding support to eligible institutions, which included entities that were part of a bank holding company and others. Programs that provided the most significant support directly to bank holding companies or their subsidiaries included Treasury's capital investment programs, the Federal Reserve System's lending programs, and FDIC's guarantee programs. Some large institutions benefited from special assistance specific to their institution.

Isolating the impact of individual government interventions is difficult, but collectively these interventions likely improved financial conditions by enhancing confidence in financial institutions and the financial system overall.[5] Bank holding companies and their subsidiaries, in addition to the financial sector and the economy as a whole, benefited from improved financial conditions. Bank holding companies and their subsidiaries also experienced individual benefits from participating in particular programs, including liquidity benefits from programs that allowed them to borrow at lower interest rates and at longer maturities than might have been available in the markets.

Government entities generally sought to set prices for assistance through these programs to be less expensive than prices available during crisis conditions but more expensive than prices available during normal market conditions. Based on our analysis, we found that emergency lending and guarantee programs were generally priced below estimated market alternatives that may have been available during the crisis.[6] This result is consistent with the programs' policy goals, which were to stabilize

[5]In prior work, we found that the Troubled Asset Relief Program (TARP), along with other efforts by the Federal Reserve System and FDIC, made important contributions to helping stabilize credit markets. For example, the TED spread—a key indicator of credit risk that gauges the willingness of banks to lend to other banks—had narrowed to precrisis levels within a year of the October 2008 announcements of TARP, the Temporary Liquidity Guarantee Program (TLGP), the Commercial Paper Funding Facility (CPFF), and other government actions.

[6]The market rates used in this analysis provide a general indication of market alternatives that could have been available to participants, but for a number of reasons the rates are unlikely to reflect available alternatives for all participants at all points in time during the crisis and cannot be used to produce a precise quantification of the benefits that accrued to participating financial institutions. See appendix III in GAO-14-18 for more details on our methodology and limitations for these analyses.

financial markets and restore confidence in the financial sector. The pricing of emergency assistance below estimated market alternatives is also evidenced by the significant participation in these programs. In addition, based on analyses of emergency equity support programs we reviewed, Treasury purchased equity in financial institutions at prices that were higher than estimated market prices. For specific programs, we were able to estimate the extent to which participants may have benefited from program pricing as well as the extent to which this pricing became unattractive in comparison to market pricing during normal and more stable credit conditions.

We also found that programs generally were made available to institutions of various sizes, and differences in the use of programs by institutions of various sizes were driven in part by differences in how institutions funded themselves.[7] For example, compared to smaller bank holding companies, larger bank holding companies relied less on deposits as a source of funding and more on short-term credit markets and participated more in programs created to stabilize these markets. In addition, large bank holding companies were significant users of Federal Reserve System programs targeting repurchase agreement markets. At the end of 2008, program use—measured for each institution as the percentage of total assets supported by the programs—was higher on average for banks and bank holding companies with over $50 billion in total assets than for smaller firms. For example, total loans outstanding from selected Federal Reserve System programs combined were at least 2 percent of assets on average for banking organizations with $50 billion or more in assets and less than 1 percent of assets on average for smaller organizations.[8] The six largest bank holding companies were

[7]To compare the extent to which banking organizations of various sizes used emergency programs, we calculated the percentage of banking organization assets that were supported by emergency programs—either through capital injections, loans, or guarantees—at quarter-end dates for 2008 through 2012. Capital provided by emergency programs includes capital investments by Treasury under the Capital Purchase Program and the Targeted Investment Program. Loans provided by emergency programs include Term Auction Facility (TAF), Term Securities Lending Facility (TSLF), Primary Dealer Credit Facility (PDCF), and CPFF loans from the Federal Reserve System. Funding guaranteed by emergency programs includes deposits guaranteed by FDIC through TLGP and debt guaranteed by FDIC through the Debt Guarantee Program. Our analysis of institutions receiving support included banking organizations receiving government support through these emergency programs for which we could reliably calculate consolidated assets. See GAO-14-18 for more information on our analysis.

[8]Selected Federal Reserve System programs included CPFF, PDCF, TAF, and TSLF.

significant participants in several emergency programs but exited most of the programs by the end of 2009. Differences in program use across banking organizations of various sizes diminished as institutions exited the programs.

In addition to these programs, the Federal Reserve Board granted several regulatory exemptions to requirements under Section 23A of the Federal Reserve Act for a range of purposes, such as allowing banks to provide greater liquidity support to the nonbank sector.[9] The number of exemptions granted increased significantly during the crisis, and the majority of these exemptions were granted to U.S. bank holding companies and other firms with $500 billion or more in total assets.

Beyond broad-based programs and regulatory exemptions, federal government agencies took special actions with respect to individual financial institutions on several occasions in 2008 and 2009. While these actions were intended to benefit a range of market participants and the broader financial system, some large U.S. bank holding companies received substantial direct benefits from these actions. Such actions included (1) assisting individual troubled financial firms or facilitating the acquisition of troubled financial firms whose failures posed significant risks to the financial system, and (2) the Federal Reserve Board granting bank holding company status to several nonbank financial companies, which provided these firms with greater access to emergency government funding support.

[9]Section 23A of the Federal Reserve Act imposes quantitative limits on certain transactions between an insured depository institution and its affiliates, prohibits banks from purchasing low-quality assets from their nonbank affiliates, and imposes collateral requirements on extensions of credit to affiliates. 12 U.S.C. § 371c. In letters documenting its approval of exemptions to Section 23A, the Federal Reserve Board has indicated that the twin purposes of Section 23A are (1) to protect against a depository institution suffering losses in transactions with its affiliates, and (2) to limit the ability of a depository institution to transfer to its affiliates the subsidy arising from the institution's access to the federal safety net. In other words, these restrictions are intended to protect the safety and soundness of banks and to prevent them from subsidizing the activities of nonbank affiliates by passing on any benefits they may receive through access to deposit insurance and the discount window.

Dodd-Frank Aims to Restrict Future Government Support, but Implementation Is Incomplete and Effectiveness Remains Uncertain

The Dodd-Frank Wall Street Reform and Consumer Protection Act (Dodd-Frank Act) includes provisions intended to restrict the ability of regulators to provide support to financial institutions, among other things.[10] Nevertheless, market observers have continued to debate whether some of the largest and most complex financial institutions—including bank holding companies with more than $500 billion in total consolidated assets—may continue to benefit from expectations of extraordinary government support that could potentially give them funding and other economic advantages relative to smaller institutions.

The Dodd-Frank Act contains provisions that aim to modify the scope of federal safety nets for financial firms, restrict future government support, and strengthen regulatory oversight for the banking sector, but implementation is not yet complete and the effectiveness of some provisions remains uncertain. Agencies have finalized certain changes to traditional safety nets for insured banks, but the impacts of provisions to limit the scope of transactions that benefit from these safety nets will depend on how they are implemented. The act also places restrictions on emergency authorities used by regulators during the crisis to assist financial firms. For example, the act effectively removes FDIC's authority to provide assistance to a single, specific failing bank outside of receivership and grants FDIC new authority to resolve a large failing institution outside of bankruptcy.[11] FDIC has made progress toward implementing its new resolution authority and continues to work to address potential obstacles to the viability of its resolution process as an alternative to bankruptcy, such as challenges that could arise when resolving more than one large institution concurrently. For example, experts have questioned whether FDIC has sufficient capacity to use its new authorities to handle multiple failures of systemically important firms and thus prevent further systemic disruption. The act also places new restrictions and requirements on the Federal Reserve Board's emergency lending authority. While the act allows the Federal Reserve Board to continue to use its authority under Section 13(3) of the Federal Reserve Act to authorize programs with broad-based eligibility, it sets forth new restrictions and requirements for such programs, including a requirement that lending not assist insolvent firms.

[10]Pub. L. No. 111-203, 124 Stat. 1376 (2010).

[11]§§ 204, 210, 124 Stat. at 1454-56, 1460.

While the Dodd-Frank Act requires the Federal Reserve Board to establish policies and procedures governing future actions under Section 13(3) authority, at the time of our report's issuance the Federal Reserve Board had not yet completed its process for drafting these policies and procedures and had not set time frames for doing so. A Federal Reserve Board official indicated that the Board of Governors has focused first on completion of other required regulations that have statutory deadlines and the regulations that are specifically directed at enhancing the safety and soundness of the U.S. financial system. While the act did not set a specific deadline, our report noted that setting time frames could help ensure more timely completion of these policies and procedures. Moreover, finalizing these procedures could help the Federal Reserve Board to ensure that any future emergency lending does not assist insolvent firms and complies with other new requirements.

Finally, the Dodd-Frank Act also introduced a number of regulatory changes designed to reduce the risks that the largest financial institutions pose to the financial system. A notable change is a set of new prudential requirements and capital standards designed to strengthen the regulatory oversight and capital base of large financial institutions. The Federal Reserve Board has made progress towards implementing these enhanced regulatory standards, which cover areas such as risk-based capital requirements and leverage limits, stress testing requirements, and debt-to-equity limits.

In our November 2013 report, we recommended that the Chairman of the Board of Governors of the Federal Reserve System set time frames for completing its process for drafting policies and procedures governing the use of emergency lending authority under Section 13(3) of the Federal Reserve Act. This recommendation is intended to better ensure that the design and implementation of any future emergency lending programs comply with Dodd-Frank Act requirements in a timely manner. The Federal Reserve Board accepted this recommendation and noted that it has made progress toward completing draft policies and procedures governing the use of its emergency lending authority under Section 13(3) of the Federal Reserve Act. On December 23, 2013, the Federal Reserve Board issued a notice of proposed rulemaking and a request for public

comment on a rule designed to establish the required policies and procedures.[12]

Chairman Brown, Ranking Member Toomey and members of the Subcommittee, this concludes my prepared remarks. I would be happy to answer any questions that you or other members of the Subcommittee may have.

For future contacts regarding this statement, please contact Lawrance L. Evans, Jr. at (202) 512-4802 or at evansl@gao.gov. Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this statement. Other GAO staff who made key contributions to this statement and the report it is based on include: Karen Tremba, Assistant Director; Jordan Anderson, Bethany Benitez, Stephanie Cheng, John Fisher, Michael Hoffman, Risto Laboski, Courtney LaFountain, Jon Menaster, Marc Molino, Robert Rieke, and Jennifer Schwartz.

[12] *Extensions of Credit by Federal Reserve Banks*, Notice of Proposed Rulemaking by Board of Governors of the Federal Reserve System, http://federalreserve.gov/newsevents/press/bcreg/201312223a.htm (Fed. Reg. publication pending) (Dec. 23, 2013).

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PREPARED STATEMENT OF LUIGI ZINGALES

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JANUARY 8, 2014

Chairman Brown, Ranking Member Senator Vitter, Members of the Committee, thank you for inviting me.

I have been asked to comment on the GAO study on the Government support of bank holding companies (BHCs)and in particular (1) on my estimates of the financial benefits enjoyed by the BHCs as a result of the extraordinary Government actions during the financial crisis; (2) on my views of how to address the issues identified in the GAO report using the authorities provided in the Dodd-Frank Act.

Regarding the estimate of the financial benefits it is important to distinguish two components: pure transfer of value from taxpayers to bank's investors and value created as a result of a reduction in the probability of a costly bankruptcy.

Veronesi and Zingales (2010) calculate the expected Government cost of the two main programs (CPP and TLGP) to be $39.9bn.[1] By using this estimate and by making reasonable assumptions on the cost of the other programs, I obtain that the total expected cost of these programs was between $59bn and $89bn (see Table 1). This represents the pure transfer of value from taxpayers to BHC financial claimholders.

Veronesi and Zingales (2010) also estimate that in case of bankruptcy, 22 percent of the enterprise value of a BHC vanishes. Thus, we can assess the value saved by computing the changes in the probability of bankruptcy triggered by the Government interventions. These estimates, however, will depend crucially on what counterfactual hypothesis we are willing to entertain, i.e., what we assume would have happened to the BHCs had the Government not intervened.

I present two extreme scenarios. The lower bound, analyzed in Veronesi and Zingales (2010), only considers the differential benefit of the set of interventions announced Columbus day weekend 2008. Since even before that weekend the market was expecting the Government to intervene, these estimates only capture the effect of an increase in the probability of a Government intervention. Overall, this set of Government interventions saves $99bn, setting the total financial benefit enjoyed by BHCs at between $158bn and 188bn.

To obtain an upper bound, I make the Jamie Dimon's hypothesis that without Government intervention all the top ten BHCs would have failed (see Ross Sorkin (2009)).[2] In this case the value saved overall would be $1,461bn, with a total financial benefit enjoyed by BHCs between $1,520bn and $1,550bn. The wide range of these estimates shows how dependent the results are on the counterfactual used.

On the second issue, I would like to classify the Dodd-Frank's interventions in three groups:

- Restrictions to interventions in case a BHC is in trouble (such as restrictions on the Federal Reserve 13(3) authority);
- Reduction in the potential cost in case of bankruptcy (such as Living Wills);
- Restrictions to risk taking in normal conditions (such Liquidity Requirements and Debt to Equity Ratio).

I regard the first set of tools to be not only useless, but also harmful. As the "no bailout clause" of the European Union Maastricht Treaty has shown, these restrictions are routinely bypassed when the need arises. If they are not, it can be dangerous, since by the time a major BHC is in trouble, the cost of not intervening becomes very high.

I regard the second set of tools as wishful thinking. A BHC's incentive to design a proper "living will" equals the desire of a man, sentenced to death by hanging, to find the right tree at which to be hung.

The only effective tool to eliminate a subsidy to large BHCs is to design a mechanism of prompt intervention, which is triggered much before a BHC becomes insolvent. Such mechanism, described in Hart and Zingales (2012), can be implemented using the authorities provided in Dodd-Frank.[3] It is sufficient that, by using its authority to set leverage standards, the Fed imposes a maximum price for the Credit Default Swap of BHC's junior debt. A CDS price subsumes both the leverage posi-

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[1] Pietro Veronesi and Luigi Zingales, "Paulson's Gift", *Journal of Financial Economics,* 2010: 97(3):339–368.

[2] Andrew Ross Sorkin, "Too Big To Fail", Penguin Books, October 20, 2009.

[3] Oliver Hart and Luigi Zingales, "A New Capital Regulation for Large Financial Institutions", *American Law and Economic Association Review,* 2012.

tion and the riskiness of the underlying assets. Every time the CDS price exceeds the predetermined threshold for, let's say, 30 days, the bank should be required to issue equity. If it does not, it should be taken over by the regulator and liquidated using the Ordinary Liquidation Authority under Dodd-Frank. The system works like a margin loan, made safe by the occasional margin calls. This is the most effective way to eradicate the "Too Big To Fail" problem.

Table 1: Government Cost of the Various Programs

For the first four programs the conservative cost estimates are obtained assuming that the average use was half the peak level for a year and that the benefit was 100 basis points (the Libor –OIS spread before Lehman's bankruptcy). The aggressive estimates are obtained assuming that the average use was the peak level for a year and that the benefit was 300 basis points (the Libor –OIS spread just before Columbus day 2008). The cost estimates of CPP, DGP, and TAGP are from Veronesi and Zingales (2010).

		Conservative estimates		Aggressive estimates	
Program Name	Peak amount bn $	% benefit to BHC	Value transferred BHC	% benefit to BHC	Value transferred BHC
TAF	493	1.0%	2.5	3.0%	14.8
PDCF	130	1.0%	0.7	3.0%	3.9
TSLF	236	1.0%	1.2	3.0%	7.1
CPFF	348	1.0%	1.7	3.0%	10.4
CPP	205	22.7%	46.6	22.7%	46.6
DGP	346	1.6%	5.7	1.6%	5.7
TAGP	835	0.1%	0.7	0.1%	0.7
Total			59.03		89.21

Table 2: Value Created by the Various Programs

Veronesi and Zingales (2010) estimate that the net percentage change in the value of a BHC ($\frac{V_1 - V_0}{V_0}$) due to a government intervention is $\frac{V_1 - V_0}{V_0} = -0.025 + 0.22 * \Delta\pi$, where $\Delta\pi$ is the change in the discounted value of the (risk neutral) probability of bankruptcy due to the government intervention (see p. 356 Veronesi and Zingales (2010)). Status quo ante is the probability prevailing October 10. "All failed" corresponds to a probability of bankruptcy without government intervention equal to one.

				Vis-à-vis status quo ante		Vis-à-vis all failed	
	Enterprise Value	Prob of default 10-Oct	Prob of default 14-Oct	Delta Pi	Bankrupcty Costs Saved	Delta Pi	Bankrupcty Costs Saved
Citigroup	2,026	5.08	2.16	0.17	23.85	0.76	287.40
Bank of America	1,803	1.43	0.76	0.10	-6.61	0.78	263.47
JP Morgan	2,257	1.42	0.77	0.08	-17.54	0.80	342.31
Wachovia	735	4.05	1.66	0.14	4.61	0.79	110.08
Wells Fargo	672	1.45	0.69	0.11	-0.68	0.79	99.61
Bank of NY Mellon	280						
StateStreet	297						
Goldman	1,089	9.74	3.72	0.25	32.05	0.72	144.15
Morgan Stanley	976	30.33	8.26	0.38	57.98	0.55	94.29
Merrill Lynch	867	7.69	3.26	0.14	5.56	0.74	120.13
Total	11,002				99.2		1,461

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Paulson's gift ☆

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ABSTRACT

We calculate the costs and benefits of the largest ever US government intervention in the financial sector announced during the 2008 Columbus-day weekend. We estimate that this intervention increased the value of banks' financial claims by $130 billion (bn) at a taxpayers' cost of $21–$44 billion with a net benefit between $86 and $109 bn. By looking at the limited cross section, we infer that this net benefit arises from a reduction in the probability of bankruptcy, which we estimate would destroy 22% of the enterprise value. The big winners of the plan were the bondholders of the three former investment banks and Citigroup, while the losers were JP Morgan shareholders and the US taxpayers.

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1. Introduction

The 2008 financial crisis witnessed the largest intervention of the US government in the financial sector. The stated goal of this intervention was to "restore confidence to our financial system,"[1] through a massive transfer of resources from the taxpayers to the banking sector. From an economic point of view, such an intervention is justified only in the presence of a market failure that the government could help alleviate. If this market failure is present, then the government intervention should create, not just redistribute, value. Did this intervention create value or was it simply a massive transfer of resources from taxpayers to financial institutions? If it did create value, why? What can we learn about the possible cost of financial distress in financial institutions?

To answer these questions, we estimate the costs and benefits of the US government plan announced on Monday, October 13, 2008. The plan included a $125 bn preferred equity infusion in the nine (ten if we consider Wachovia still independent) largest US commercial banks joined by a three-year government guarantee on new unsecured bank debt issues. For brevity, throughout the paper we refer to the US Treasury-Federal Deposit Insurance Corporation (FDIC) joint plan as "Paulson's Plan," after the name of the then US Treasury Secretary, Hank Paulson.

Given the worldwide changes in financial markets occurring between Friday, October 10, and Tuesday, October 14, it is impossible to estimate the systemic

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[1] Statement by US Treasury Secretary Henry M. Paulson, Jr. on Actions to Protect the US Economy, October 14, 2008. http://www.financialstability.gov/latest/hp1205.html.

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effects of the intervention. However, it is possible to estimate its effects on the banks involved. If the intervention stopped a bank run, for instance, it should have created some value in the banking sector. To compute the intervention's effect on the value of banks, we do not limit ourselves to the changes in the value of common and preferred equity, but we look at the changes in the entire enterprise value by looking also at changes in the value of existing debt. In fact, by using liquid credit default swap (CDS) rates, we introduce a new way to perform event studies on debt.

To separate the effect of the Paulson Plan from that of other events occurring at the same time, we control for the change in the CDS rates of GE Capital, the largest non-bank financial company. This difference-in-difference approach estimates the total increase in debt value due to the plan at $119 bn. If we add to these changes the abnormal variation in the market value of common equity (−$2.8 bn) and of preferred equity (+$6.7 bn), we obtain that the enterprise value of the ten banks involved in the first phase of the plan increased by $128 bn. If we add the value increase in the derivative liabilities, we come to a total increase of $130 bn.

This increase, however, came at a cost to the taxpayers. By computing the value of the preferred equity and the warrants the government will receive in exchange for the $125 bn investment, we obtain an estimate between $89 and $112 bn. Hence, the preferred equity infusion costs taxpayers between $13 and $36 bn. We also estimate the cost of the debt guarantee extended by the FDIC on all the new bank debt to be worth $11 bn. Adding of the extended guarantee on non-interest-bearing deposits and subtracting the reduction in the value of the FDIC deposit guarantee brings the total taxpayers' cost at between $21 and $44 bn.

Therefore, the plan had two effects: it transferred between $21 and $44 bn from taxpayers to the nine largest banks, but in so doing it created between $86 and $109 billion in value. Even if we account for a 30% deadweight cost of taxation (see Ballard, Shoven, and Whalley, 1985; Feldstein, 1999), the plan created between $73 and $91 bn in value. Where does this added value come from? What frictions did the plan help to resolve? Who are the main beneficiaries of the plan?

To address these questions we exploit the (very small) cross section of results at our disposition. We find that the bulk of the value added stems from the banks that were more at risk of a run. For each bank, we compute a "bank run" index, which measures the difference between the (risk-neutral) probability of default in the year immediately following and the (risk-neutral) probability of default between year one and year two, conditional on surviving at the end of year one. This index is higher when a bank is subject to a run.

We find a very high correlation (96%) between the ex ante value of the bank run index and the percentage increase in a bank enterprise value at the announcement of the plan. The big beneficiaries of the intervention were the three former investment banks and Citigroup, while the loser was JP Morgan whose total asset value decreased even before factoring in the cost of the Paulson Plan. This result is not so paradoxical. In spite of the benefits of the Paulson Plan, banks might lose value because their participation provides a negative signal to the market about the true value of the assets in place, because the future government interference in banks' affairs reduces value, or because intervention has redistributive effects across banks.

Since all the major banks were "forced" to participate by a very strong arm-twisting exercised by Treasury Secretary Paulson, it is unlikely that participation might signal any inside information about the value of the assets in place. A more realistic interpretation is that the government intervention has two conflicting effects: a negative one linked to the government's future interference in banks' affairs, and a positive one, associated with the reduction in the probability of bankruptcy and hence, the expected cost of bankruptcy. Exploiting the firm variation in this latter probability, we estimate that the expected cost of government interference is about 2.5% of enterprise value, while the cost of bankruptcy is about 22% of enterprise value.

Given the extreme volatility of markets during this period, one may wonder whether the observed outcome represents a fair assessment of the intervention's effects. For this reason, we evaluate the plan on an ex ante basis by using the standard Black and Scholes (1973) and Merton (1974) models of equity as an option on the value of the underlying assets. When we keep the assets' value constant (i.e., the intervention neither creates nor destroys any value), the model grossly underestimates the market response. According to the model, the shareholders should have lost $25 bn and instead lost only $3 bn. The debt holders should have gained $49 bn and instead gain $119 bn. To bridge this difference we need to hypothesize an increase in the value of the underlying assets. It is only if we assume an increase in the value of assets of $113 bn that the model can approximate well the actual changes in the value of debt and equity. This alternative method confirms the magnitude of the asset increase.

Finally, we try to evaluate whether the same objective achieved by the plan could have been obtained at a lower cost to taxpayers. If the main goal was to make banks solvent, we assume that the objective is to achieve a reduction in the CDS rates equivalent to the one observed in the data after the plan. We analyze four alternative plans: the original Paulson Plan where banks' assets were purchased at market value, the original Paulson Plan with banks' assets purchased above market (we assume 20% above), a British-style equity infusion without any debt guarantee, and a debt-for-equity swap. We rate these alternatives on the basis of up-front investment required by the government, taxpayers' expected cost, taxpayers' value at risk, and government ownership of banks. While inferior to a debt-for-equity swap, the Revised Paulson Plan appears superior to the other strategies. The approach followed by the Paulson Plan, however, did not require a redistribution of between $21 and $44 bn from taxpayers to banks: the government could have charged more for both the equity infusion and the debt guarantee as Warren Buffett did when he invested in Goldman Sachs three weeks before the Paulson Plan.

The rest of the paper proceeds as follows. Section 2 describes the 2008 financial crisis and discusses the potential reasons for a government intervention. It also describes the details of the plan announced by the US Treasury and FDIC on October 13, 2008. Section 3 analyzes the effect of the plan on the prices of the bonds, the common equity, and the preferred equity. Section 4 computes the net cost of the preferred equity infusion and the debt guarantee. Section 5 analyzes the plan from an ex ante point of view. Section 6 studies the cost of alternative plans that would have achieved the same objective. Conclusions follow.

2. The 2008 financial crisis and rationale of government intervention

2.1. Government response to the crisis and the Revised Paulson Plan

On Friday, October 3, 2008 the US Treasury Secretary Hank Paulson obtained Congressional approval to buy distressed assets for a total of US$ 700 bn, but this plan failed to reassure investors about the solvability of the banking sector. The following week the US stock market had its worst week ever with a negative return of 18%. All the world exchanges followed suit.

During the weekend of October 11–12, British Prime Minister Gordon Brown announced his own stabilization plan, which included an injection of government money in the capital of troubled banks and a guarantee on the new debt issued by banks. On Monday, October 13, 2008, the US Treasury, the Federal Reserve, and the FDIC jointly announced the government decision to follow the British Prime Minister's footsteps. That day, the chief executive officers (CEOs) of the main nine banks were called for a meeting in Washington and briefed on the government plan. According to a *New York Times* article, the CEOs were taken by complete surprise and were coaxed into accepting the deal (Landler and Dash, 2008). Since this is the only component of the plan that arrived to the market as a surprise, we limit our analysis to the effect of this Revised Paulson Plan.[2]

Paulson's revised plan, summarized in Table 1, has three parts. First, the government injects $125 billion preferred equity investment in the nine largest US commercial banks (ten including Wachovia which has accepted an offer to be purchased by Wells Fargo). In this broad category, we also include the three surviving investment banks that either filed to become commercial banks (Goldman Sachs and Morgan Stanley) or are merging with a commercial bank (Merrill Lynch). In exchange for this preferred equity infusion, the government receives an amount of preferred equity with a nominal value equal to the amount invested. This preferred equity pays a dividend of 5% for the first five years and 9% after that. In addition, the government receives a warrant for an amount equal to 15% of the value of the preferred equity infusion with a strike price equal to the average price of the stock in the 20 working days before the money is actually invested.

The second part of the plan, contextually announced by the Federal Deposit Insurance Corporation, includes a three-year government guarantee for all new issues of unsecured bank debt until June 30, 2009.[3] The FDIC guarantee is for a maximum of 125% of the sum of the unsecured short-term debt and long-term debt maturing between then and June 2009. To provide this guarantee, the FDIC will charge a fee. When the program was first announced (on October 14, 2008) this fee was set at 75 basis points (bps). On November 12, it was changed and differentiated according to the maturity of the debt. Since we want to calculate the value at the announcement, we will use the 75 bps for all the maturities in our calculations. The last column of Table 1 approximates the maximum amount of guaranteed debt that could be issued by summing all the unsecured short-term debt plus half of the long-term debt maturing in 2009.

The third part is an extension of the FDIC deposit insurance to all the non-interest-bearing deposits. While on October 3, 2008, the FDIC had increased deposit insurance from $100,000 to $250,000 per depositor, as part of the Temporary Liquidity Guarantee Program announced October 14, the FDIC provided for a temporary full guarantee for funds held at FDIC-insured depository institutions in non-interest-bearing transaction accounts above the existing deposit insurance limit. While we do not have the exact amount of these accounts, we can approximate it by looking at the amount of non-interest-bearing accounts (column 2 of Table 2) and the percentage of insured deposits (column 3 of Table 2), as reported in the bank call reports for September 2008.[4]

Table 2, Panel A reports other relevant information about the capital structure of these banks before the announced deal, and Table 2, Panel B provides some key market value information about these banks.

2.2. Rationale for government intervention

From an economic point of view, there are two reasons why the government intervention could create value. The first one is that the banking system was subjected to a run. To run were not the depositors, as in traditional bank runs, but short-term creditors, who refused to roll-over their short-term lending (Gorton and Metrick, 2009). Since bank runs can be inefficient (Diamond and Dybvig, 1983), stopping a bank run can create value.

Was there a bank run in early October 2008? We can partly answer this question by looking at the behavior of credit default swap rates. The credit default swap (CDS) is a contract that in case of default by the referenced entity, provides the buyer with the opportunity to exchange the defaulted debt with an amount of cash equal to the face value of that debt minus any amount recovered from the defaulted security. In other words, a credit default swap is

[2] In particular, our analysis cannot capture the effects of the other interventions under the Trouble Asset Relief Program (TARP), such as the AIG bailout, the investments in the automotive companies, etc.

[3] For more information, see http://www.fdic.gov/news/news/press/2008/pr08100b.html.

[4] These reports are available online at http://www2.fdic.gov/idasp/main.asp.

Table 1
The Revised Paulson Plan.

Equity infusion is the amount of money (in billions of US$) the government will invest in each of these banks according to the Revised Paulson Plan. The price is the market value of common equity stock at closing on 10/14/2008. The number of shares (in billions) are as of 9/30/2008 as from the latest company filings. The number of warrants is 15% of the equity infusion divided by the price of common stock on 10/14/2008. The dilution factor, which is used to price the warrants, equal $1/(1+m/n)$, where m is the number of warrants and n the number of shares. The amount of guaranteed debt is 125% of the sum of the short-term debt plus the long-term debt maturing before 6/30/2009.

	Equity infusion	Price 10/14/2008	No. of outstanding shares	No. of warrants	Dilution factor	Guaranteed debt
Citigroup	25	18.62	5.45	0.20	0.96	127.3
Bank of America	15	26.53	5.02	0.08	0.98	182.3
JP Morgan Chase	25	40.71	3.73	0.09	0.98	277.9
Wachovia	5	6.31	2.15	0.12	0.95	15.8
Wells Fargo	20	33.52	3.32	0.09	0.97	76.0
Bank of NY Mellon	3	34.76	1.15	0.01	0.99	3.6
State Street Corp	2	56.69	0.44	0.01	0.99	5.4
Goldman Sachs	10	122.9	0.43	0.01	0.97	80.9
Morgan Stanley	10	21.94	1.11	0.07	0.94	17.8
Merrill Lynch	10	18.24	1.60	0.08	0.95	32.1
Total	125.0					819.1

(a) Mkt. price of the participating institution's common stock at the time of issuance, calculated on a 20-trading day trailing average (http://www.treas.gov/press/releases/hp1207.htm).
(b) Aggregate market price=15% equity infusion (http://www.treas.gov/press/releases/hp1207.htm).

an insurance against the risk of default. The party obtaining insurance pays a quarterly premium, called the CDS rate, which is quoted as basis points of premium per year per notional amount of $100. CDS rates are generally available for all the maturities between one and five years.

Since the one-year CDS reflects the probability of default this year, while the two-year CDS reflects the average probability of default over the next two years etc., the term structure of CDS rates can be used to obtain the conditional probability of default in any given year.

We obtain CDS rates data from Datastream (see Fig. 1). Appendix A contains the details of the bootstrap procedure used to obtain the probabilities of default. In particular, we compute the following conditional (risk-neutral) probability:

$$P(n) = Prob(Default\ in\ year\ n | No\ Default\ before\ year\ n). \quad (1)$$

In a normal environment the conditional probability of bankruptcy in any given year is increasing over time, since the variance in assets' value is increasing over time. An exception is when a bank is facing the risk of a run. If today an otherwise solvent bank faces the risk of a run, its probability of bankruptcy in the near term would be much higher than the probability of bankruptcy in the future, conditional on surviving this year. If a bank run is likely, then we should find $P(1) > P(2)$, as it is more likely that default occurs in the short-term than in the longer-term, conditional on surviving. Conversely, if $P(1) < P(2)$, then it is unlikely that a bank is subject to a bank run. We therefore compute the bank run index as

$$R = P(1) - P(2) \quad (3)$$

to gauge whether a bank is at risk of a run.[5] We compute the bank run index for the banks that are the first recipients of government funding, namely, the nine largest commercial banks (ten with Wachovia), including in this category also the three investment banks that either filed to become commercial banks or were going to merge with one. Unfortunately, CDS data on State Street and Bank of NY Mellon are not available.

Fig. 2 shows the time series of these indices for the eight banks. The vertical dotted line corresponds to October 10, 2008, the Friday before the government announcement of the Revised Paulson Plan. As can be seen, on October 10, 2008, Citigroup, Wachovia, and the three investment banks had a positive bank run index R, an indication that potentially a bank run was indeed taking place on them. It is interesting to note that before Lehman's bankruptcy on September 15, 2008, only two banks, Morgan Stanley and Merrill Lynch, displayed a positive index R. At the time of Lehman Brothers Bankruptcy, Goldman Sachs bank run index R also turned positive, and a few weeks later Citigroup's did, while the other commercial banks' indices remained unchanged.

If the main source of inefficiency is the risk of a bank run, then a government intervention that reduces the risk of a run should mainly benefit the banks at risk of a run. In other words, at the announcement of the government intervention, banks with a positive bank run index should experience an increase in the value of their assets that far exceeds the subsidy, while banks with a negative index should not.

Alternatively, the inefficiency could arise from banks being excessively levered and thus, unable to exploit future investment opportunities.[6] If this is the case, a

[5] While a bank run is a sufficient condition to have $P(1) > P(2)$, it is not a necessary one. Other reasons could make the bank more risky in the short- than in the long-term. Hence, the bank run index should be interpreted only as a proxy of the probability of a run and not as an exact measure.

[6] As it is known since Myers (1977), if a firm is burdened by a large (risky) debt, then an equity infusion provides a safety cushion to debt in those states of the world in which it would not have been paid in full. As a result, the value of risky debt goes up when new equity is raised. This transfer of value, which is also known in the literature as debt overhang or co-insurance effect, is what makes it so unattractive for equity holders to raise new equity. If banks need to raise private capital to extend new loans, they may be prevented because private equity holders refuse to provide the capital. Thus, banks may pass up on positive Net Present Value (NPV) projects, losing value.

Table 2

Main data on banks targeted by the Revised Paulson Plan.

Panel A reports balance sheet information for the banks targeted by the first phase of the plan. The information comes from the banks' 10Q filing as of 09/30/2008 (except Goldman Sachs and Morgan Stanley, whose data are as of 08/31/2008), which were the latest available on 10/10/2008. The data for the end of the third quarter are very similar. All figures in billions of US$. Panel B report some additional market information used in the analysis. Market capitalization is in billions of US$. The implied volatility is extracted from at-the-money call options on 10/10/2008 with the longest maturity available. Actual volatility is the annualized daily standard deviation of daily returns estimated during the period July–September 2008. The preferred yield is computed using the most recent preferred issue by each company that is trading. Dividend per share is obtained multiplying the last quarterly dividend times four. Maturity is the average maturity (in years) of the long-term debt outstanding. Coupon is the average coupon (in % terms) of the long-term debt outstanding.

Panel A: Balance sheet data

	Deposits			Short-term debt		Long-term debt	Other liabilities	Total liabilities	Equity	Total assets
	Total	Non-interest bearing	Percent insured	Total	Unsecured					
Citigroup	780.3	108.0	47.4	352.3	101.9	396.1	395.7	1,924.4	126.1	2,050.5
Bank of America	874.1	204.5	62.9	371.5	145.8	257.7	166.8	1,670.1	161.0	1,831.2
JP Morgan Chase	959.8	203.0	37.4	446.4	222.3	255.4	434.0	2,105.6	145.8	2,251.0
Wachovia	389.5	57.5	66.9	58.2	12.7	183.8	90.2	721.7	70.2	791.9
Wells Fargo	339.1	89.4	64.2	86.1	60.8	103.9	31.9	561.1	48.0	609.1
Bank of NY Mellon	174.2	81.7	3.1	20.3	2.9	15.5	30.0	240.0	27.5	267.5
State Street Corp	150.9	70.0	0.6	100.2	4.3	4.1	17.3	272.5	13.1	285.6
Goldman Sachs	29.1	0.0	14.3	443.5	64.7	176.4	387.2	1,036.2	45.6	1,081.8
Morgan Stanley	36.8	0.0	81.6	193.7	14.2	202.3	518.8	951.6	34.5	986.1
Merrill Lynch	90.0	0.0	85.3	242.9	25.7	232.5	272.0	837.4	38.4	875.8
Total	3,834			2,315		1,828	2,344	10,321	710	11,030

Panel B: Other market information

	Mkt. cap 10/14/08	Implied volatility	Actual volatility	Preferred yields	Dividends per share	Average maturity	Average coupon
Citigroup	101.5	77.59%	170.78%	12.46%	1.28	8.0	4.17
Bank of America	133.1	77.75%	193.52%	8.83%	2.56	8.6	3.66
JP Morgan Chase	151.7	57.37%	152.34%	8.84%	1.52	6.8	3.69
Wachovia	13.6	79.08%	696.48%	11.33%	0.20	7.1	3.57
Wells Fargo	111.3	56.48%	125.54%	8.73%	1.36	6.3	4.47
Bank of NY Mellon	40.0	85.79%	177.78%	8.16%	0.96	7.6	5.41
State Street Corp	24.7	67.00%	166.84%	7.25%	0.96	7.2	2.65
Goldman Sachs (a)	52.6	67.73%	90.50%	7.79%	1.40	7.2	4.93
Morgan Stanley (a)	24.3	88.57%	151.25%	11.16%	1.08	5.4	4.71
Merrill Lynch	29.2	82.23%	177.94%	11.55%	1.40	4.9	3.26
Average	68.2	73.96%	210.29%	9.61%	1.27	6.9	4.05
Total	681.9						

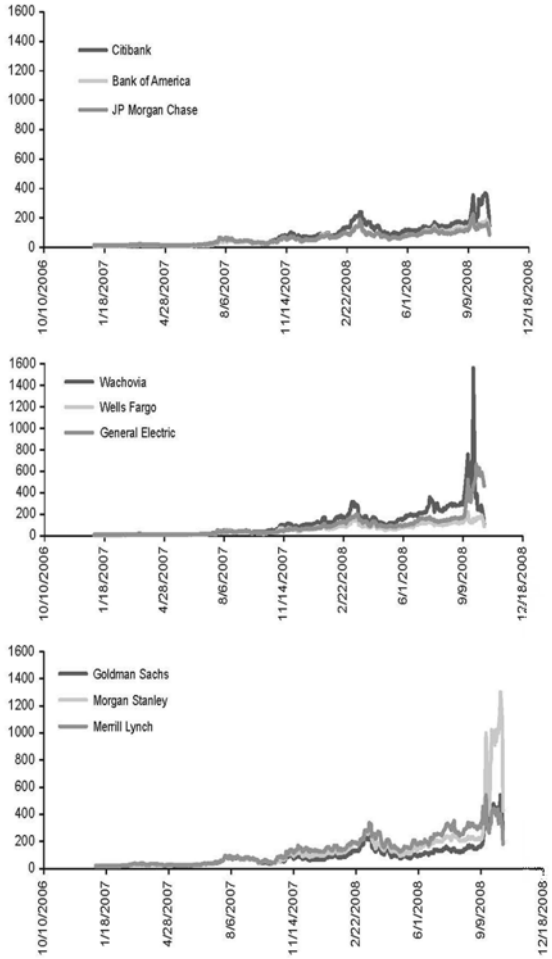

Fig. 1. CDS rates. All the rates are in basis points per year. *Source*: Datastream.

government intervention that injects new capital in banks would prevent this loss in valuable investment opportunities. If the banking sector were perfectly competitive, the entire value saved would accrue to the companies receiving the financing. But if the banking sector were perfectly competitive, then the loss of a few banks would have no negative consequences in the economy, because the others would step in to provide the financing with no friction. Hence, if debt overhang is the main inefficiency that the government intervention is meant to solve, then we should find that the change in the enterprise value of the bank exceeds the taxpayers' cost of the rescue.

A government intervention can have negative effects too. First, the government can impose restrictions on banks' decisions (for example, executive compensation or

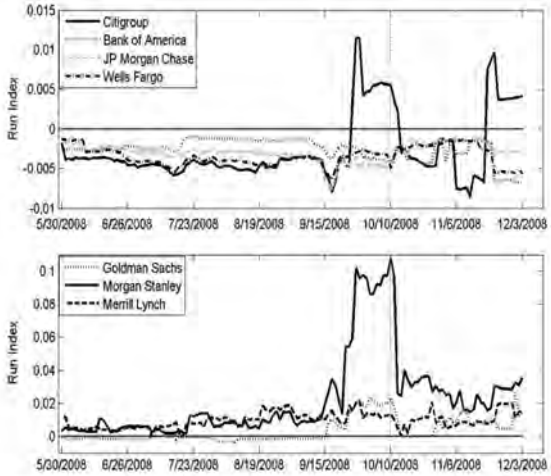

Fig. 2. The Bank Run Index. The figure plots the difference $R_t = P_t(1) - P_t(2)$, where $P_t(n)$ is the conditional probability of default in year n after t, conditional on not defaulting before n. These conditional probabilities are inferred from the term structure of CDS rates.

lending requirements) that reduce a bank's profit. Second, the government can introduce political criteria into the lending decisions, reducing a bank's profitability (Sapienza, 2004). Finally, the government intervention can delay or block the natural transfers of assets to the more efficient managers, reducing the overall profitability of the banking industry. The first and second effects are more likely to be present in banks where government ownership becomes larger, while the third one is likely to manifest itself in the price of the better-run banks, which will be prevented from taking advantage of the acquisition opportunities.

3. Effect of the plan announcement on the value of the banks' financial claims

In this section, we test the effectiveness of the government intervention through an event study analysis. An event study is unable to measure the systemic effect of the government intervention, as such an effect is commingled with many other events taking place at the same time. Therefore, we will be able to estimate only the differential impact of the government intervention on the banking sector compared to the rest of the economy: If the source of the inefficiency is debt overhang or a bank run, we should find evidence that the banking sector is, in fact, the main beneficiary of the government help. If we do not find such a differential effect, however, then we should conclude that the main effect has been to stave off a panic or a systemic event unrelated to the banking sector.

Event studies have generally focused on the changes in the market value of equity since the value of equity, which is a residual claim, is most sensitive to information and/or decisions. However, when a company is highly levered (as banks are), bond prices are also very sensitive to the value of the underlying assets. Unfortunately, bond prices are generally not very liquid and, generally, it is very difficult to undertake a proper event study on the value of debt. However, the development of the credit default swap market has made such a study possible.

3.1. An event study on bonds

The market for CDSs, barely existing in 1999, reached more than $57 trillion of notional amount by June 2008. Given the high volume, this market provides a reliable measure of the changes in the value of debt, much more reliable than the sparse quote on bonds. In fact, the availability of daily CDS rates opens the possibilities of systematic event studies on bonds and so on the entire value of the enterprise. In what follows we outline how.

3.1.1. Methodology

If a debt becomes less risky, it appreciates in value. When we cannot observe this appreciation directly, we can measure it by looking at the reduced cost of insuring this debt with a CDS. This cost will go down since a reduction in the risk of default translates into a reduction in the CDS rates. If we ignore the counterparty risk, the market value of a bond (B) plus the present value of the cost of insuring it with the CDSs equals the value of a

government bond (GB) with similar rate and maturity, or[7]

$$B + PV(Insurance\ Cost) = GB \tag{4}$$

The present value of the insurance cost can be obtained as the discounted value of the cost of insuring the existing debt (as measured by the CDS rate) in each year t (from today to the maturity of the longest maturity bond) multiplied by the probability the company did not default up to year t times the amount of existing debt $D(t)$ that will not have matured by year t:

$$PV(Insurance\ Cost) = \sum_{t=0}^{T} \frac{CDS(t)}{10000} D(t) Q(t) Z(t), \tag{5}$$

where $Z(t)$ is the risk-free discount factor, and $Q(t)$ is the risk-neutral probability of not defaulting up to time t, obtained in Eq. (A.2) in Appendix A.

A decline in the risk of a bond not triggered by a change in the bond's rate and/or maturity should not affect the value of its corresponding government bond.[8] Since the right-hand side of (4) remains constant, an increase in the value of B due to a reduction in risk translates into an equivalent reduction in the present value of the insurance cost

$$\Delta B = -\Delta PV(CDS)$$

with

$$\Delta PV(CDS) = \sum_{t=0}^{T} \frac{CDS_1(t)}{10000} D(t) Q_1(t) Z(t) - \sum_{t=0}^{T} \frac{CDS_0(t)}{10000} D(t) Q_0(t) Z(t), \tag{6}$$

where the index 1 indicates after the fact and the index 0 before the fact.

3.1.2. Application

We obtain from Datastream CDS rates for contracts up to five years for all banks, except for the two smallest banks, Bank of New York and State Street, for which CDS contracts are unavailable. Given the small amount of outstanding debt these two banks have, we can ignore them without much of an effect on the results. Fig. 1 plots the five-year CDS rates for the eight banks for which they are available from January 1, 2007 to October 14, 2008.

To gauge the magnitudes of the change, we report the five-year CDS rates for the relevant dates in Table 3. The risk-neutral probabilities of no default $Q(t)$, computed in Appendix A, depend on an assumption about recovery rate. We report our results for an intermediate value, 20%.[9] Since this choice is somewhat arbitrary, Section 4.6 discusses the robustness of our conclusion to various assumptions, including larger or smaller recovery rates.

To measure the changes in the value of the debt surrounding the announcement of the new Paulson Plan, we look at the changes in CDS rates between Friday, October 10 and Tuesday, October 14 (see Table 3). We then apply formula (6) to estimate the change in value of debt.

There are, however, two problems in using the raw variation in CDS rates to measure the effect of the plan. First, this variation reflects only the additional value of the revised plan vis-à-vis the old one. Given the vague description of the original troubled asset purchase plan, the poor market response (the week of October 3 through October 10 had the worst performance on record), we are not too worried about this problem. Nevertheless, we should interpret all the results as differential impacts.

The second problem is that a lot of things changed during the weekend October 11–12, including the rescue organized by the Europeans. At the same time, several bad events did not happen. For example, a feared international ban on short-sales that was rumored to be introduced at the G-8 meeting during the weekend did not occur. Since CDSs are an alternative to short-sales to bet on the value of a company falling, the fear of a ban on short-sales could have artificially pushed up CDS rates before the weekend.

To identify the impact that other factors could have had on the CDS rates of financial firms we look at the CDS rates of the largest financial firm not involved in the intervention: GE Capital. Interestingly, the five-year CDS rate of GE Capital dropped from 590 to 466 basis points over those two trading days. Since at the announcement of the plan, the government did not intervene on GE Capital, we can use this change as a control for all the other events that occurred during the weekend including possible systemic effects of the plan. Eventually, however, the same conditions offered to banks were extended to GE too. If the market anticipated (at least with positive probability) this possibility, then GE would not be a good control. For this reason, in Section 4.6 we test the robustness of our results to using a CDX index.[10]

To isolate the effect of the Paulson strategy itself, we apply the same methodology widely used to correct for market movements in event studies on stocks. In particular, for each bank we subtract from the raw change in insurance cost given in expression (6) the percentage change in insurance costs of GE Capital (our control) multiplied by the ex ante cost of insurance of the bank:

$$Adjusted\ \Delta PV(CDS) = \Delta PV(CDS) - PV_0(CDS) \times \frac{\Delta PV^{GE}(CDS)}{PV_0^{GE}(CDS)} \tag{7}$$

The results are in column 6 of Table 3. Overall, the bonds gained $124 bn in value. The bonds of the three old investments banks gained the most from the plan. The adjusted

[7] Eq. (4) represents an arbitrage-free condition that holds in general, but during the fall of 2008 many basic arbitrage conditions were violated and this was no exception. It is our understanding that the violations were due to the illiquidity of the corporate bond market and not of the CDS market. Nevertheless, for our exercise to hold, we do not need this condition to hold precisely, but only that the magnitude of the deviation did not change (or did not change much) over the two days we consider.

[8] Our calculations are predicated upon the fact that the price of government bonds did not change during the event windows. In fact, the one-year CDS rate on US government bonds dropped from 21.3 to 18.5 bps, while the five-year CDS rated dropped from 33 to 28.7 bps. Since this corresponds to a (slight) increase in the government bonds, ignoring it has the effect of underestimating the increase in market value produced by the Paulson Plan.

[9] The historical average recovery rate of bonds is about 40%, but it declines to about 20% during recessions (see, e.g., Chen, to appear).

[10] Ignoring the possible effect of the plan on GE will underestimate the effects of the plan. Given the strong positive effect, our main results would be unchanged.

Table 3
Change in the value of long-term debt around the announcement of the Revised Paulson Plan.

CDS rates refer to a five-year debt instrument and are expressed in basis points per year. The source is Bloomberg. The adjusted gain is the present value of the reduction in insurance costs paid on all the debt outstanding, with the actual structure of maturity, as a result of a drop in the CDS rates, adjusted for the percentage reduction in GE cost. As a discount rate we use 3.9%. The debt and the adjusted gain data are in billions of US$.

	Five-year CDS spread 10/10/08	Five-year CDS spread 10/14/08	Raw decline	Long-term debt			Net derivative payables		
				LT debt	GE adj. gain	CDX adj. gain	Amount net deriv.	GE adj. gain	CDX adj. gain
Citigroup	341.7	144.6	197.1	396.1	21.4	23.9	103.4	3.6	3.9
Bank of America	186.2	99.2	87.0	257.7	4.2	5.1	26.5	0.3	0.3
JP Morgan Chase	162.5	88.0	74.5	255.4	3.6	4.2	85.8	0.8	0.9
Wachovia	267.5	109.2	158.3	183.8	7.5	8.4	13.4	0.4	0.4
Wells Fargo	186.7	89.8	96.9	103.9	1.6	1.8	10.8	0.1	0.1
Bank of NY Mellon				15.5					
State Street Corp				4.1					
Goldman Sachs	540.0	201.7	338.3	176.4	17.6	19.0	103.9	6.7	7.1
Morgan Stanley	1300.9	427.1	873.8	202.3	51.6	54.4	68.4	11.8	12.5
Merrill Lynch	398.3	182.5	215.8	232.5	13.0	14.3	55.6	2.6	2.8
General Electric Capital	590.0	465.8	124.2						
CDX Index	213.0	176.8	36.2						
Total				1,828	120.5	131.3	467.8	26.3	28.0

gains of the three were $87 bn. Among the old commercial banks, Citigroup stood to gain the most, both in level, $21 bn, and in percentage of outstanding debt, 5.3%.

3.2. An event study on common stock

Table 4, Panel A reports the results of a standard event study on the value of common stock around the announcement of the Revised Paulson Plan. Like the bond prices, we use the period from Friday, October 10 to Tuesday, October 14 as the event window. During that period the market rose by 11%, while the stock of the companies involved in the plan rose by 34%. This might seem a huge difference, but we need to compute the beta of each of these securities since the equity betas of firms close to default can be very high. In fact, when we estimate the beta of the common stock of these banks by using the daily return from January 1, 2007 to October 9, 2008, we obtain on average a beta of 2.2. Our estimates are reported in the second column of Table 4.

When we market-adjust these changes, the average return over the event period drops to 10%, with huge variation: from −24% of Wachovia to a +103% return of Morgan Stanley. Once again, the return on Morgan Stanley could be the effect of the announcement of the finalization of the Mitsubishi investment. It is important to keep in mind, though, that ignoring the impact of this news has the effect of overestimating the benefits of the Paulson Plan.

We obtain the value added to common equity by the plan when we multiply the abnormal return and the market capitalization as of Friday, October 10th. If we adjust the individual stock movement for the market movement by using the actual beta, we learn that overall, banks' shareholders do not benefit from the plan (−$2.8 bn). There is, however, a wide variation. While JP Morgan shareholders lose $34 bn, Morgan Stanley's gain $11 bn, while Citigroup and Goldman shareholders gained roughly $8 bn each.

3.3. An event study on preferred equity

We perform a similar analysis for the preferred equity. Given the amount of preferred outstanding, these numbers will not change the overall results. Nevertheless, it is useful to add this piece of information.

The biggest problem in performing this event study is the definition of the preferred. Several of these firms have different classes of preferred and not all these classes are traded. Hence, as a reference price for all the preferred shares outstanding we choose the most recently issued preferred that is actively traded. The numbers and the results are presented in Table 4, Panel B.

All the preferred increased in price by +36%, well above the market return of +11%. To compute excess returns, we estimate the beta of each preferred stock using the daily returns from January 1, 2007 to October 9, 2008.[11] The results are reported in Table 4, Panel B. Once these differences are accounted for, the preferred increased in value at the announcement of the plan by $6.7 bn.

3.4. Other claims

We have only computed the change in value of debt and equity claims, but we have not computed the changes in the value of the other liabilities. In particular, we know that there is a dense network of positions in derivative contracts and credit default swaps, whose value depends

[11] In a few cases, the span is shorter because we could not find any preferred traded on Bloomberg.

Table 4

Change in the value of equity around the announcement of the Revised Paulson Plan.

Panel A refers to common equity, while Panel B to preferred equity. The market capitalization is price per share on 10/10/2008 times the number of shares outstanding. The betas are estimated from daily stock prices during the period 1/1/07–10/9/08. The daily prices are from Bloomberg. As a price for the preferred equity we use the most recently issued preferred of each company, assuming that all preferred of each bank have the same characteristics. The abnormal return equals raw return − beta×market return, where the market return (measures as S&P 500) increased by 11% over those two trading days. Value increase is the product of the initial market capitalization time the abnormal return. Market capitalizations and value increases are in billions of US$.

Panel A: Common equity

	Market cap 10/10/2008	Estimated beta	Raw return	Abnormal return		Value increase	
				Beta=1	Est. beta	Beta=1	Est. beta
Citigroup	76.89	1.97	0.32	0.21	0.10	16.1	7.9
Bank of America	104.71	2.08	0.27	0.16	0.04	16.9	4.4
JP Morgan Chase	155.19	1.77	−0.02	−0.13	−0.22	−20.5	−33.6
Wachovia	11.07	4.28	0.23	0.12	−0.24	1.3	−2.7
Wells Fargo	93.99	1.73	0.18	0.07	−0.01	7.0	−0.5
Bank of NY Mellon	30.48	1.85	0.31	0.20	0.11	6.2	3.3
State Street Corp	18.79	1.70	0.31	0.20	0.13	3.8	2.4
Goldman Sachs	38.01	1.60	0.38	0.27	0.21	10.4	7.9
Morgan Stanley	10.74	2.19	1.27	1.16	1.03	12.4	11.0
Merrill Lynch	25.20	2.47	0.16	0.05	−0.11	1.2	−2.8
Total	565.1					54.8	−2.8
Average		2.16	0.34	0.23	0.10		

Panel B: Preferred equity

	Market cap 10/10/2008	Estimated beta	Raw return	Abnormal return		Value increase	
				Beta=1	Est. beta	Beta=1	Est. beta
Citigroup	9.48	1.35	0.37	0.26	0.22	2.4	2.1
Bank of America	11.28	0.19	0.22	0.11	0.20	1.2	2.2
JP Morgan Chase	5.32	0.45	0.12	0.01	0.07	0.0	0.4
Wachovia	5.90	1.27	0.20	0.09	0.06	0.5	0.3
Wells Fargo	0.34	0.36	0.22	0.11	0.18	0.0	0.1
Bank of NY Mellon							
State Street Corp							
Goldman Sachs	0.74	0.50	0.21	0.10	0.15	0.1	0.1
Morgan Stanley	0.30	1.14	1.13	1.02	1.01	0.3	0.3
Merrill Lynch	4.50	1.03	0.39	0.28	0.28	1.3	1.2
Total	37.9					5.9	6.7
Average		0.79	0.36	0.25	0.27		

upon the counterparty value and hence, it is affected by the Paulson Plan. While this is certainly true, it might only impact our conclusions as far as we look at individual companies, but it can hardly impact our overall conclusions. The reason is that the vast majority of these contracts are within the group of these ten banks. Indeed, recently released Depository Trust and Clearing Corporation (DTCC) data show that about 90% of the transactions on credit derivatives are between security dealers. Since we focus on the ten largest banks, they must account for most of the transactions.[12] In addition, a 2007 International Swaps and Derivatives (ISDA) survey on Counterparty Risk Concentration – carried out before the current crisis – found that inter-dealer exposures are modest, as among the top ten dealers, almost 100% of derivatives are covered by Credit Support Annexes, which establish guidelines for credit risk mitigation. The same survey also shows that among the top ten dealers, collateralization in derivative transactions reduces the risk exposure of about 80% from their five largest counterparties. Although we do not have aggregate numbers and self-reported survey results should be taken with a degree of suspicion, these findings do suggest that derivative transactions are highly collateralized, and mainly taking place among the largest security dealers.

While the results above suggest that the impact on the aggregate results from including other liabilities should be modest, we nonetheless quantify the gain from counterparty exposure as follows: first, from the balance sheet we obtain the net liability position from derivative securities. Second, we impute the maturity of these derivative positions from the Bank for International Settlement tables, which report the average maturity of various over-the-counter (OTC) derivatives. Finally, we treat these liabilities as "debt" and use the same methodology illustrated in Section 3.1 to compute the increase in value of these liabilities. The raw value of this computation is reported in the last column of Table 3.

When we follow this procedure, the total value of derivative liabilities increases by $26 billion at the announcement of the Paulson Plan. This amount grossly overestimates the impact of the plan on the net derivative liabilities, since collateralization reduces by 80% the actual exposure to counterparty risk. When we adjust for this the next value increase is only $5.2 billion. Section 4.6 discusses the robustness of our conclusions to variations in this assumption.

3.5. Overall increase in value

In Table 5, we compute the overall value increase due to the plan as the sum of the three most variable components on the right-hand side of the balance sheet. The market value of debt increased by $119 bn, the aggregate derivative liabilities by $5.5 bn, the market value of preferred by $6.7 bn, while the market value of equity dropped by $2.8 bn. Overall, the total value of financial claims in the top ten banks increased by $128 bn as a result of the plan.

This increase cannot be considered as the value added of the plan, since the government is deploying considerable resources to implement this plan. To assess the net aggregate effect of the revised plan, we need first to compute the cost taxpayers paid for it.

4. Taxpayer's cost and aggregate effects

4.1. Cost of the preferred equity infusion

On October 13, the government announced that it will invest $125 bn in the top ten banks. The $125 bn represents the size of the investment, not its costs, since the government receives in exchange some claims on the underlying companies. Thus, the actual cost is the difference between the amount invested and the value of those claims.

In order to calculate these claims – preferred equity and warrants – we need to make some assumptions. First, we assume that the preferred equity will be redeemed after five years, i.e., right before it starts to pay a 9% dividend. This assumption over-estimates the value of preferred equity because only firms whose cost of capital will be above 9% will choose not to redeem, but that would be bad news for the government, as it would receive 9% instead of a higher market value.

The second key assumption in the valuation of the government's claim is at what rate we discount the 5% dividend paid by the preferred in the first five years. Since there is room for disagreement we adopt two different approaches. In Table 6, Panel A we compute the present value of the preferred dividend by using the yield on existing preferred shares, as reported by Bloomberg. As discussed earlier, we use the data from the most recently issued preferred shares with available data. Instead, in Panel B we use a capital asset pricing model with the beta estimated from common stock.

Third, we compute the value of warrants as ten-year American options on the stocks, adjusted for the usual dilution adjustment (see Table 2, Panel A). In this calculation, we assume that dividend disbursement remains constant at its latest level. Given that the recent banking crisis did not spur banks to decrease dividend disbursement in the past year, assuming constant dividends seems plausible.[13] Note that Paulson's Plan forbids banks from increasing dividends without authorization from the Treasury only for the first three years. Thus, there is a serious risk that the banks will increase their dividends after that, reducing the value of the government's warrants. For this reason, we use two hypotheses. In Table 6, Panel A we use the actual maturity of the warrant (ten years). In Panel B we assume the effective maturity of three years, assuming that the banks'

[12] We do not consider here the effects of the funds given to AIG, which helped many foreign counterparties.

[13] Indeed, we think this assumption is in fact conservative, as it would be in the interest of banks to increase dividends after the three-year lock out, in order to decrease the value of outstanding warrants.

Table 5
Aggregate effects of the Revised Paulson Plan.

The changes in the value of common and preferred equity come respectively from Table 4a and b. The changes in the value of the debt and in net derivative payables come from Table 3. The total of change in derivative payables is equal to the sum of the individual components times 20%, to take into account collateralization and the fact that in aggregate most derivative transactions are between the large dealers. The total benefit is the sum of the three above components. The net cost of equity infusion comes from Table 6 and the net cost of the debt insurance from Table 7. The total cost is the sum of these two above components. The net benefit is the difference between the total benefit and the total cost. All figures are in billions of US$.

	Change in the value of common equity	Change in the value of preferred equity	Change in the value of debt	Change in value of derivative liabilities	Reduction in the cost of deposit insurance	Total	Net cost of equity infusion	Net cost of unsecured debt insurance	Cost of extended deposit guarantee	Total	Net benefit	% Net benefit
Citigroup	7.9	2.3	21.4	0.7	1.1	33.3	4.8	3.0	0.4	8.2	25.1	1.2%
Bank of America	4.4	2.2	4.2	0.1	0.3	11.3	1.2	0.2	0.0	1.4	9.8	0.5%
JP Morgan Chase	−33.6	0.4	3.6	0.2	0.2	−29.4	1.8	0.6	0.3	2.7	−32.1	−1.4%
Wachovia	−2.7	0.3	7.5	0.1	0.7	5.9	0.7	0.2	0.0	0.9	5.0	0.7%
Wells Fargo	−0.5	0.1	1.6	0.0	0.2	1.3	1.5	0.0	0.0	1.5	−0.1	0.0%
Bank of NY Mellon	3.3	0.0			0.0	3.3	0.1		0.0	0.1	3.3	1.2%
State Street Corp	2.4	0.0			0.0	2.4	0.0		0.0	0.0	2.4	0.8%
Goldman Sachs	7.9	0.1	17.6	1.3	0.0	27.0	0.1	3.5	0.0	3.6	23.3	2.1%
Morgan Stanley	11.0	0.3	51.6	2.4	0.8	66.0	1.4	2.1	0.0	3.5	62.5	6.4%
Merrill Lynch	−2.8	1.2	15.0	0.5	0.4	12.3	1.7	1.3	0.0	2.9	9.4	1.1%
Total (pessimistic case)	−2.8	6.7	120.5	5.3	3.7	133.3	35.8	10.8	0.7	47.3	86.0	0.8%
Total (oversight panel)	−2.8	6.7	120.5	5.3	3.7	133.3	28.4	10.8	0.7	39.9	93.4	0.8%
Total (optimistic case)	−2.8	6.7	120.5	5.3	3.7	133.3	13.2	10.8	0.7	24.8	108.6	1.0%
Without Morgan Stanley												
Total (pessimistic case)	−13.8	6.4	68.9	2.9	2.9	67.3	32.7	8.7	0.7	42.2	25.2	0.2%
Total (oversight panel)	−13.8	6.4	68.9	2.9	2.9	67.3	24.2	8.7	0.7	33.6	33.7	0.3%
Total (optimistic case)	−13.8	6.4	68.9	2.9	2.9	67.3	11.8	8.7	0.7	21.2	46.1	0.4%

shareholders will pay dividends so as to eliminate any gain for the government.

In both cases we value the warrants by using the implied volatility from at-the-money call options with the longest maturity available. The implied volatility is also reported in Table 2, Panel B.[14] In neither case do we price in the option banks have to buy back the warrant at an agreed "fair market" price. In so doing we are over-estimating the value of the warrant received by the government, since we are not pricing in the likely discount the government will grant when the banks want to buy the warrants back.[15]

Table 6, Panel A, which contains the most optimistic estimates of the value of the government's claim, estimates the value of the preferred at $101 bn and the value of the 15% of warrants at $10.5 bn, for a total value of $112 bn. By contrast, Panel B, which contains the most conservative estimates of the value of the government's claim, values the preferred at $82 bn and the value of the 15% of warrants at $7 bn, for a total value of $89 bn. Hence, depending on the estimates, the preferred equity infusion cost taxpayers between $13 and $36 bn.

Finally, we price these warrants assuming a constant volatility. With jumps and stochastic volatility, these long-maturity warrants could be substantially more valuable. Since this will only reduce the cost of the government intervention, it would only increase the size of the value created by the plan.[16]

The total values of the securities in Table 6 can be compared with the results of the February Oversight Report from the Congressional Oversight Panel, released on February 6, 2009. The international valuation firm Duff & Phelps was retained by the US government to assess the fair valuation of the securities obtained in exchange for the capital infusion. Although not all banks we analyze were included in the report, we can assess the difference in valuation on the common set of firms. Citigroup: $15.5 bn; Bank of America: $12.5 bn; JP Morgan Chase $20.6 bn; Wells Fargo plus Wachovia: $23.2 bn; Goldman Sachs: $7.5 bn; Morgan Stanley: $5.8 bn. These values

[14] The value of American options, both for exchange-traded and the warrants, is computed through a standard finite difference method.

[15] According to several reports (e.g. Beals, 2009), in several instances the government has been too accommodating. For example, Old National, the first one to repurchase the warrants, bought back warrants over $15 m-worth of shares for $1.2 m (Beals, 2009).

[16] On December 10, 2009, the warrants of JP Morgan were auctioned off. This provides us with a market test of our model. For this reason, we recomputed the model used in Table 6, Panel A with the data as of December 10, obtaining a value of the warrant equal to $944 million, which is higher than (but very close to) the valued fetched in the marketplace ($936 million).

Table 6
Shareholders' net gain from the government's equity infusion.

This table provides two estimates of the present value of the claims the government is receiving in exchange for the equity infusion. In Panel A the present value of the preferred is computed using the yield to maturity of the bonds and the warrant is assumed to have a maturity of ten years. In Panel B the present value of the preferred is computed using the CAPM beta, while the warrant is assumed to have an effective maturity of three years since it is not protected against the payment of dividend after that date. Finally, the Congressional Oversight Report provided valuation of the same claims for all of our banks, except Merrill Lynch, Bank of NY Mellon and State Street. We impute their values using the average difference between our valuation the Report valuation for the common set of banks. In addition, Wachovia and Wells Fargo are reported jointly in the Report, and we split their values according to the equity infusion percentage in the second column.

Panel A: Optimistic

		Our calculations				Congr. oversight report	
	Equity infusion	Theoretical value of preferred	Theoretical value of warrant	Total theoretical value claim	Difference	Total theoretical value claim	Difference
Citigroup	25	18.1	2.0	20.2	4.8	15.5	9.5
Bank of America	15	12.7	1.1	13.8	1.2	12.5	2.5
JP Morgan Chase	25	21.2	2.0	23.2	1.8	20.6	4.4
Wachovia	5	3.8	0.5	4.3	0.7	4.6	0.4
Wells Fargo	20	17.0	1.5	18.5	1.5	18.6	1.4
Bank of NY Mellon	3	2.6	0.3	2.9	0.1	2.6	0.4
State Street Corp	2	1.8	0.2	2.0	0.0	1.8	0.2
Goldman Sachs	10	8.9	1.0	9.9	0.1	7.5	2.5
Morgan Stanley	10	7.7	1.0	8.6	1.4	5.8	4.2
Merrill Lynch	10	7.5	0.8	8.3	1.7	7.2	2.8
Total	125.0	101.3	10.5	111.8	13.2	96.6	28.4

Panel B: Pessimistic

		Our calculations				Minimum between pessimistic and congr. oversight report	
	Equity infusion	Theoretical value of preferred	Theoretical value of warrant	Total theoretical value claim	Difference	Value claim	Difference
Citigroup	25	16.5	1.5	18.0	7.0	15.5	9.5
Bank of America	15	9.6	0.9	10.5	4.5	10.5	4.5
JP Morgan Chase	25	17.3	1.3	18.6	6.4	18.6	6.4
Wachovia	5	1.9	0.3	2.2	2.8	2.2	2.8
Wells Fargo	20	14.0	1.0	15.0	5.0	15.0	5.0
Bank of NY Mellon	3	2.0	0.2	2.3	0.7	2.3	0.7
State Street Corp	2	1.4	0.1	1.5	0.5	1.5	0.5
Goldman Sachs	10	7.2	0.6	7.9	2.1	7.5	2.5
Morgan Stanley	10	6.2	0.7	6.9	3.1	5.8	4.2
Merrill Lynch	10	5.8	0.6	6.4	3.6	6.4	3.6
Total	125.0	81.9	7.3	89.2	35.8	85.3	39.7

Table 7
Cost of the bank debt guarantee provided by the FDIC.

The CDS rates, in basis points, are for a three-year contract and are obtained from Datastream. All the balance sheet information is as of 09/30/08, apart from Goldman Sachs and Merrill Lynch whose values are as of 08/31/08. The total debt guaranteed is 125% of the short-term unsecured debt. The total cost of the Government guarantee is discounted value of the difference between the value of this guarantee (CDS rate times the value of the debt guaranteed) minus the cost to the banks (75 basis points times the value of the debt guarantee) over the period of the guarantee (the next three years). All values in billions of US$, exception made for the CDS rates.

	Debt insurance				Deposit insurance		
	Unsecured short-term debt	Three-year CDS spread 10/14/2008	Total guaranteed debt	Total cost of insurance	Uninsured non-int. bearing deposits	Total cost of insurance	Savings from deposit guarantee
Citigroup	101.9	155.9	127.3	3.0	56.8	0.39	1.1
Bank of America	145.8	79.1	182.3	0.2	75.9	0.03	0.3
JP Morgan Chase	222.3	82.3	277.9	0.6	127.1	0.28	0.2
Wachovia	12.7	117.3	15.9	0.2	19.1	0.00	0.7
Wells Fargo	60.8	74.1	76.0	0.0	32.1	0.00	0.2
Bank of NY Mellon	2.9		3.6				
State Street Corp	4.3		5.4				
Goldman Sachs	64.7	227.7	80.9	3.5	0.0	0.00	0.0
Morgan Stanley	14.2	490.3	17.8	2.1	0.0	0.00	0.8
Merrill Lynch	25.7	213.5	32.1	1.3	0.0	0.00	0.4
Total	655.3		819.1	10.8	310.8	0.7	3.7

mostly fit between our optimistic and pessimistic case, except for Citigroup and the two investment banks, whose values are even below our pessimistic estimates. Substituting these values into our optimistic case leads to a total cost of $28.4 bn, while substituting them into our pessimistic case leads to a total cost of $39.7 bn. These findings lend support to our pricing methodology.

4.2. Cost of the debt guarantee

The FDIC offered a government guarantee to all new issues of unsecured bank debt until June 2009 for three years.[17] To measure the ex ante cost of this guarantee, we will make use once again of the CDS rates, albeit this time the three-year maturity CDS since the guarantee is a three-year one.

Thanks to this FDIC guarantee, the nine (plus one) banks can issue unsecured debt guaranteed by the government. Thus, it is as if they save the cost of insuring their own new debt issues for three years. The rate the FDIC charges for this is 75 basis points. Since this guarantee is limited to 125% of the existing unsecured short-term debt plus the long-term debt maturing up to June 2009, in Table 7, we compute the maximum amount of guaranteed debt that can be issued and multiply it by CDS rates minus the 75 basis points. This is the annual cost, which discounted over the three years using the Treasury discount curve leads to $11 bn. The biggest beneficiaries of this guarantee are Goldman Sachs, $3.5 bn; Citigroup $3 bn; and Morgan Stanley $2.1 bn.

Some might argue that this is a hypothetical cost. If none of these banks fail, the realized cost of this guarantee will be zero (in fact, negative, since the banks pay a fee to insure themselves). Yet, if an option ends up expiring out-of-the-money, it does not imply that the ex ante value of that option is zero nor that the firm underwriting it does not pay any cost. In fact, our Value-at-Risk calculation in Section 6 shows it is quite likely the government will be called to guarantee the debt of some banks.

4.3. The cost of the extended guarantee on uninsured transactional accounts

For completeness, we try to calculate the value of the extended insurance on the non-interest-bearing accounts. To estimate the amount of non-interest-bearing accounts that were uninsured as of October 12, we take the total amount of non-interest-bearing accounts as of September 30, 2008 from the call report and multiply it by the percentage of uninsured deposits (also from the call report). This amount is reported in column 5 of Table 7.

As is well-known from the work of Merton (1977), the FDIC deposit guarantee can be considered a put option on the asset of the firm, and thus, its value can be computed from the (modified) Merton model discussed in Appendix B

[17] In an earlier version of the paper, we assumed that the guarantee was for all the new issues of debt and not just the unsecured component. This makes an enormous difference, especially for the investment banks for which most of the short-term debt is secured. A careful reading of the Temporary Liquidity Guarantee Program (http://www.fdic.gov/news/board/08BODtlgp.pdf) confirmed that the guarantee was extended only to unsecured new debt issued.

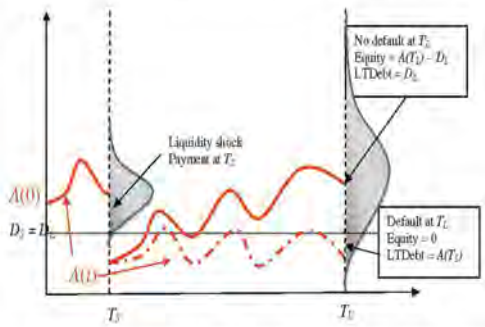

Fig. 3. An illustration of the model. Assets $A(t)$ move over time. At T_S there is the rollover of short-term debt and deposits. However, at this time, there is also a probability p of a liquidity shock, which reduces the value of assets by x, that is, if the liquidity shock hits then $A(T_S)=xA(T_S-)$. If at T_S $A(T_S)<D_S$, there is default at T_S. In this case, equity and long-term debt holders are wiped out, while short-term bond holders receive $A(T_S)$. If $A(T_S)\geq D_S$, assets $A(t)$ evolve according to a lognormal model until T_L. At T_L, default occurs if $A(T_L)<D_L$. In the computations we further divide the short-term debt in deposits, while long-term debt include also other liabilities.

and illustrated in Fig. 3. In this model, we assume that banks can either default in a short period, T_S=3 month, when it rolls over its short-term debt (and deposits), or much later, when long-term debt matures. At time T_S the firm may also be hit by a liquidity shock, with probability p, which makes its asset value drop to $x\bar{S}$ of its pre-shock value. This assumption allows us to obtain a calibration of the model that is able to match both the short-term and the long-term CDS rates. We calibrate the model CDS rates, equity value, and return volatility to the data on October 10, 2008, before the announcement, using the procedure described in Appendix B, which also contains more details of the model. To be conservative, however, we consider the value of the put option on October 14, 2008, after the government announcement, so that we take into account the resulting higher value of assets and lower probability of default. To control for other confounding news between October 10 and 14, 2008, we exploit the estimation results in Sections 3.1 and 3.2, and use the adjusted value of equity and debt in the calibration for the latter date. Given the calibrated values of the (modified) Merton model, we can compute the value of the FDIC deposit guarantee put option.

The estimated value of this put option for the additional debt insured is reported in column 6 of Table 7. The amounts are very small. The biggest beneficiary is Citigroup with $390 million. Overall, the total cost of this guarantee is $0.7 bn.

4.4. *The savings on the FDIC put option on commercial banks*

One qualification to the previous calculations is that the government intervention, both the preferred equity infusion and the FDIC guarantee on debt, will decrease the value of the FDIC guarantee on deposits. This is an implicit gain for the government. We resort to our structural model in order to compute the change in value of this put option.

We calibrate the (modified) Merton model to both equity and debt (CDS) data before and after the government announcement, i.e., October 10 and October 14, 2008, respectively, as explained above. Given the calibrated models, we compute the value of the put options on these two dates, and then calculate the difference. The result is in the last column of Table 7, which shows a small effect on the value of the put option. The reason is that in order to match short-term CDS rates, on both dates the model implies small probabilities of default, but large decreases in asset value in case of default. The increase in asset values and the decrease in the probability of default are small compared to the losses in case of a liquidity shock. Thus, the change in value of put options is small as well.

4.5. *Aggregate analysis*

Table 5 summarizes the overall effects of the Revised Paulson Plan. As stated in Section 3, the plan increased the value of banks' financial claims by $128 bn. If we add the $3.7 bn of reduction in the cost of the FDIC deposit insurance, the total value increase amounts to $131.5 bn. This goal was achieved at a cost that in the more optimistic valuation is $25 bn and in the less optimistic one $47 bn, with a net effect between $84 and $107 bn.

These estimates are obtained attributing all the gains of Morgan Stanley to the Paulson Plan. If we exclude Morgan Stanley from the analysis, the value increase is only $66 bn, with a cost between $21–$42, with a net benefit oscillating between $24 and $45 bn. Where does this value come from? We try to answer this question in Section 4.7. Before doing so, however, we check the robustness of our results to different assumptions.

One possible objection to interpreting the large gain in market value as value creation is that this might represent the market anticipation of future transfers of taxpayers' money to the banking sector. While possible, we regard this possibility as unlikely. Given the opposition that TARP

Table 8
Summary of robustness check results.

This table reports the final aggregate results from numerous robustness checks. Each column reports the final net benefit of the government intervention from Table 5. The four cases correspond to the four assumptions we made in the calculations: namely optimistic/pessimistic in terms of the valuation of the securities the US government received in exchange of the capital infusion (see Table 6) and with or without Morgan Stanley, whose price moved also because of the announcement of a capital infusion from Mitsubishi. Each row reports the parameter we changed compared to the base case, reported in the first row.

	With Morgan Stanley Oversight			W/o Morgan Stanley Oversight		
	Pessimistic	Report	Optimistic	Pessimistic	Report	Optimistic
Base case	86.0	93.4	108.6	25.2	33.7	46.1
CDS recovery 0%	93.7	101.1	116.3	28.6	37.2	49.5
CDS recovery 40%	75.0	82.5	97.6	20.1	28.7	41.0
LIBOR discount	84.2	91.6	106.8	23.8	32.4	44.7
Control by CDX	97.5	105.0	120.1	33.8	42.4	54.7
Beta-2 St. Err	96.3	103.8	118.9	35.3	43.9	56.2
Beta+2 St. Err	77.0	84.5	99.6	16.4	25.0	37.3
100% Derivative exposure	107.8	115.2	130.3	37.5	46.1	58.4
50% Derivative exposure	94.6	102.0	117.2	30.2	38.8	51.1
30% Deadweight cost of fax	72.7	82.4	91.0	13.4	35.6	40.6
54% Deadweight cost of fax	63.4	74.5	86.2	5.1	29.0	36.5
Average	86.2	94.2	108.4	24.5	35.7	46.9

encountered in Congress it is hard to imagine additional funds for banks. Furthermore, the cost of more bailouts should have been reflected in higher US government CDS rates, while these dropped during the Columbus Day-weekend.

Another objection is that the rescue represented a redistribution of value from other banks, who would have acquired the assets of distressed banks at lower prices, to the rescued banks. The negative return of JP Morgan is suggestive in this sense. To exclude this possibility we computed the excess return of an ETF (KRE), which replicates the KBW Regional Banking index, during this long weekend. That the excess return is positive (+4%) is inconsistent with this alternative interpretation.

4.6. Robustness

In this section we investigate the robustness of our conclusions to some key alternative hypotheses about the underlying quantities. More robustness is presented in Appendix C.

The summary results are contained in Table 8, which reports only the final aggregate values in the last column of Table 5, for six cases: pessimistic, oversight report, optimistic scenarios, and with and without Morgan Stanley. For instance, the first row of Table 8, the base case, shows the same results reported in the second to last column of Table 5. Each subsequent row contains the estimates of the value added in the six scenarios when one hypothesis is changed (explained in the first column) from the base case.

4.6.1. CDX as control

A reasonable concern about our control is that during the event window, General Electric Capital may have been affected by the expectation that it will eventually be included in the Plan or by its own idiosyncratic shock. Therefore, as a robustness check we use the CDX index as a control. The CDX index represents the cost of insurance against default on a diversified portfolio of 125 firms. In particular, the insurance buyer pays a quarterly premium during the life of the insurance, and in exchange it receives from the insurance seller the notional minus recovery amount anytime any of the underlying names defaults.

There are two complications on performing the adjustment in expression (4): the first is that CDX quotes are only available for five-year contracts. We therefore assume that CDX quotes are constant across maturities. The second complication is that we do not have the outstanding debt for the referenced entity (the 125 names in the index). To circumvent this problem we proceed as follows: for each bank i we first compute the present value of insurance costs (formula (5)) using the CDX index, which we denote by $PV^i(CDX)$. We then use expression (4) with $PV^{CE}(CDS)$ substituted by $PV^i(CDX)$ to compute the adjusted change in the value of the bonds. The resulting ratio $\Delta PV^i(CDX)/PV_0^i(CDX)$ provides the percentage change in the value of firm i debt were the CDX its insurance premium, instead of CDS^i. The results are again similar. In particular, the range of value created is between \$98 and \$120 bn (\$34 and \$55 bn without Morgan Stanley).

4.6.2. Full exposure derivatives net positions

As an additional check, we consider the case in which in aggregate security dealers bear the full credit risk exposure in their derivative net positions. This is clearly an overstatement, as most of these transactions are between them, and not with respect to other counterparties. Still, it is informative to see how important this exposure is in our calculations. We find that accounting for the full net derivative liabilities, the range of value created is between \$108 and \$119 bn (\$38 and \$58 bn without Morgan Stanley),

while a 50% exposure leads to a range of \$95–\$106 bn (\$30–\$51 bn without Morgan Stanley). Again, our major conclusions remain.

4.7. Some evidence on the sources of the costs and benefits of the plan

Where does the value increase come from? One possibility is that the capital infusion and the renewed access to funds enables banks to take advantage of the positive net present value lending opportunities. Yet, we know from Ivashina and Scharfstein (to appear) that the discretionary lending of the major banks went down, not up during this period. Of course, one could argue that in the absence of the intervention the positive NVP lending would have dropped even further. Unfortunately, since this counterfactual is difficult to pin down, this proposition seems untestable.

By contrast, it is possible to test, albeit with very few observations, the proposition that the value created arises from the reduction of the risk of a bank run. As described in Section 2.2, we can construct an index of the probability of a bank run by looking at the difference between the probability of bankruptcy over the next year and over the following one, conditional on not going bankrupt this year. In Fig. 4A we plot the net percentage gain produced by the Paulson Plan on the index of the probability of a bank run. As we can see, the observations lay on almost a straight line (a linear regression has an R-squared of 92%). Note that there is nothing mechanical about this relationship. The explanatory variable is a difference between probabilities of bankruptcy embedded in CDS rates as of October 10, 2008, while the dependent variable is a relative increase in enterprise value, where the adjusted change in CDS rates from October 10 to 14, 2008 plays a role. The data seem to confirm that the banks more at risk of a run gained the most during this period.

In Fig. 4B we repeat the same exercise with the difference that the explanatory variable is a bank's past performance (measured as stock return from July 1, 2007

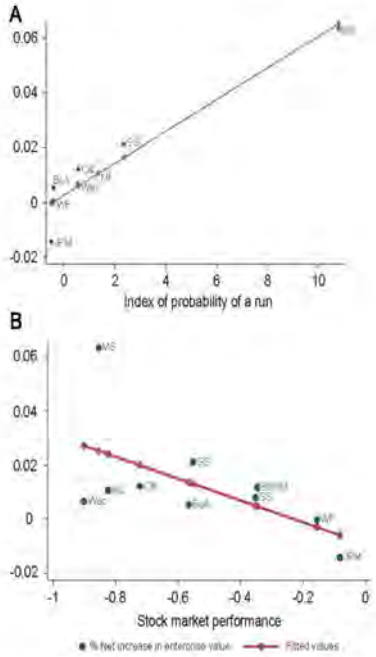

Fig. 4. Predicting the size of the net value increase. (A) plots the net percentage value increase at the announcement of the plan on the run index, i.e. the difference in the probability of default embedded in the one-year CDS rates and in the three-year CDS rates before the announcement. (B) plots the net percentage value increase at the announcement of the plan on the equity market performance of the corresponding stock during the crisis, i.e. from 7/1/07 to 10/10/08 ((A) % net increase in enterprise value on probability of run and (B) % net increase in enterprise value on previous stock market). BoA=Bank of America, Citi=Citigroup, GS=Goldman Sachs, JPM=JPMorgan, ML=Merrill Lynch, MS=Morgan Stanley, Wac=Wachovia, WF=Wells Fargo.

Table 9
Implied estimates of the cost of bankruptcy.

This table estimates the value of bankruptcy costs implicit in the market response to the Revised Paulson Plan. The first two columns report the total enterprise value (book value of debt and preferred plus market value of common equity) and the change in the market value of each of the banks involved in the Paulson Plan (all values are in billions of US$). The third and fourth columns report the risk neutral probability of bankruptcy embedded in the CDS rates before and after the announcement. Columns five and six report the implicit estimate of the bankruptcy costs calculated according to formula (8) in the text.

	Enterprise value	Change in enterprise value	Prob of default 10-October	Prob of default 14-October	Estimated bankruptcy	
					Costs bn $	Costs %
Citigroup	2,026	25	5.08	2.16	150	7.4%
Bank of America	1,803	10	1.43	0.76	101	5.6%
JP Morgan Chase	2,257	−32	1.42	0.77		
Wachovia	735	5	4.05	1.66	35	4.8%
Wells Fargo	672	0	1.45	0.69		
Bank of NY Mellon	280	3				
State Street Corp	297	2				
Goldman Sachs	1,089	23	9.74	3.72	94	8.7%
Morgan Stanley	976	62	30.33	8.26	163	16.7%
Merrill Lynch	867	9	7.69	3.26	66	7.6%
Total	11,002					
Recovery rate	0.2					
Discount rate	0.1					

to October 10, 2008. Even in this case we obtain a very high fit, where the banks that performed the worst gained the most. Performance during this period, however, is highly correlated with the probability of a bank run at the end of the period. When we run a regression with both, only the probability of a bank run remains significant.

Reducing the probability of a run implies reducing the probability that a firm will face the direct and indirect costs of bankruptcy. Given our estimates of the gain and of the changes in the probability of bankruptcy, we can verify whether the costs of bankruptcy implicit in our estimates are reasonable.

The value of any firm can be written as the discounted value of the future cash flow (CF_t) of a 100% equity-financed firm minus the expected value of the future bankruptcy costs:[18]

$$V=\frac{CF_1-p_1BC}{1+r}+\frac{CF_2-p_2(1-p_1)BC}{(1+r)^2}+\frac{CF_3-p_3(1-p_1)(1-p_2)BC}{(1+r)^3}+\cdots,$$

where we have assumed that the probability of bankruptcy p_t is independent from period to period. If, in addition, we assume that the probability of bankruptcy is constant after year five, we can rewrite this expression as

$$V=\sum_{t=0}^{\infty}\frac{CF_t}{(1+r)^t}+BC\left[\frac{p_1}{1+r}+\frac{p_2(1-p_1)}{(1+r)^2}+\frac{p_3(1-p_1)(1-p_2)}{(1+r)^3}+\frac{p_4(1-p_1)(1-p_2)(1-p_3)}{(1+r)^4}+\frac{p_5(1-p_1)(1-p_2)(1-p_3)(1-p_4)}{(1+r)^5}+\frac{\frac{p_5}{r+p_5}}{(1+r)^5}\right].$$

Under the (strong) assumptions that the announcement of the Paulson Plan does not alter the future cash-flow values and does not change the bankruptcy costs (but only the probability of bankruptcy), we can infer the cost of bankruptcy from the changes in the enterprise value before and after the announcement of the Paulson Plan as[19]

$$BC=\frac{\Delta V}{\Delta p}, \tag{8}$$

where ΔV is the change in the enterprise value at the announcement and

$$\Delta p=\left[\frac{p_1^0}{1+r}+\frac{p_2^0(1-p_1^0)}{(1+r)^2}+\frac{p_3^0(1-p_1^0)(1-p_2^0)}{(1+r)^3}+\frac{p_4^0(1-p_1^0)(1-p_2^0)(1-p_3^0)}{(1+r)^4}+\frac{p_5^0(1-p_1^0)(1-p_2^0)(1-p_3^0)(1-p_4^0)}{(1+r)^5}+\frac{\frac{p_5^0}{r+p_5^0}}{(1+r)^5}\right]-\left[\frac{p_1^1}{1+r}+\frac{p_2^1(1-p_1^1)}{(1+r)^2}+\frac{p_3^1(1-p_1^1)(1-p_2^1)}{(1+r)^3}+\frac{p_4^1(1-p_1^1)(1-p_2^1)(1-p_3^1)}{(1+r)^4}+\frac{p_5^1(1-p_1^1)(1-p_2^1)(1-p_3^1)(1-p_4^1)}{(1+r)^5}+\frac{\frac{p_5^1}{r+p_5^1}}{(1+r)^5}\right],$$

where p_t^0 is the (risk-neutral) probability of bankruptcy in year t embedded in the CDS rates before the announcement of the Paulson Plan and p_t^1 is the same probability after the announcement.

[18] Nothing prevents the bankruptcy cost to be so large as to wipe out all the future cash flow. Hence, this formulation does not imply that the firm will necessarily survive after bankruptcy.

[19] In Section 5.5, we will provide some evidence that the cost of bankruptcy conditional on entering bankruptcy does not change much during the event windows.

Table 9 reports such estimates. The inferred bankruptcy costs oscillate between \$34 and \$164 bn, corresponding to between 5% and 17% of the enterprise value. These estimates seem reasonable, but decisively on the low side. Cutler and Summers (1988) estimate the cost of financial distress to be over 30% of the combined market value of Texaco and Pennzoil. Opler and Titman (1994) find that financially distressed firms lose 26% of their sales, while Andrade and Kaplan (1998), who study the cost of financial distress for firms that underwent a leveraged buyout (and so are likely not to have very high cost of financial distress), estimate it to be between 10% and 20% of firm value. Finally, Korteweg (2007) finds that the cost of financial distress in bankruptcy is, on average, 30% of firm value, albeit he finds that it is −14% in the banking industry.

One possible reason for such low estimates is that the assumption of invariance of cash flow at the announcement is false. In fact, government intervention per se (without any cost of financial distress) might be bad news for future cash flow. If we drop the invariance of cash flow, we can write the percentage change in enterprise value at the announcement of the plan as

$$\frac{V^1-V^0}{V^0}=\frac{\sum_{t=0}^{\infty}(CF_t^1/((1+r)^t))-\sum_{t=0}^{\infty}CF_t^0/((1+r)^t)}{\sum_{t=0}^{\infty}CF_t/(1+r)^t}+BC\Delta p.$$

Since Δp varies from company to company, if we regress the percentage change in enterprise value at the announcement on a constant and Δp, we obtain

$$\frac{V^1-V^0}{V^0}_i=-0.025^{***}+0.22^{***}\Delta p_i.$$

These estimates suggest that the cost of government intervention (which reduces the ordinary cash flow independent of the probability of bankruptcy) is equal to 2.5% of the enterprise value, while the potential cost of bankruptcy is 22% of the enterprise value. These estimates appear quite reasonable and can potentially be used in the future to estimate the benefit of a government rescue of a bank.

5. The ex ante effects of the plan

Given the extreme volatility of markets during this period, it is legitimate to ask whether our estimates represent a fair assessment of the ex ante costs and benefits of the Revised Paulson Plan. For this reason, in this section we try to evaluate the plan on an ex ante basis, by using an extended version of the Merton (1974) model, where we introduce the risk of a liquidity shock/bank run. The goal of this section is twofold. On the one hand, to provide a reality check to the above results. On the other hand, to show that a simple extension of the Merton model can be used ex ante to provide accurate estimates of what the effects of various interventions will be.

5.1. The model

Since the seminal work of Black and Scholes (1973) and Merton (1974), it has been recognized that claims on a firm's assets, such as equity and debt, can be valued as options on the assets of the firm. To illustrate the logic in a simple setting, consider a bank (or a firm, more generally) with an amount $A(0)$ of assets at time zero. These assets are financed by short-term debt, long-term debt, or equity. Assume for simplicity that the principal on short-term debt and long-term debt is the same, $D_L=D_S$, and that debt carries no coupon payments. Finally, we let short-term debt be senior to long-term debt. The value of a bank's assets changes over time, due to cash inflows and outflows, as well as the willingness of market participants to purchase such assets. For instance, if some of these assets are mortgage-backed securities, then their market value may decrease in price if market participants expect higher mortgage defaults in the future.

In this simplified setting, consider the bank now at maturity of the short-term debt T_S. There are two possibilities: either the bank has a sufficient amount of assets to pay for these short-term liabilities or not. If the market value of the assets of the firm is below the principal of short-term debt D_S, the bank defaults. In this case, equity and long-term (LT) debt holders are wiped out and short-term debt holders seize the remaining assets $A(T_S)$. If assets are instead above the principal D_S, the bank pays for its short-term (ST) debt by liquidating some of its assets and proceeds on with its operations.

To take into account the possibility of a bank run or a liquidity shock, we assume that at time T_S there is probability p that the market value of assets drops to $x\%$ of its value before the shock. If $A(T_S)<D_S$, the bank defaults, equity and LT debt holders are wiped out and ST debt holders seize the remaining assets $A(T_S)$. If $A(T_S)>D_S$, the bank pays D_S and proceeds on with its operations.

At maturity of the long-term debt T_L, the situation is similar. If assets $A(T_L)$ are below the principal due at T_L, the bank defaults, equity holders receive nothing, and debt holders receive the assets $A(T_L)$. Conversely, if assets are sufficient to pay for the principal, debt holders receive their principal D_L back and equity holders obtain the remaining assets $A(T_L)-D_L$.

Fig. 3 illustrates these two scenarios: the two vertical dotted lines correspond to the maturities of the short-term and long-term debt. The solid curved line represents one hypothetical path of assets over time, while the shaded areas correspond to possible asset values at T_S and T_L from the perspective of a market participant at time zero. The solid curved line represents the case in which no default on long-term debt takes place, neither at T_S nor at T_L. In contrast, the dashed line that starts at T_S represents a hypothetical path leading to default of the bank: at T_L the bank does not have enough to pay in full its obligations to debt holders.

What is the value of debt and equity as of time zero, then? Using the option pricing methodology developed by Black and Scholes (1973) and Merton (1974), the value at time zero is the expected discounted value of the payoff at maturity, adjusted for risk. The only noteworthy point is to recall that the payoff at time T_L may be zero because default occurs at T_S. Appendix B contains more details on the model, as well a discussion on how we treat various forms of liabilities.

There are four unobservable entries in this model's formulas: the value of assets today $A(0)$, the volatility of

Table 10
Value transferred to long-term debt by equity infusion.

This table estimates the changes in the value of equity due only to the infusion of equity. The first two columns report the value in the model of long-term debt and equity before the equity infution, columns 3 and 4 report the value of long-term debt and equity after the equity infusion reported in column 5. Columns 6 and 7 report the difference in the value of debt and equity as a result of the equity infusion. The last column reports what fraction of the equity infusion goes to increase the value of the long-term debt. All values in billions of US$, exception made for the fraction of equity infusion to debt.

	Value before equity infusion announc LT		Value after equity infusion announc LT		Amount of equity infusion	Difference LT		Fraction of equity infusion to debt
	Bonds	Equity	Bonds	Equity		Bonds	Equity	
Citigroup	346.3	86.4	355.7	101.7	25	9.4	15.3	0.38
Bank of America	240.1	116.0	243.4	127.6	15	3.3	11.6	0.22
JP Morgan Chase	244.8	0.5	249.1	181.2	25	4.2	180.7	0.17
Wachovia	163.9	17.0	166.4	19.5	5	2.5	2.5	0.49
Wells Fargo	103.0	94.3	105.6	111.7	20	2.6	17.3	0.13
Bank of NY Mellon								
State Street Corp								
Goldman Sachs	145.8	34.0	150.2	44.1	10	4.4	10.1	0.44
Morgan Stanley	122.8	18.3	129.6	13.3	10	6.8	-5.0	0.68
Merrill Lynch	198.9	78.3	203.7	34.7	10	4.8	-43.6	0.48
Total	1565.7	444.8	1603.7	633.8	125.0	38.0	189.1	0.29

assets σ_A, the probability of a liquidity shock p, and the loss in case of a shock x. We choose these quantities to match four observables: the market capitalization of each bank on October 10, 2008, the volatility of equity, as well as an estimate of market values of ST debt and LT debt on the same day. The estimated market value of debt is computed from CDS rates.[20] Table 2 reports the other data used in our estimations. In particular, for each bank this table reports the bank's capital structure – namely, the deposit amounts, short-term debt, long-term debt, etc. – as well as the firm market cap and equity volatility.

5.2. The co-insurance effect

Table 10 contains the results of the estimation. The first two columns report the estimated market value of long-term bonds and the firm market capitalization as of Friday, October 10, 2008. The next two columns report the same quantities after the $125 bn preferred equity infusion. In particular, the $125 bn preferred equity infusion increases the overall value of the equity of these ten banks by only $80 bn, reported in column 7.

This increase in the value of debt is exactly what is predicted by Myers (1977). When debt is risky, by definition there are several states of the world in which is not paid in full. An equity infusion provides a safety cushion to debt in those states of the world in which it would not have been paid in full. As a result, the value of risky debt goes up when new equity is raised. This transfer of value, which is also known in the literature as debt overhang or co-insurance effect, is what makes it so unattractive for equity holders to raise new equity.

Overall, the size of the transfer in favor of debt holders is $38 bn (see column 6), equal to 29% of the value of the money invested. However, the magnitude of this transfer varies across firms depending on the extent of their leverage and the volatility of their assets. It is highest (in relative terms) for Morgan Stanley (68%), Wachovia (49%), Merrill Lynch (48%), Goldman Sachs (44%), and Citigroup (38%). It is smaller for JP Morgan (17%), Bank of America (22%), and Wells Fargo (13%).

5.3. Explaining the changes in the market value of debt

Table 11 compares the model's prediction about the changes in market value of debt and equity to the actual changes in the market. All these calculations are made under the assumption that the overall asset value does not change. As we saw in Section 4.5, however, there is strong evidence that it did change. These model-based comparisons will lead to the same answer.

Table 11, Panel A shows that the model predicts an increase in the market value of debt equal to $49 bn: $38 bn coming from the value transfer from the preferred equity infusion and $11 bn from the FDIC debt guarantee (as computed in Section 4.2). This estimate falls $72 bn short of the actual increase, equal to $120 bn. This amount is hard to rationalize without assuming an increase in the value of assets. Even if we were to assume that the government intervention eliminates the risk of a liquidity crisis (and thus, in the model, we put the probability of a run at zero), we can explain only another $19 bn of value increase, still $52 bn short of the actual amount.

5.4. Explaining the changes in the market value of equity

We reach similar conclusions if we look at the impact of the plan on equity holders (Table 11, Panel B). The model

[20] It is worth pointing out that the CDS implied yields underestimate the true yield of bonds (see, e.g., Longstaff, Mithal, and Neis, 2005) and thus, we overestimate the value of debt in this case. We also computed the value of debt and implied transfers by treating the principal value as a zero coupon bond itself, thereby grossly underestimating the value of debt. The transfers from equity holders to debt holders were very similar.

Table 11
Explaining the changes in the market value of debt and equity.

This table confronts the changes in the value of debt (Panel A) and equity (Panel B) predicted by the model with the actual changes observed in the market place. The changes in the value of the debt should be the value transferred as a result of the equity infusion (first column) and of the debt guarantee (second column). The changes in the value of equity after the equity infusion is announced (but before it is executed) are the sum of the expected gain from the equity infusion due to the fact that the government pays more than what it receives (see Table 6) minus the transfer to the debt holders (Table 8). The next to the last column reports the fraction of the debt guarantee that does appear to have been absorbed by debt holders (last column of Panel A). The last column is the difference between the market value changes (column 4), the total predicted value changes (column 3) and the residual benefit of debt guarantee (column 5). All the figures are in billions of US$.

Panel A: Changes in the value of debt

	Market changes	Model transfer from equity	Net insurance benefits	Total	Difference	Eliminate liquidity shock	Difference
Citigroup	21.4	9.4	3.0	12.4	9.0	3.5	5.5
Bank of America	4.2	3.3	0.2	3.5	0.7	0.6	0.1
JP Morgan Chase	3.6	4.2	0.6	4.8	−1.2	0.7	−1.9
Wachovia	7.5	2.5	0.2	2.7	4.8	0.9	3.9
Wells Fargo	1.6	2.6	0.0	2.6	−1.0	0.3	−1.3
Bank of NY Mellon		0.0		0.0			
State Street Corp		0.0		0.0			
Goldman Sachs	17.6	4.4	3.5	7.9	9.7	2.8	6.9
Morgan Stanley	51.6	6.8	2.1	8.9	42.6	7.2	35.4
Merrill Lynch	13.0	4.8	1.3	6.1	6.9	3.0	3.9
Total	120.5	38.0	10.8	48.9	71.6	19.1	52.5

Panel B: Changes in the value of equity

	Change in market value	Net gain of equity		
		Net gain from equity infusion	Transfer to debt	Total
Citigroup	7.9	4.8	9.4	−4.6
Bank of America	4.4	1.2	3.3	−2.1
JP Morgan Chase	−33.6	1.8	4.2	−2.4
Wachovia	−2.7	0.7	2.5	−1.8
Wells Fargo	−0.5	1.5	2.6	−1.1
Bank of NY Mellon	3.3	0.1	0.0	0.1
State Street Corp	2.4	0.0	0.0	0.0
Goldman Sachs	7.9	0.1	4.4	−4.3
Morgan Stanley	11.0	1.4	6.8	−5.5
Merrill Lynch	−2.8	1.7	4.8	−3.2
Total	−2.8	13.2	38.0	−24.8

predicts a loss of $25 bn, the net result of a gain of $13 bn from the preferred equity infusion and a loss of $38 bn due to the value transferred to debt holders—see Panel A, column 2. The actual change is −2.8 bn, with a difference of $25 bn. We could argue that the equity captures some of the value provided by the FDIC debt guarantee. But even if the entire value were captured by equity, this would not explain the value increase (and would make explaining the increase in the value of debt even more difficult).

5.5. *Inferring the changes in the value of assets from the model*

If we maintain the value of the underlying assets constant, the model is unable to account for the observed changes in the value of debt and equity. This result could imply that the model does not fit the data well or that indeed, the value of the underlying assets has increased. To distinguish between these two hypotheses we calibrate the model twice, before the announcement (October 10, 2008) and after the announcement (October 14, 2008). As in Section 3.1 and 3.2, we control for news between the two dates by exploiting the estimation results in 3.1 and 3.2 and using the adjusted increase in equity and bond values for the calibration at the later date. Table 12 reports the results.

Several factors are worth mentioning. First, the model is able to mimic very well the change in the value of the underlying assets, with a mean squared error of only 5%. Second, the volatility of the underlying assets does not seem to have changed a lot over the long weekend, but the probability of a bank run did. Before the announcement of the plan, it was on average 1.4%, after the announcement it dropped to 0.9%. The biggest beneficiary was Morgan Stanley, for whom the probability of a run went from 5.7% to 3.2%. Finally, the model estimates that the recovery rate in case of a run did not change before and after the announcement. This validates the assumption we made in Section 4.7.

6. Valuations of alternative plans

Our analysis thus far shows that the Paulson Plan created substantial value (between $84 and $107 bn), but it did so redistributing between $25 and $47 bn from the

Table 12
Change in the value of assets implied by the model.

In the extended Merton (1974) model described in Appendix B, we choose the four unobservable variables (value of assets today $A(0)$, volatility of assets σA, probability of a liquidity shock p, and loss in case of a shock x) to match the four observables: the market capitalization of each bank, the volatility of equity, the estimated of market value of ST debt, and the estimated market value of LT debt. The estimated market value of debt is computed from CDS rates. The first four columns report the value estimated by using the October 10, 2008 data, while the second four columns report the value estimated by using the October 14, 2008 data. The next to the last column reports the difference between the value of assets estimated for each of the two days and the last column reports the change in the value of assets as derived in Table 5 (common equity, preferred equity, debt). All the $ figures are in billions of US$. The volatilities and the probabilities are in percentage terms. The recovery rate is the fraction of value recovered.

	Values estimated on 10/10/2008				Values estimated on 10/14/2008				Estimated changes in asset value	Actual changes in asset value
	Asset volatility	Asset value	Prob. of run	Recovery rate	Asset volatility	Asset value	Prob. of run	Recovery rate		
Citigroup	9.5	1,915	1.00	0.25	8.8	1,945	0.69	0.29	29.8	31.4
Bank of America	11.4	1,748	0.27	0.31	11.3	1,758	0.21	0.31	10.5	10.9
JP Morgan Chase	9.3	2,202	0.28	0.30	7.7	2,172	0.22	0.31	−30.0	−29.7
Wachovia	7.3	768	0.54	0.27	5.8	713	0.31	0.33	4.6	5.1
Wells Fargo	20.1	651	0.28	0.27	19.2	652	0.21	0.27	0.9	1.1
Bank of NY Mellon										
State Street Corp										
Goldman Sachs	8.0	999	1.91	0.23	7.2	1,024	1.25	0.26	24.6	25.6
Morgan Stanley	7.0	825	5.71	0.15	5.3	887	3.17	0.16	62.1	62.9
Merrill Lynch	7.8	803	1.50	0.24	6.2	813	1.04	0.28	10.3	11.4
Average	10.1		1.4	0.3	8.9		0.9	0.3		
Total		9,851				9,964			113	119

taxpayers to the nine largest banks. In this section, we analyze whether the same objective could have been achieved in a more cost effective way and/or in a less expensive way for the taxpayers.

6.1. Efficiency of the plan

Philippon and Schnabl (2009) analyze the trade-offs of different intervention strategies from a theoretical point of view. Here, we want to perform this analysis from an empirical point of view. This exercise is clearly speculative, since the counterfactuals are difficult to assess. Nevertheless, the extended Merton model we used has been very successful in matching the observed variations; thus, we feel reasonably confident to use it as a benchmark to evaluate the counterfactuals.

To evaluate these counterfactuals we need to impose one constraint and make one assumption. The constraint is that we only consider plans that achieve the same goal as the Paulson Plan. Since Paulson's Plan objective was to recapitalize the banking system so that the risk of default of a financial institution became sufficiently low, we evaluate alternative plans with the constraint that they reach this objective: i.e., a reduction in the CDS rates of each bank equivalent to the one observed in the data (see Table 3). Since there are multiple CDS rates, depending on the maturity, we impose in particular that the alternative matches the drop in the one-year CDS rates, since these are the ones that indicate the imminent risk of a run, and the five-year CDS rates, which instead mainly depend on the current value of assets $A(0)$.

As in the event study, we want to consider the direct impact of the plan on CDS, and not the systemic effect. For this reason, Table 3 reports two declines in CDS rates: the actual decline and the adjusted decline, where the latter is adjusted for the decline in GE Capital CDS rates. Since we do not know whether the general decline, captured in the decline of GE Capital CDS rates, is due to the plan or to the other events, for completeness we consider two possibilities: that the plan achieves the adjusted decline in CDS or that the plan achieves the unadjusted decline in CDS. Clearly, the second hypothesis puts a much higher hurdle on the plan.

Conditional on achieving this objective, we rate the different plans along several dimensions, which are important both economically and politically: the investment required, the net cost, the value at risk, and the percentage of bank's equity capital the government will end up owning. The need to evaluate the amount of funds required separately from the net cost arises from two considerations. First, there are some political constraints on the amount of funds employed, regardless of whether they are invested or given away as subsidies, as shown by the fact that the entire debate on the original Paulson Plan (to buy distressed assets from banks) was about the amount of money invested, not on the actual cost for taxpayers of this investment. Second, the expected cost of debt guarantee does not appear in the government budget as a cost simply because of the way government accounting is done. Third, since large government losses may have disproportionate negative effects, we

Table 13
Cost of alternative plans.

This table measures the Revised Paulson Plan along five dimensions and compares it along these dimensions with four alternatives. The five dimensions are: the amount of funds required by the plan, the ex ante cost of the plan for taxpayers, the *statistical* value at risk for taxpayers (5% probability of a loss in three years under the actual probabilaty), the *economic* value at risk for taxpayers (5% probability of a loss in three years under the risk neutral probability, which subsumes the fact that the costs of funds in certain states of the world is higher), and the percentage of ownership the Government would have acquired if it invested in straight equity. All the plans in Panel A are constrained to deliver a reduction in CDS rates at least as big as the adjusted decline reported in Table 3. All the plans in Panel B are constrained to deliver a reduction in CDS rates at least as big as the raw decline reported in Table 3. All the figures are in billions of US$.

Panel A: Target=adjusted reduction in CDS rates

	Revised Paulson Plan	Original Paulson Plan: asset purchase		Pure equity infusion	Long-term debt-for-equity swap
		No over-payment	20% over-payment		
Investment required	125	3,084	953	261	0
Net cost to taxpayers	49	0	191	65	0
5% Three-year statistical value at risk	97	123	47	189	0
5% Three-year economic value at risk	114	373	147	230	0
% of banks owned by government	20	0	0	40	0

Panel B: Target=raw reduction in CDS rates

	Revised Paulson Plan	Original Paulson Plan: asset purchase		Pure equity infusion	Long-term debt-for-equity swap
		No over-payment	20% over-payment		
Investment required	125	4,585	1,654	495	0
Net cost to taxpayers	49	0	331	139	0
5% Three-year statistical value at risk	99	197	86	341	0
5% Three-year economic value at risk	112	568	257	426	0
% of banks owned by government	20	0	0	52	0

calculate the value at risk. In fact, we use two definitions of Value-at-Risk (VaR). The first one is the standard statistical measure of the maximum dollar losses that the taxpayer will suffer over three years with 95% probability. This measure is informative as it can be directly compared with the (dollar) size of the investments. However, the statistical VaR measure does not reveal the marginal costs to the economy from such potential losses. If these losses occur during recessions, for instance, they have a marginal cost that is higher than in the case in which these losses occur during booms. A simple way to compute a risk measure for the government that takes into account the marginal costs of these losses is to compute the Value-at-Risk under the risk-neutral (or risk-adjusted) probabilities, which by construction weight the probability of each future state of nature by the proper state price density (marginal utility) of those states (see Ait-Sahalia and Lo, 2000). Because the state price density is implicit in the CDS rates we used in the calibration of the model, a VaR computed under risk-neutral probabilities takes implicitly into account the marginal cost of future losses. As in Ait-Sahalia and Lo (2000), we refer to this VaR number as Economic VaR. Finally, we compute the percentage ownership of the large banks acquired by the US government has both political and economic consequences in the short- and the long-run.

For comparison, in the first column of Table 13 we report the values of these criteria for the Revised Paulson Plan analyzed so far. The only two parameters we have not discussed yet are the two values at risk and the overall government ownership of banks. The statistical value at risk is just below $100 bn, while the economic one is slightly higher ($114 bn).[21] A more interesting dimension is the percentage of ownership acquired by the government. We compute this as the amount of money invested divided by the sum of the market capitalization of the common equity and the preferred equity before the plan is announced (i.e., the October 10, 2008) plus the amount of money invested. This is the fraction of equity the government should have taken, not necessarily what it will take since the warrant will be priced at the moment of the infusion. With this plan, the government would own on average 20% of the top ten banks, with a maximum of 48% ownership in Morgan Stanley.

[21] If we assume that the effect of the plan is to reduce not just the adjusted CDS, but also the raw CDS rates (Table 13, Panel B), the 5% VaR is slightly lower, because the initial value of the assets is higher, to match the higher value of debt. Appendix D elaborates on the methodologies we use to calculate the VaR under the various alternative plans.

We are now in the position to compare the Revised Paulson Plan with some alternatives. The first one we analyze is the original Paulson Plan, with no overpayment. The idea of this plan was to substitute risky assets of dubious value with assets of certain value (cash) on the banks' balance sheets. Even if these transactions occurred at market prices, this plan would have reduced the riskiness of banks' underlying assets and in so doing reduced their risk of default.

By using the model described above, we calculate that it would have been necessary to purchase $3.1 trillion of banks' assets to achieve the same adjusted drop in CDS rates achieved by the Revised Paulson Plan (see Table 13, Panel A). If we want to achieve the same unadjusted drop, we would need $4.6 trillion. This is clearly a theoretical exercise since purchases of this entity would certainly alter market prices. Nevertheless, it gives a sense of the order of magnitude of the intervention required to achieve the stated goal only with asset purchases. The magnitudes involved suggest that even if it were possible not to overpay for the assets, it would have been unfeasible to reach the objective with the money requested under TARP.

Since by definition these transactions are done at the fair value, the expected cost of this strategy is zero. Nevertheless, it subjects taxpayers to an enormous risk. In Panel A Table 13, the 5% statistical value at risk for this alternative is $123 bn, while the corresponding figure for the economic value at risk is $373 bn. This clearly shows the risk implicit in this strategy. The situation is even worse when we target the raw reduction in CDS rates (Panel B): the statistical value at risk is $197 bn, while the economic one $568 bn! The only advantage of this approach is that it does not require any government ownership of banks.

The second alternative plan we consider is a variation of the original Paulson Plan, with the difference that the government has an explicit mandate to overpay. We fix this overpayment at 20%. This overpayment could be the result of an explicit government decision or the result of a surge in prices due to the massive purchases made by the government under this plan.

In this case, the amount of investment needed decreases significantly: $953 billion if we target the adjusted reduction in CDS rates, and $1.7 trillion if we target the raw reduction. Note that the amount necessary to achieve the required reduction in adjusted CDS is similar to, but falls short of, the amount Secretary Paulson requested to buy toxic assets. This reduction in the funds needed comes at a high price for the taxpayers: they have to pay $191 bn up front. In addition to this cost, the statistical value at risk predicts a $47 bn additional loss in three years, while the economic value at risk $147 bn. Once again, one benefit of this approach is that the government does not end up owning any share in the banking sector. The only additional benefit of this strategy is reducing the amount of funds needed, at the cost of a very significant up-front cost for taxpayers: almost $200 bn.

The third hypothesis we consider is a pure equity infusion, with no debt guarantee. This is the proposal advanced by several economists (Diamond, Kaplan, Kashyap, Rajan, and Thaler, 2008; Stiglitz, 2008). If the goal is simply to achieve the adjusted reduction in the CDS rates, the preferred equity infusion achieves it at twice the upfront investment of the Revised Paulson Plan: $261 bn vs $125 bn. The cost of this option, $65 bn, is represented by the transfer in value from equity holders to debt holders that occurs when equity is injected in a very highly levered firm. We attribute this share to the government in proportion to the equity acquired at the price before the announcement. Clearly, the government could have imposed all these costs on the existing equity holders buying at a lower price, but this would have required a forced recapitalization, not a voluntary one. The VaR would also have been significantly higher than the Revised Paulson Plan: $189 bn for the statistical VaR and $236 bn for the economic one.

This approach would have had very adverse effects in terms of government ownership of banks. On average, the government would have ended up owning 40% of the top ten banks. This ownership would have been very unequally distributed. As Fig. 5 shows, the equity infusion plan will concentrate the investment in the three former investment banks and Citigroup. Such investment would have given the government 61% of Citigroup, 50% of Morgan Stanley, and 39% of Goldman Sachs. The scenario is worse if we want to target the raw reduction in CDS rates. In this case, the equity infusion required would be $495 bn, with a cost for the taxpayers of $139 bn and a government ownership of banks of 52% (Panel B of Table 13).

This analysis suggests that the original Paulson Plan not only would have been extremely costly for taxpayers, but it would have also been unfeasible in the terms proposed by Paulson. Even ignoring the fact that it would have been difficult to limit the purchase of assets from banks alone and assuming a generous overpayment (20%), the entire TARP money would not have been sufficient to rescue the ten largest banks alone. Had it been implemented, this plan would have exposed taxpayers to a significant amount of risk.

By contrast, the Revised Paulson Plan seems to perform the best, among the options considered at the time and analyzed by Philippon and Schnabl (2009). It has the lowest up-front investment need, the lowest up-front cost, and the lowest sum of the immediate cost plus VaR cost. This advantage stems from the cost effectiveness of the debt guarantee. A debt guarantee on unsecured debt provides the necessary access to funds in a crucial moment, making all the debt safer, while not guaranteeing it all. The only drawback of the Revised Paulson Plan vis-à-vis alternatives is the higher government ownership of banks it generates.

While the Revised Paulson plan performs best within this set of options, it is clearly dominated by a debt-for-equity swap along the lines proposed by Zingales (2008a, 2008b). The idea aims at eliminating the threat of default by converting long-term debt into equity. To protect the value of the existing equity holders, such a plan would grant them the option to buy back their claim from the old debt holders (now transformed into equity holders) at the face value of debt. The beauty of this scheme, first devised by Bebchuk (1988), is that it does not require any valuation

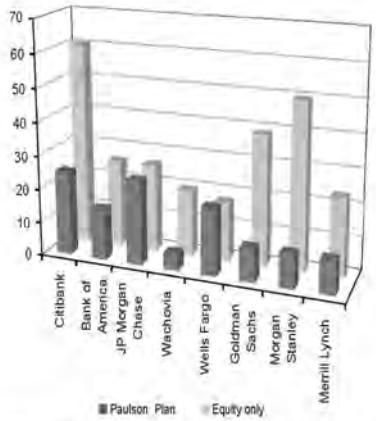

Fig. 5. Difference in equity infusion. This figure compares the equity infusion under the Revised Paulson Plan and the equity infusion needed to match the observed adjusted reduction in the CDS rates observed after the announcement of the Revised Paulson Plan (see Table 3). All the numbers are in billions.

Table 14
The Paulson Plan using the Warren Buffet terms.

This table measures what would have happened if the Revised Paulson Plan had been implemented by using the terms that Warren Buffett obtained from Goldman Sachs when he invested $5 billion on the 14th of September 2008. The first column reports the value of the perpetual preferred with a 10% coupon rate, which can be called back at any time at a 10% premium. The second and third columns report the value of the warrants under two assumptions: that they were issued with a strike price 8% below the price on 10/10/2008 and on 10/14/2008. The fourth and fifth columns report the sum of the packages the government would have obtained under the two hypotheses. Columns 6 and 7 report the ex ante gain the government would have obtained by applying the Warren Buffet terms, computed as the difference between the value of the package and the amount of the investment made. Columns 8 and 9 report the net gain captured by the government as a fraction of the net gain in enterprise value experienced by each company during the event window. Columns 10 and 11 do the same as a fraction of the net gain in equity value (common plus preferred) experienced by each company during the event window. "neg" means that the denominator was negative.

	Pref.	Warrant at 8% discount at		Total		Net gain		Net gain as fraction of change in enterprise value		Net gain as fraction of change in equity value	
		10/10	10/14	10/10	10/14	10/10	10/14	10/10	10/14	10/10	10/14
Citigroup	18.1	14.4	10.8	32.5	28.9	7.5	3.9	0.30	0.16	0.74	0.39
Bank of America	13.4	8.9	6.7	22.2	20.1	7.2	5.1	0.74	0.52	1.09	0.76
JP Morgan Chase	23.9	10.1	10.4	34.0	34.3	9.0	9.3	neg.	neg.	neg.	neg.
Wachovia	3.8	2.8	2.3	6.6	6.1	1.6	1.1	0.32	0.22	neg.	neg.
Wells Fargo	19.9	9.9	7.9	29.8	27.8	9.8	7.8	neg.	neg.	neg.	neg.
Bank of NY Mellon	2.8	2.6	1.9	5.4	4.7	2.4	1.7	0.72	0.52	0.72	0.52
State Street Corp	2.0	1.6	1.1	3.6	3.2	1.6	1.2	0.68	0.49	0.68	0.49
Goldman Sachs	10.0	7.5	5.2	17.5	15.2	7.5	5.2	0.32	0.22	0.94	0.65
Morgan Stanley	7.6	8.4	4.5	16.0	12.1	6.0	2.1	0.10	0.03	0.53	0.19
Merrill Lynch	7.5	4.7	4.1	12.2	11.6	2.2	1.6	0.23	0.17	neg.	neg.
Total	108.9	70.8	55.0	179.7	163.9	54.7	38.9				
Average								0.4	0.3	0.8	0.5

of the existing assets, which is the biggest problem any plan is facing given the uncertainty in the value of the underlying assets. Since this plan does not involve any government money, all the entries are obviously zero. We did compute, however, whether the conversion of the long-term debt would have been sufficient to achieve the stated goals. In fact, it is more than sufficient. Converting the long-term debt insures a dramatic drop of the CDS rates to 7–8 basis points, the level most banks had at the beginning of 2007. So this plan was economically feasible, but it would have required new legislation to be implemented (Swagel, 2009).

6.2. *Redistributive effects of the plan*

Even accepting the idea that the strategy used was the most cost-effective given the existing legal constraints, we

need to explain why the government left so much money on the table: not only did the government not capture any of the value increase it generated, but it also subsidized it with a gift estimated between \$21 and \$44 bn. Could the government have done better? Only three weeks before, when Warren Buffett invested in Goldman Sachs, he obtained much better terms: a 10% coupon on the preferred and a warrant with a strike price 8% below the closing price before the announcement (not a 5% coupon and a warrant with a strike price at the market price after the announcement of the injection) (Craig, Karnitscnig, and Lucchetti, 2008). In Table 14 we report what the cost for the various banks would have been if the Treasury had applied the Warren Buffett terms to all ten banks.[22] Given the huge surge in absolute (not just market-adjusted) prices that took place at the announcement of the plan, we consider two hypotheses: a warrant with a strike price 8% below the market price of October 10 and a warrant with a strike price 8% below the market price of October 14. Columns 6 and 7 of Table 14 report the net gain the government would have obtained had it asked for the same terms as Warren Buffett. Columns 8 and 9 relate this gain to the increase in enterprise value experienced by each company as a result of the plan (Table 5, column 6). Except for JP Morgan and Wells Fargo (where the gain was negative), the government would have captured between 30% and 40% of the gain (i.e., between \$39 and \$55 bn), instead of losing between \$21 bn and \$44 billion. The relevant question, though, is whether all the banks would have accepted these terms.

To answer this question, a more relevant comparison is with the gain experienced by equity holders. Since the claims offered to the government are junior with respect to debt, the gain captured by the government would have been mostly at the expense of equity holders.[23] As columns 10 and 11 show, four out of ten experienced a negative change in the value of equity (adjusted for market movements). For the rest, the government would have captured between 50% and 80% of the benefits of the plan enjoyed by equity holders. Therefore, if the goal of the plan was to achieve 100% participation by all top ten banks (to avoid signaling effects), tougher terms might have gotten in the way.

7. Conclusions

By analyzing the market response to the Revised Paulson Plan we show that, systemic effects aside, this plan "gifted" \$130 bn to the ten largest banks. This gift was made of two components: a transfer of between \$21 and \$44 bn from taxpayers to banks' investors and an efficiency gain of between \$86 and \$109 bn. From a purely economic point of view, the plan could be considered a success because it created value. It did, however, achieve this objective via a massive redistribution of resources from taxpayers to banks, in particular to banks' bondholders who gained \$121 bn as a result of the plan. This redistribution had and will have significant political costs. Most importantly, it did not need to be done that way. The government could have asked for significantly more, both for the equity infusion and the debt guarantee. For instance, if the government had applied the same terms Warren Buffett obtained from Goldman Sachs, taxpayers would have gained between \$39 and \$55 bn, instead of losing between \$21 and \$44 bn. However, we find that such terms may not have been accepted by four of the ten banks. An open question is how much power did the government have to coerce firms to participate (after all, it did exercise some "moral suasion"), and how important as a goal was 100% participation. Even accepting that nothing could be done at that time, it remains unanswered why the government did not try to extract some of these benefits on the way out, i.e., when these banks asked to get out of TARP.

By looking at the limited cross section we can infer that the net benefit created is the combination of two factors. On the one hand, a government intervention reduces the enterprise value by 2.5%, possibly due to the inefficient restrictions the government will impose. On the other hand, the government money infusion reduces the probability of bankruptcy, which – we estimate – could cause a dissipation of 22% of the enterprise value.

We then study the cost of alternative plans that would have achieved the same effects in terms of reduction of the default risk of existing banks. The Revised Paulson Plan vastly dominates the original Paulson Plan and performs better than the most popular alternatives advanced at the time. Only a debt-for-equity swap would have done better, but this would have required specific legislation to be implemented.

Appendix A. Bootstrapping risk-neutral default probabilities from CDS rates

Denote by $r(\tau)$ the riskless rate at time τ and by $p(\tau)$ the risk-neutral default intensity for time τ. We assume for simplicity that both $r(\tau)$ and $p(\tau)$ are simple deterministic functions of time. Assuming continuous payments, the no-arbitrage formula for a CDS rate on a contract with maturity T is given by

$$CDS(T) = \frac{(1-\delta)\int_0^T p(\tau)e^{-\int_0^\tau r(u)+p(u)\,du}d\tau}{\int_0^T e^{-\int_0^\tau r(u)+p(u)\,du}d\tau}, \tag{A.1}$$

where δ is the recovery rate. Note that if the default intensity $p(\tau)=p$ is constant, then $CDS(T)=p(1-\delta)$. When $p(\tau)$ is not constant, we can use CDS rates for various maturities T to bootstrap out $p(\tau)$ for every τ. For simplicity, we assume that $p(\tau)$ is a step function with one-year step size. To implement the procedure, we need

[22] To approximate the lower bound value of a perpetual callable preferred, we calculated the value of the perpetual non-callable preferred as the perpetuity value of the 10% dividend discounted at the rate of existing preferred securities, and subtract the value of a standard American call option with a 15-year maturity and a volatility equal to the implied volatility at that time. Since the volatility of common stock is much higher than the volatility of the preferred, this is a lower bound of the value of the perpetual callable preferred.

[23] The dividend paid on the preferred is de facto junior to the principal repayment of long-term debt. Thus, the value of the debt would be lower with a higher dividend payment. We expect this effect to be small, though.

the spot rates $r(\tau)$, which we bootstrap out from plain-vanilla swap rates data, available on the Federal Reserve Board Web site. Fixed-for-floating swap rates implicitly embed the London Interbank Offered Rate (LIBOR) discount curve, which is used by dealers to price CDS contracts and other derivatives. The LIBOR curve implicitly embeds the risk of default of derivative security dealers. In this bootstrap procedure, we assume a recovery rate $\delta=0$, 20%, or 40%, depending on cases discussed in the text. Note that $\delta=40\%$ is the standard assumption in the pricing of CDS (see, e.g., the Bloomberg description of CDS).

Given intensities $p(\tau)$, we can finally compute the probability to survive up to time T as

$$Q(T)=e^{-\int_0^T p(\tau)\,d\tau}. \tag{A.2}$$

The conditional probability of defaulting in year n conditional on not defaulting earlier, $P(n)=Prob(Default\ in\ year\ n|No\ Default\ before\ year\ n)$, can be computed from $Q(t)$ from Bayes' rule:

$$P(n)=\frac{Q(n-1)-Q(n)}{Q(n-1)}, \tag{A.3}$$

where $Q(0)=1$.

Appendix B. The Merton model of equity as an option

In order to take into account the possibility of a short-term default, we modify the Merton (1974) model to consider two possible maturities of debt, short-term (ST) and long-term (LT). Consider a bank with an amount $A(0)$ of assets at time zero. To illustrate the simple model, assume for simplicity that the principal on ST debt and LT debt is the same, $D_L=D_S$, that debt carries no coupon payments, and that short-term debt is senior to long-term debt. The value of $A(t)$ changes over time, due to cash inflows and outflows, as well as the willingness of market participants to purchase such assets. For instance, if some of these assets are mortgage-backed-securities, then their market value may decrease in price if market participants expect higher mortgage defaults in the future.

In this simplified setting, consider the bank is now at maturity of the short-term debt T_S. In order to cover its liabilities, the bank has to sell some of its assets $A(T_S)$, or, equivalently, roll-over ST debt. To take into account the possibility of a bank run or a liquidity shock, we assume that at time T_S there is a risk-neutral probability p that the market value of assets drops by x%. If $A(T_S)<D_S$, the bank defaults, equity and LT debt holders are wiped out, and ST debt holders seize the remaining assets $A(T_S)$. If $A(T_S)>D_S$, the bank pays D_S and proceeds on with its operations. At maturity of the long-term debt T_L, the situation is similar. If assets $A(T_L)<D_L$, the bank defaults, equity holders receive nothing, and debt holders receive the assets $A(T_L)$. Otherwise, debt holders receive their principal D_L and equity holders obtain the remaining assets $A(T_L)-D_L$.

Fig. 3 illustrates the model: the two vertical dotted lines correspond to the maturities of the short-term and long-term debt. The solid curved line represents one hypothetical path of assets over time, while the shaded areas correspond to possible asset values at T_S and T_L from the perspective of a market participant at time zero. The solid curved line represents the case in which no default on long-term debt takes place, neither at T_S nor at T_L. In contrast, the dashed line that starts at T_S represents a hypothetical path leading to default of the bank: at T_L the bank does not have enough to pay in full its obligations to debt holders.

More specifically, now, consider a bank at time zero, with assets $A(0)$, financed by short-term deposits Dep, unsecured and secured short-term debt, denoted by D_S and D_S^{Sec}, respectively, and long-term debt D_L. We make the simplifying assumption that deposits, short-term debt, and long-term debt are all zero coupon instruments, maturing at T_S (deposits and short-term debt) and at T_L (long-term debt). The balance sheet also reports "other liabilities" among the long-term liabilities. We assume that these liabilities also mature at T_L, and are senior to long-term debt. Finally, we assume secured short-term debt is senior to everything else, including deposits (which are instead partly insured by the FDIC).

As in Black and Scholes (1973) and Merton (1974), the market value of assets $A(t)$ follows a geometric Brownian motion. Under the pricing probability distribution, we then have that

$$\log(A(T_S-))\sim N(\log(A(0))+(r-0.5\sigma_A^2)T_S,\sigma_A^2T_S),$$

where r is the riskless rate. At T_S, there is a (risk-neutral) probability p that the asset value will drop to $A(T_S)=xA(T_S-)$. Because deposits are senior to unsecured short-term debt holders (and are insured by FDIC), the payoff to short-term debt holders at T_S is

$$\begin{aligned}ST\ Deb\ Payoff &= max(A(T_S)-(Dep+D_S^{Sec}),0)-max(A(T_S)\\ &\quad-(Dep+D_S^{Sec}+D_S),0).\end{aligned}$$

That is, the payoff is zero if $A(T_S)<Dep+D_S^{Sec}$, while it is $A(T_S)-(Dep+D_S^{Sec})$ if $A(T_S)>Dep+D_S^{Sec}$ but $A(T_S)<Dep+D_S^{Sec}+D_S$, and it is finally equal to D_S if $A(T_S)>(Dep+D_S^{Sec}+D_S)$. Note that in the former two cases, equity holders and debt holders get zero. It follows that by the usual option pricing arguments, the value of short-term debt under the two scenarios of no liquidity shock or with a liquidity shock at T_S are

$$\begin{aligned}V^S(A(0)|no\ shock\ at\ T_S) &= BSC(A(0),Dep+D_S^{Sec},\sigma_A,r,T_S)\\ &\quad-BSC(A(0),Dep+D_S^{Sec}+D_S,\sigma_A,r,T_S)\end{aligned}$$

$$\begin{aligned}V^S(A(0)|shock\ at\ TS) &= BSC(A(0)x,Dep+D_S^{Sec},\sigma_A,r,T_S)\\ &\quad-BSC(A(0)x,Dep+D_S^{Sec}+D_S,\sigma_A,r,T_S),\end{aligned}$$

where BSC denotes the Black and Scholes option pricing formula. Thus, the value of short-term debt is

$$\begin{aligned}V^S(A(0)) &= V^S(A(0)|no\ shock\ at\ T_S)(1-p)\\ &\quad+V^S(A(0)|shock\ at\ T_S)p.\end{aligned}$$

Conditional on the bank surviving at T_S, we can compute then the value of long-term claims. In particular, if the firm survives at T_S, its assets will be reset at

$$A^*(T_S)=A(T_S)-(Dep+D_S^{Sec}+D_S)$$

For simplicity, after paying the short-term liabilities, we assume that assets are still log-normally distributed

going forward. In particular, conditioning on a given $A(T_S) > Dep + D_S^{Sec} + D_S$, we assume

$$log(A^*(T_L))|_{A(T_S)} \sim N(log(A^*(T_S) + (r - 0.5\sigma_A^2)(T_L - T_S), \sigma_A^2(T_L - T_S)).$$

Given this, we can value the equity at T_S conditional on $A(T_S) > Dep + D_S^{Sec} + D_S$ again by Black and Scholes formula. In particular, under this condition the payoff to equity is given by

$$Equity\ Payoff = max(A^*(T_L) - (D_L + D_O), 0),$$

where D_O are the other liabilities in the balance sheet, and D_L is the face value of long-term debt, computed in such a way to make the value of the zero coupon bond equal to the estimated market value of debt of the bank (see below). Assuming the other liabilities are senior to long-term debt, the payoff to long-term debt holders is then

$$LT\ Debt\ Payoff = max(A^*(T_L) - D_O, 0) - max(A^*(T_L) - (D_L + D_O), 0).$$

It follows that conditional on $A(T_S) > Dep + D_S^{Sec} + D_S$, the value at T_S of equity and LT debt are, respectively:

$$V^E(A^*(T_S)) = BSC(A^*(T_S), D_L + D_O, \sigma_A, r, T_L - T_S)$$

and

$$V^{LT}(A^*(T_S)) = BSC(A^*(T_S), D_O, \sigma_A, r, T_L - T_S) - BSC(A^*(T_S), D_L + D_O, \sigma_A, r, T_L - T_S).$$

If $A(T_S) < Dep + D_S^{Sec} + D_S$, instead, the value of both equity and LT debt is zero. In order to compute the value today (i.e., time zero) for LT debt and equity, we must take their discounted expected value of the payoff at T_S, under the pricing probability distribution. Given the log-normality assumption, we therefore obtain

$$V^E(A(0)) = \int_{Dep + D_S^{Sec} + D_S}^{\infty} e^{-rT_S} V^E(A - (Dep + D_S^{Sec} + D_S)) f(A)\, dA$$

$$V^{LT}(A(0)) = \int_{Dep + D_S^{Sec} + D_S}^{\infty} e^{-rT_S} V^{LT}(A - (Dep + D_S^{Sec} + D_S)) f(A)\, dA$$

where $f(A)$ is a mixture of log-normal distributions, weighted by the probabilities p and $(1-p)$ that a liquidity shock occurs at T_S.

Finally, the calculations above also allow us to compute the value of the FDIC deposit guarantee. Let $Dep^{Ins} < Dep$ be the total amount of deposits that are insured by the FDIC. The same argument as above implies that the cost of the guarantee is given by the spread put option

$$V^G(A(0)) = V^G(A(0)|no\ shock\ at\ T_S)(1-p) + V^G(A(0)|shock\ at\ T_S)p,$$

where

$$V^G(A(0)|no\ shock\ at\ T_S) = BSP(A(0),\ Dep + D_S^{Sec}, \sigma_A, r, T_S) - BSP(A(0),\ Dep + D_S^{Sec} - Dep^{Ins}, \sigma_A, r, T_S)$$

and

$$V^G(A(0)|shock\ at\ T_S) = BSP(A(0)x, Dep + D_S^{Sec}, \sigma_A, r, T_S) - BSP(A(0)x, Dep + D_S^{Sec} - Dep^{Ins}, \sigma_A, r, T_S).$$

There are four unobservable entries in these formulas: the value of assets today $A(0)$, the volatility of assets σ_A, the probability of a liquidity shock p, and the loss in case of a shock x. We choose these quantities to match four observables: the market capitalization of each bank on October 10, 2008, the volatility of equity, as well as an estimate of market values of ST debt and LT debt on the same day. The estimated market value of debt is computed from CDS rates. First, we compute the average coupon and average maturity of debt, using data from Bloomberg (see Table 2). Second, we compute the present value of future (average) coupons and principal up to the (average) maturity, discounting them at the CDS implied yield

$$Yield = Risk\ Free\ Rate + CDS\ Rate.$$

Given the value of LT debt, we compute the principal value of an equivalent zero coupon bond with five year to maturity (the maturity of CDS) as

$$D_L = Value\ of\ Debt^*(1 + Yield)^5.$$

For ST debt we apply the same methodology, although we do not have coupons in this case. Since we are interested in very short-term probability of default, we considered a maturity of only three months in the calibration, and used the shortest maturity CDS (one year) to compute the implied yield.

It is worth pointing out that the CDS implied yields underestimate the true yield of bonds (see, e.g., Longstaff, Mithal, and Neis, 2005) and thus, we overestimate the value of debt in this case. We also computed the value of debt and implied transfers by treating the principal value as a zero coupon bond itself, thereby grossly underestimating the value of debt. The transfers from equity holders to debt holders were very similar.

For the calibration after the announcement on October 14, 2008, we control for other confounding news between October 10 and 14, 2008 by exploiting the estimation results in Sections 3.1 and 3.2, which provide the increase in the values of equity and debt that control for the market variation and the variation in GE Capital, respectively. In particular, we impose that the values of equity and debt on October 14, 2008 are equal to the respective values on October 10, 2008 plus the adjusted values. Because these adjustments do not regard the value of short-term debt, we perform a similar adjustment to the one-year CDS rates of banks on October 14, 2008, in which we control for the percentage decline in the CDS rate of GE Capital. The remaining part of the calibration on October 14, 2008 is the same as at the previous date.

Appendix C. More robustness calculations

C.1. Recovery rates and discounts

Another robustness check has to do with the assumptions we made about the recovery rates, a key assumption to compute the risk-neutral probabilities of default, used then to compute the value of debt insurance. In the body of the text we assume 20%, which is below the standard value assumed for single-name CDSs, which is 40% instead. Table 8 shows that changing the value of recovery rate from 20% to 0% or to 40% changes the result, but not the conclusion. In particular, with 0% recovery, the best (optimistic with Morgan Stanley) and worst (pessimistic without Morgan Stanley) cases are \$116 and \$25 bn.

respectively. With 40% recovery, instead, the best and worst cases are \$98 and \$20 bn, respectively.

One additional concern pertains to the discount rate used to compute the present value of insurance. In the body of the paper we use the US Treasury curve. However, since security dealers may default, it is customary to use the LIBOR curve to price CDS contracts. Using the LIBOR curve also does not change our conclusions, as the best and worst possible cases are now \$107 and \$24 bn, respectively.

C.2. Beta estimates

To compute the change in value of common stock, we controlled for the change in the stock market. The resulting adjusted equity values are therefore just an estimate, and we must consider their standard errors in our analysis. We check the robustness of our results to these estimation errors by computing the total costs and benefits after shifting of the regression coefficients by plus/minus two standard errors, which amounts to assuming that all regression coefficients are perfectly correlated, a strong, but conservative assumption. Once again, Table 8 shows that our conclusions remain the same: a two-standard deviation decrease in betas leads to a best and worst case of \$120 and \$35 bn, respectively, while these numbers are \$100 and \$16 bn when we increase the betas by two standard errors.

Appendix D. Taxpayers VaR calculations

For the Revised Paulson Plan, we compute the VaR from the perspective of taxpayers as follows: First, we estimate the correlation structure of banks' assets from the correlation of changes of short-term and long-term CDS rates. Second, we use these correlation structures to simulate the joint "liquidity shock" at T_S as well as the joint assets realization at $T=3$. More specifically, we compute the liquidity shock at T_S as follows: for each bank i, given a probability p_i of a liquidity shock, we compute a cutoff level $e_i=N^{-1}(p_i)$, where $N(\ )$ denotes the cumulative standard normal distribution. We then simulate a vector $\tilde{\varepsilon}\sim\varphi(0,R)$, where $\varphi(0,R)$ denotes the multivariate normal density with correlation matrix R. A liquidity shock for bank i is declared if $\tilde{\varepsilon}_i<e_i$. The correlation structure for liquidity shocks R is obtained from the variance covariance of the changes in short-term CDS rates. We simulate the value of assets $A^*(T)=(A_1^*(T),\ldots,A_n^*(T))$ at T jointly according to the model

$$\log(A^*(T))|_{A(T_S)}\sim N(\log(A^*(T_S))+(\mu-0.5\sigma_A^2)(T-T_S),\Sigma_A(T-T_S)),$$

where Σ_A is the joint covariance matrix obtained from the correlation of CDS rate changes and the calibrated asset volatilities σ_A, and μ is the risk-natural drift rate of assets, discussed further below. In this formula, for each bank i we have that its assets at T_S are given by

$$A_i^*(T_S)=max(A_i(T_S)+D_{ST}^*1.25-(Dep_i+DS_i+D_{SI}^{Gov}),0).$$

To explain this formula, $A_i(T_S)$ denotes the amount of assets at T_S, when the short-term liabilities become "due." This is given by $(A_i(T_S))=x_iA_i(T_{S^-})$ with a probability π_i and $(A_i(T_S))=A_i(T_{S^-})$ with probability $(1-\pi_i)$, where π_i denotes the risk-natural probability of a shock, discussed below. To compute the three-year VaR, we need to take into account the ability of banks to issue new debt (as part of the FDIC plan), therefore, we augment the asset value by the amount that the bank can issue at T_S minus the total liabilities that become due at T_S, according to the model, namely, deposits Dep, unsecured ST debt D_S, and secured ST debt D_S^{Gov}. If the bank total net assets at T_S are smaller than zero, the bank fails. As before, we simulate the vector $A(T_S)=(A_1(T_S),\ldots,A_n(T_S))$ jointly according to the model

$$\log(A(T_S))\sim N(\log(A(0)+(\mu_0-0.5\sigma_A^2)T_S,\Sigma_AT_S),$$

where μ_0 is the drift rate of assets before T_S is discussed further below.

For each bank i we then compute the government disbursement at $T=3$ as the difference between $D-A(T)$, if any, where D equals the total LT debt maturing by T plus the new guaranteed debt $D_S{}^*1.25$ issued at T_S, capitalized at the risk-free rate to T (because it is government guaranteed), up to the maximum guaranteed debt. To be conservative, we do not include "other liabilities" in D. On top of this, we compute the value of the investment in equity for the government, by using the Black and Scholes (1973) option pricing formula to compute the value of equity defined on the simulated assets at time T, minus of course the maturing guaranteed debt $D_S{}^*1.25$, capitalized at the risk-free rate to T. This approach ensures the correct correlation between losses from the guarantee and equity investment, as if a bank needs a government intervention because of losses on assets, its equity value ought to be small as well, implying a double loss for the government. The potential losses are given by the sum of losses from the guarantee and from the equity position.

We compute the VaR for the other three cases (purchase of assets with and without overpayment, and pure capital infusion without guarantee) in an analogous manner. In particular, consider the scenario in which the government purchases the banks' assets (with or without overpayment). As mentioned, we calibrate the amount of the purchase, and the risk-neutral probability p_i as of October 14, 2008 to match the decline in the one-year and five-year CDS rates. Because we assume the government buys assets with cash, we assume that both the asset volatility σ_A and the losses in case of a liquidity shock x decline proportionally with the fraction of total assets purchased by the government. Let $A_i(0)$ be the total amount purchased from bank i. We then simulate the value at $T=3$ of these assets $A_i(T)$ as above. For symmetry, we also consider in this case a shock at T_S for the value of assets held by the government. In particular, we define the after-shock value of assets as $A_i^*(T_S)=A_i(T_S)$ if no shock occurs, and $A_i^*(T_S)=xA_i(T_S)$ if a shock occurs. The remaining calculations are the same, noting that in this case there is no guarantee in place, and thus, all of the VaR is coming from the devaluation of the assets purchased.

Finally, for the case of a pure capital infusion, we follow the same approach of simulating the value of assets at $T=3$. From the calibration we obtain the capital infusion necessary at zero to yield a reduction in the value of CDS

rates comparable to the ones in the data. From the capital infusion, we then obtain the percentage of government ownership of the bank and the value of initial assets of the bank (equal to old assets plus additional capital). We then simulate the value of assets at T as in the previous cases, taking into account that at T_S the bank can fail if its assets are below the total amount of short-term liabilities D. Recall that there is no guarantee in this case. At T, we compute the value of equity using the Black and Scholes formula for equity, and compute the profits/loss for the government as the difference from the initial capital infusion. We obtain the VaR number from the distribution of profits/losses at T.

One final important issue in the simulation of the asset value of each bank i, $A_i(T)$, is how to move from the risk-neutral dynamics to the risk-natural (physical) dynamics, which is needed for VaR calculations. To move from risk-neutral to risk-natural probability measures, it suffices to make an assumption about the risk premium on traded assets. We assume that the market value of these assets has a relatively generous Sharpe Ratio of 35%. Note that the higher the Sharpe Ratio, the higher is the expected value of future assets and thus, the lower is the VaR. Given the assumed Sharpe Ratio λ=35%, the annual drift rate of assets after T_S is then given by

$$\text{drift rate of assets} = \mu = \text{risk free rate} + \lambda\sigma_A,$$

where σ_A is the volatility of assets. This transformation must hold for $t > T_S$. At T_S there is also the liquidity shock, and thus, the drift rate of assets before T_S must be adjusted to ensure that the ex ante Sharpe Ratio is consistent with the possible crash. In particular, we proceed as follows: Let π denote the risk-natural probability of a drop at T_S. Then, we first require that the return on assets over T_S must still be μ, that is $E[A(T_S)]=A(0)\exp(\mu T_S)$, which in turn implies

$$\begin{aligned} E[A(T_S)] &= (1-\pi)A(0)\exp(\mu_0 T_S) + \pi x A(0)\exp(\mu_0 T_S) \\ &= A(0)\exp(\mu T_S) \end{aligned}$$

or

$$\mu_0(\pi) = \mu - \log((1-\pi)+\pi x)/T_S.$$

That is, for a given π we can compute the drift μ_0 which ensures the proper expected return. We can then pin down π by imposing a Sharpe Ratio also on the ex ante investment. In particular, we can compute the variance of $A(T_S)$. The second moment is

$$\begin{aligned} E[A(T_S)^2] &= [(1-\pi)+\pi x^2]E[A(T_S)^2] = [(1-\pi)+\pi x^2]E[A(T_S)^2] \\ &= [(1-\pi)+\pi x^2]A(0)^2\exp(2\mu_0+\sigma_A^2)T_S) \end{aligned}$$

yielding

$$\begin{aligned} V(A(T_S)) &= E[A(T_S)^2] - E[A(T_S)]^2 \\ &= [(1-\pi)+\pi x^2]A(0)^2\exp((2\mu_0+\sigma_A^2)T_S) \\ &\quad -[(1-\pi)+\pi x]^2 A(0)^2\exp(2\mu_0 T_S) \\ &= \{[(1-\pi)+\pi x^2]\exp(\sigma_A^2 T_S) - [(1-\pi)+\pi x]^2\} \\ &\quad \times A(0)^2\exp(2\mu_0 T_S). \end{aligned}$$

The T_S Sharpe Ratio (SR) is then the expected excess return $E[A(T_S)/A(0)-\exp(rT_S)]$ divided by the standard deviation $STD(A(T_S)/A(0)) = V(A(T_S)/A(0))^{1/2}$, that is

$$\begin{aligned} SR &= E[A(T_S)/A(0) - \exp(rT_S)]/STD(A(T_S)/A(0)) \\ &= [(1-\pi)+\pi x - \exp(-(\mu_0(\pi)-r)T_S)]/\{[(1-\pi)+\pi x^2] \\ &\quad \times \exp(\sigma_A^2 T_S) - [(1-\pi)+\pi x]^2\}^{1/2} \end{aligned}$$

We obtain the probability π by imposing $SR=0.35\sqrt{T_S}$ [in random-walk types of models, the Sharpe Ratio is increased as a square root of time, as the expected return at the numerator increases linearly, but the standard deviation increases as a square root of time].

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A New Capital Regulation For Large Financial Institutions

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Abstract

We design a new, implementable capital requirement for large financial institutions (LFIs) that are "too big to fail". Our mechanism mimics the operation of margin accounts. To ensure that LFIs do not default on either their deposits or their derivative contracts, we require that they maintain a cushion of equity and junior long-term debt sufficiently great that the credit default swap price on the long-term debt stays below a threshold level. If the CDS price moves above the threshold, the LFI can issue new equity to bring it back down. If this effort fails and the CDS price stays above the threshold for a predetermined period of time, the regulator intervenes. We show that this mechanism ensures that LFIs are always solvent, while preserving some of the benefits of debt.

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1. Introduction

If there is one lesson to be learned from the 2008 financial crisis, it is that large financial institutions (LFIs) are too big to fail. [1] This may be for (sound) economic reasons or (less sound) political economy ones. The economic reasons are that LFIs are highly interconnected through a web of contracts, that the failure of one will lead to the failure of others, and that while the economy can survive the loss of a single LFI it cannot survive the loss of the entire financial sector. The political economy reasons are that politicians cannot resist the pressure by the public or by the LFIs themselves to intervene in a crisis.

Of course, a regime in which LFIs won't be allowed to go bankrupt in the normal way can impose large costs on society. First, there is the possibility of large future taxpayer losses to cover bail-outs. Second, knowing that they will be saved, LFIs may engage in risky behavior that will help to bring about the very crisis that society is trying to avoid. We already see signs that the market has understood that large LFIs may, paradoxically, be safer after the crisis than before. Large banks, which before the crisis could borrow at 29 basis points below small banks' borrowing rates, can today borrow at 78 basis points below. For the 18 bank holding companies with more than $100 billion in assets the 49bps advantage corresponds to a $34.1 billion subsidy a year.[2]

Given that society will bear the ex post costs of LFI failures there is a strong argument for regulating LFIs ex ante to mitigate these costs. The question, of course, is what form should the regulation take. Many suggestions have been made. These include limiting the size of LFIs; restricting the kinds of activities an LFI can undertake (as in the former Glass-Steagall act and the "Volcker plan" that is part of the 2010 Dodd and Frank Act); encouraging LFIs to plan for their own demise by writing living wills; issuing debt that converts into equity if the company is in trouble ("COCO bonds"); constraining executive pay; or requiring LFIs to take out contingent capital insurance.[3] In this paper we argue for a different approach. We suggest that, rather than micro-managing the

[1] The too-big-to-fail doctrine is not new (Stern and Feldman, 2004), but its practical relevance has often been questioned (Meltzer, 2004).
[2] Baker and McArthur (2009).
[3] For proposals to restrict bank size, see, for example, Fisher (2010); to restrict activities, see Kotlikoff (2010); for living wills, see Goodhart and Schoenmaker (2010); for convertible bonds, see Squam Lake Report (2010);for constraining executive compensations, see Bebchuck and Spamann (2009); for contingent capital insurance, see Acharya et al. (2010) and Kashyap et al. (2008).

activities of an LFI, it might be better to implement an early warning system that will alert the regulator to the fact that an LFI is in trouble. The regulator can then intervene before the damage spreads to other institutions and social costs are incurred. We propose a mechanism that achieves this goal. It is market-based and minimizes policy-maker discretion. It also avoids bail-outs.

In broad terms, our mechanism mimics the way margin calls function. In a margin account an investor buys some stock, putting down only part of the cost. When the stock price drops, the broker who extended the loan asks the investor to post additional collateral. The investor can choose between posting new collateral (and in so doing re-establishing the safety of the position) or having his position liquidated (which allows creditors to be paid in full). With a dynamic system of margin calls, the broker minimizes the amount of collateral posted by the investor, while at the same time ensuring that the debt is paid with probability one.

Our capital requirement system works in a similar way. First, we distinguish between an LFI's "systemically relevant" obligations, e.g., bank deposits, short-term interbank borrowing, derivative contracts; and its "non-systemically relevant" ones, e.g., long-term debt. We regard the systemic obligations as sacrosanct—they should be protected in all circumstances. In contrast the non-systemic obligations can at least in principle be impaired (although it is a feature of our mechanism that this will not happen in equilibrium) because they are not generally held by other financial institutions. This debt is typically held in the portfolios of mutual funds and pension funds, which can absorb losses on the debt in the same way that they absorb losses on equity investments. In our mechanism the systemic obligations would be explicitly senior, while the non-systemic ones would be explicitly junior.[4] (In the current system, this priority is implicit rather than explicit.)

Not only do we allow an LFI to have non-systemic obligations, we *require* it. That is, an LFI would be forced to have a minimum ratio of junior long-term debt to assets as in the Basel III proposal. Moreover, LFIs would have to post enough collateral

[4] An LFI could also issue secured debt, which would lie between systemic and non-systemic debt in seniority.

(equity) to ensure that the junior long-term debt, as well as the systemically relevant debt, is paid in full.

In our capital requirement system, when a fall in the value of the underlying assets puts the junior debt at risk, LFI equity-holders are faced with a margin call and they must either inject new capital or lose their equity. There are three main differences between our system and standard margin calls: the trigger mechanism, the action taken if the trigger is activated, and the presence of the additional cushion of junior long-term debt. In a margin account the broker looks at the value of the investments (which is easily determined since all assets are traded) and compares the value of the collateral posted with the possible losses the position might have in the near future. If the collateral is insufficient to cover an adverse movement in the value of the position, the broker calls for more collateral. In the LFI case, the value of investments (i.e., the value of the LFI's assets) is not easily calculable, because the underlying assets—commercial loans and home equity lines, for example—are not standardized and not frequently traded. Thus it is not easy to determine when the margin is too thin to protect the existing debt.

To solve this problem we rely on the price of a credit default swap (CDS) on an LFI's junior long-term debt as the trigger. A credit default swap is an insurance claim that pays off if the LFI fails and creditors are not paid in full. Since the CDS is a "bet" on the institution's strength, its price reflects the probability that the junior long-term debt will not be repaid in full. In essence, the CDS indicates the risk that the LFI will fail. As we will explain, the CDS is a better indicator than equity, because equity prices capture also the upside and thus might disguise the probability of default when the assets are very volatile. As an alternative to the CDS we could use the yield on the junior long-term debt, although this debt tends to be less liquid than the CDS.

In our mechanism, when the CDS price rises above a critical threshold, the LFI can issue equity to bring it down. If this effort fails and the CDS price stays above the threshold for a predetermined period of time, the regulator intervenes. (The criterion for intervention might be that the average CDS price over the previous month exceeds 100 basis points.)

The role of the regulator is the second difference from a standard margin call system. Debt-holders of an LFI are often dispersed and so cannot coordinate their actions:

one of the regulator's roles is to act as a coordinator. If the regulator intervenes she first determines whether the LFI debt is at risk – in effect, she carries out a "stress test". If she finds that the long-term debt is not at risk (i.e., the CDS prices were inaccurate), then she declares the company adequately capitalized and to prove it injects some government money. If, on the other hand, she finds that the debt is at risk, the regulator eliminates all the debt except for the systemic obligations and replaces the CEO with a receiver (or trustee). The receiver's task is to raise as much cash as possible from the new "debt-lite" firm. To this end he may sell it (possibly after running it for a while); alternatively, he may recapitalize the firm and raise cash by carrying out an IPO. Any cash raised is used to pay off creditors—however, they receive a haircut (at least 20%, say). Shareholders are wiped out. Any remaining funds go to the taxpayer. This regulatory takeover is similar to a milder form of bankruptcy, and it achieves the goals of bankruptcy (discipline on the investors and management) without imposing systemic costs.

The third difference from a standard margin call system is the layer of junior long-term debt. This debt has a dual function: to provide extra protection for the systemic obligations and to provide the underlying asset on which the CDS is traded.

As will become clear below, the stress test and haircut are important features of our approach. The stress test prevents "bear raids" that can lead to the liquidation of a healthy LFI. The haircut ensures that the CDS price provides an accurate assessment of an LFI's probability of default.

One of the advantages of our approach is that it is easily applicable to all financial institutions regardless of their organizational structure. One of the weaknesses of the current capital requirement system is that it applies only to certain types of institutions (commercial banks, but not investment banks or hedge funds), creating ample opportunity for regulatory arbitrage. In contrast, our rule can be applied to all financial institutions holding assets in excess of a predetermined threshold ($200 billion, say).

Our mechanism belongs to the category of market-based corrective actions, analyzed by Bond et al. (2010). We eliminate the possibility of multiple equilibria, however, by having the regulator impose a cost on bondholders even when the debt can be paid back in full (this does not happen on the equilibrium path).

Our capital requirement mechanism resembles in some respects the interesting proposal by Flannery (2005), which has been refined by many others (Albul et al (2010), McDonald (2010), Flannery (2009), Pennacchi et al. (2010), Raviv (2009), Squam Lake Working Group on Financial Regulation (2009)). In this proposal debt is converted into equity when the value of equity becomes close to zero. This solution has some potential shortcomings. First, it is lenient toward management, eliminating one of the disciplinary effects of debt. Second, it can have perverse effects: the manager talking down the stock so as to obtain more slack. Third, it can generate a self fulfilling equilibrium, in which the equity price is low because the market anticipates that equity will be diluted in a debt conversion.[5] These shortcomings have been addressed in a recent proposal advanced by the Squam Lake Working Group on Financial Regulation (2009). This proposal conditions the conversion of the debt on two events: the declaration by the regulator that the financial system is suffering a systemic crisis and the violation by the bank of covenants in the "convertible" debt security. Apart from the exact mechanism, the main practical difference between this proposal and ours is the timing: our proposal tries to prevent systemic crises, while the Squam Lake Working Group proposal tries to minimize the costs when a crisis occurs.

Our proposal is also similar to Duffie (2010), who advocates the use of a mandatory offer to existing shareholders to purchase new equity at a low price when a financial institution fails to meet a stipulated liquidity or capital requirement. In fact, we provide a market-based trigger for such a requirement.

In addition our proposal is related to that of Kashyap et al. (2008), who devise a form of state contingent insurance to inject capital in the banking sector during a systemic crisis. The two proposals have in common that they both rely on a contingent capital rule. They differ, however, in that our proposal relies only on firm-level information, while their proposal depends on aggregate information. We discuss the differences further below. Finally, our market-based trigger is similar to various proposals to use subordinated debt as a signal of bank solvency (see, e.g., Calomiris (1999) and, for a comprehensive survey, Evanoff and Wall (2000)). While the idea of using the market to

[5] Pennacchi et al. (2010) eliminate the possibility of multiple equilibria by giving shareholders the option to buy back the shares at the issuing price. This modification does not resolve (in fact, it exacerbates) the first concern: that convertible debt becomes too lenient toward management.

collect information is common to both sets of proposals, the mechanism and the trigger differ. More importantly, we explain how a debt instrument can provide valuable market signals even if the institution is not allowed to go into bankruptcy.

Our proposal follows the micro approach to prudential regulation in that it deals with the perverse incentives at the company level, but it does not address the possible underinvestment problem that will occur at the macro level if all financial institutions find themselves in trouble and try to deal with this by shrinking their lending rather than raising new equity. Kashyap and Stein (2004) propose to address this problem by having an adjustable capital requirement, which depends possibly on the business cycle. Our proposal can easily be merged with theirs, since the CDS trigger can be indexed to macroeconomic factors.

The rest of the paper proceeds as follows. Section 2 describes the framework. Section 3 presents the main results. Section 4 extends the model to the case where LFI activities are endogenous; in particular, the LFI can choose how much risk to undertake. Section 5 provides further discussion of our mechanism and describes how it would work in practice. Section 6 concludes.

2. Framework

As we have noted, the economic logic of "too big to fail" is based on the idea that financial institutions are highly interconnected through derivative and repo contracts and that the default of one might trigger losses for counterparties, producing further defaults. To function properly the financial system needs to operate under the assumption that certain assets, such as deposits, are "worry free", i.e., depositors do not have to monitor counterparty solvency. This belief saves a tremendous quantity of resources, permitting the system to operate more efficiently. But this belief can be supported only if the prompt and full repayment of "sensitive" or "systemically relevant" obligations is not in question. In this respect, even the risk of some minor bureaucratic delay in repayment can undermine confidence. For this reason, we assume that the role of regulation is not only to eliminate the risk of losses on systemic obligations, but also to protect such obligations

from the uncertainty triggered by a default on non-systemic obligations. In short, we suppose that the regulator wants to avoid bankruptcy altogether.[6]

In what follows, we categorize as systemic obligations short-term interbank borrowing, derivative contracts, and bank deposits; while we consider long-term debt as non-systemic. We refer to non-systemic obligations as "financial debt".

From the issuer point of view, there may be various advantages to issuing systemic obligations over non-systemic ones; for example, they may incur a lower interest rate.[7] In our formal model we will not include the advantages of systemic obligations (although we will relax this assumption at the end of Section 3). Indeed our formal model does not deal with the issue of why an LFI issues sensitive obligations, such as bank deposits, at all. To put it another way our model is as much one of a regular company such as General Motors as it is of Citigroup or AIG. In future work we hope to deal more thoroughly with what is special about a financial institution. Note, however, that the current approach has one advantage. The recent crisis suggests that some non-financial firms are also too big to fail, and our mechanism may be relevant for them as well.

To the extent that our model applies to a generic company we have to explain why such a company raises capital by issuing debt rather than equity. There are several possible reasons. First, debt may be cheap to the extent that it is implicitly backed by the government. Second, debt has certain tax advantages. Third, debt reduces agency costs.

In our model we focus on this last reason--the agency benefits of debt-- but the thrust of our analysis carries through regardless of the motive for issuing debt. To model the agency benefits of debt in a very simple manner we assume that the LFI manager can "steal" a fraction λ of the cash flow available after having paid down the debt. One possible interpretation of this assumption is that managers can pay themselves large bonuses as long as the firm does not become insolvent afterwards. If the company

[6] In other words, we are implicitly assuming that the cost of a systemic failure outweighs everything else in the regulator's objective function.

[7] A difference between systemic and non- systemic obligations will also arise if the LFI can use systemic obligations strategically to ensure a government bailout. Since in our model there is no scope for a government bailout, this strategic motive will be absent in equilibrium.

becomes insolvent, then the managers risk losing their bonuses because creditors can try to reclaim them through a fraudulent conveyance suit.[8]

In the absence of a board that is loyal to shareholders, this managerial agency problem cannot be resolved through contracts, since shareholders have no legal right to bind managers through contracts, while they do have the ability to constrain them through debt and fraudulent conveyance suits.

For simplicity we consider a three date model with the structure displayed in Figure 1, where the $p_i > 0$ indicate the probabilities of the various branches and the V_i the cash flow realizations in the different states of the world.

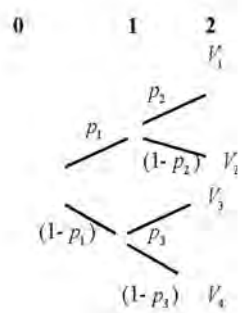

Figure1

We suppose that $V_1 > V_2 > V_3 > V_4$.

In our model the firm's capital structure consists of a choice of debt D due at date 2 (we will discuss the possibility of short-term debt in Section 5.4). (To repeat, we do not distinguish between systemic and non-systemic debt until the end of Section 3.) We

[8] The New York's "fraudulent conveyance" statute gives creditors the right to recover a payment to an insider if "the paying firm (1) did not receive fair consideration for the payment and (2) at the time had unreasonably small capital for its business operations" (Fried (2008)). Similarly, the 2005 "Bankruptcy Abuse Prevention and Consumer Protection Act" introduced the possibility of clawing back executive bonuses paid in the last two years under the fraudulent conveyance rule or in the last year under the preference-payment rule. In the early 1990s the Resolution Trust Corporation sued former employees of Drexel Burnham Lambert Inc., seeking the return of more than $250 million of bonuses paid. Many Drexel employees agreed to surrender a portion of their bonus. This situation is not unique to the United States. Thorburn (2004) finds that in 23% of the Swedish bankruptcy cases she studies there are fraudulent conveyance claims, with successful recovery in two thirds of the cases. In 86% of the cases where fraud is alleged the transfer has been made to insiders.

assume that the capital structure is set in a value maximizing way at date zero as a result of some takeover threat or coordinated effort by large shareholders. At date 1 the LFI manager can modify the capital structure by issuing equity only if he has shareholders' approval. At date 2 the company pays out the cash flow V_i, i=1,...,4, according to the state, and terminates. The market is supposed to be risk neutral, and the interest rate is zero.

In the absence of any debt the market value of the LFI (which we label V^U, i.e., value of the unlevered firm) would be

$$V^U = (1-\lambda)[p_1 p_2 V_1 + p_1(1-p_2)V_2 + (1-p_1)p_3 V_3 + (1-p_1)(1-p_3)V_4].$$

If we introduce debt D, due at date 2, such that $V_4 < D < V_3$, then the market value of the debt V^D at issue will be

$$V^D = [p_1 p_2 + p_1(1-p_2) + (1-p_1)p_3]D + (1-p_1)(1-p_3)V_4,$$

and the total value (net of the systemic debt) of the levered LFI (V^L) will be

$$V^L = V^U + \lambda[p_1 p_2 + p_1(1-p_2) + (1-p_1)p_3]D + \lambda(1-p_1)(1-p_3)V_4.$$

Not surprisingly, since we have assumed that there is a benefit, but not a (private) cost, of debt, the value of a LFI is monotonically increasing in the level of debt outstanding. Strictly speaking, the above formula applies only for $V_4 < D < V_3$, but the same reasoning extends to all intervals. As a result, a value-maximizing LFI left to its own devices will pick a debt level equal to V_1, which would lead to bankruptcy essentially all the time.[9]

We could, of course, qualify this extreme result by introducing a private cost of debt for the LFI. Instead, however, we will focus on the social cost of debt. In particular, as discussed above, we will assume that the social cost of the LFI's bankruptcy is so great that bankruptcy must be avoided with probability 1.[10]

To ensure no risk of bankruptcy a regulator could impose a debt level less than or equal to V_4. However, this would impose a high cost for the LFI, which will lose $\lambda[p_1 p_2 + p_1(1-p_2) + (1-p_1)p_3](D - V_4)$ in value.

[9] The LFI will use the debt it issues to buy back equity at date zero. Shareholders are able to extract the full value of the company through this buy-back even though the ex post value of equity is zero.
[10] We do not consider mechanisms that use taxpayers' money to bail out the LFI in equilibrium.

The question then is whether there exists a contingent capital requirement such that the value of the LFI is above

(1) $$V^{L} = V^{U} + \lambda V_4,$$

but debt is paid with probability one. In the next section we will show that this is possible. We start by assuming that at date 1 the states of the world are observable and verifiable (i.e., everyone knows whether we went along the upper branch of the tree or the lower one). We then relax this assumption and show how such a rule is implementable even if the states of the world are observable but not verifiable, as long as there is an active market for credit default swaps.

3. Main Results

3.1 The States of the World are Verifiable

In this section we allow the regulator to force the company to raise additional equity capital as a function of what happens between dates 0 and 1 (whether we follow the upper branch or the lower one). We continue to assume that the initial debt level D is not state-contingent. [11]

Consider a date zero debt level D (due at date 2) such that $V_4 < D < V_3$. Then, if at date 1 the realization is positive (upper branch of the tree), the debt is not at risk and nothing needs to be done. If the realization is negative (lower branch of the tree), then the debt starts to become risky and the LFI receives a margin call, i.e., it is forced to raise more equity. In order for the debt to return to being riskless, the LFI must raise $y \equiv D - V_4$. However, by diluting the entire value of existing equity-holders, the LFI can raise at most

$$p_3(1-\lambda)(V_3 + y - D).$$

Hence feasibility requires

$$p_3(1-\lambda)(V_3 + y - D) \geq y,$$

which implies that for a debt level D to be made riskless through a margin call it must satisfy

[11] One possibility we rule out is that the initial capital structure mandates that leverage be increased if the company is in the upper branch. Allowing this would not affect the benefits of our market-based capital requirement.

(2) $$D \le V_4 + p_3(1-\lambda)(V_3 - V_4).$$

The value of the LFI at date zero can be calculated as the expected value of the date-2 payoffs minus the expected value of the additional equity issue, or

$$V^L = (1-\lambda)[p_1 p_2 (V_1 - D) + p_1(1-p_2)(V_2 - D) + (1-p_1)p_3(V_3 + y - D)] + D - (1-p_1)y.$$

Substituting the value of y we obtain

(3) $$V^L = V^U + p_1 \lambda D + (1-p_1)\lambda V_4.$$

Since (3) is increasing in the debt level D, it will be optimal for the LFI to set D at the maximum level compatible with the financing constraint (2). Substituting this level in (3) and rearranging we obtain the maximized value of the LFI $\hat{V}^L$:

(4) $$\hat{V}^L = V^U + \lambda V_4 + \lambda p_1 p_3 (1-\lambda)(V_3 - V_4).$$

Equation (4) has an easy interpretation. In a levered firm debt prevents managerial stealing. Since in all states of the world there is at least V_4 in debt, the second term (λV_4) represents the stealing prevented in all states of the world. With probability p_1 the higher debt level remains in place and this will prevent some further stealing. Since in these cases the debt level exceeds V_4 by $p_3(1-\lambda)(V_3 - V_4)$, and stealing occurs at rate λ, this explains the third term. With probability $(1-p_1)$ at date 1 we find ourselves in the lower branch of the tree. Since in these cases the debt level must be brought down to V_4 to avoid default, there is no additional stealing prevented in these states of the world. Thus, there is no additional term.

Since (4) is clearly larger than (1), when we require a LFI never to fail, a contingent capital allocation yields a higher market value for the LFI than a non-contingent capital allocation.

Equation (4) also provides us with a nice intuition for the conditions that will make a LFI with a contingent capital structure more valuable than a LFI with a non-contingent capital structure. If we interpret $(V_3 - V_4)$ as a measure of the volatility of the underlying assets, we have that the higher the volatility, the higher is the difference between (4) and (1). Similarly, for a low level of agency costs λ ($\lambda < 1/2$), the larger the size of the agency problem λ, the larger is the difference between (4) and (1). For a high level of agency costs this relationship is inverted because the amount of extra borrowing

the LFI can undertake with a contingent capital structure is limited by the difficulty of raising additional equity, which is not worth a lot when agency costs are high. Finally, a contingent capital structure is more preferable the more likely is the good case scenario (i.e., the higher p_1 and p_3 are).

We should emphasize that our mechanism does not achieve the first-best. In the first-best there would be no bankruptcy *and* no stealing. One way to achieve this would be to have state-contingent debt: in state i the company owes $D = V_i$. The problem, of course, is that we are really interested in the case where the states of the world are not verifiable, in which case state-contingent debt would be hard to implement. Thus for the rest of the paper we will restrict ourselves to mechanisms of the following type: the company issues non-contingent debt at date 0, and the only possible adjustment consists of the issuance of new equity at date 1.

Given this, and the constraint that the probability of bankruptcy must be zero, it is easy to see that we have solved for the second-best; that is, one cannot do better than to set $D = V_4 + p_3(1-\lambda)(V_3 - V_4)$ and have the company issue new equity if it follows the lower branch between dates 0 and 1. The reason is simple: lower levels of debt lead to more stealing while higher levels of debt lead to the possibility at date 1 that the company cannot issue enough equity to avoid bankruptcy at date 2.

3.2 The States of the World are Not Verifiable

So far we have assumed that the states of the world are verifiable and that the regulator can write a state contingent rule. This is clearly unrealistic. In fact, the very problem of a contingent capital requirement is how to make this rule implementable in a world where neither the regulator nor (many of) the debt-holders know what the true value of the LFI's assets is.

While the value of LFI assets is not verifiable, there are several claims on these assets that are generally traded and whose prices can be easily verified: a common stock, bonds, a short-term interest rate, and a credit default swap (CDS). If there is a significant fraction of traders who observe the state of the world, the prices of these securities will incorporate the informed traders' information. This information reflects not only what

traders know about the value of the LFI's assets but also what traders expect that the regulator will do in case of insolvency (an example of market-based corrective actions).

As Bond et al. (2010) show, this endogeneity of market prices limits the effectiveness of market-based corrective actions. We take this problem into account and show that, if we use credit default swaps, we can design an intervention mechanism that supports fully revealing prices. As we discuss in Section 5.2, there are several reasons why prices of CDSs (if the CDS are properly collateralized and transparently traded on an exchange) are preferable to other debt-based prices. Yet, our result applies to any debt-like instrument.

The CDS is a contract that promises to exchange a bond with an amount of cash equal to the bond's notional value in the event of default (which, if our scheme is in place, would include receivership, since this leads to an automatic haircut). The price of this contract in basis points (p_{CDS}) is the insurance premium paid every year on a notional amount of $100 of debt. By arbitrage the CDS rate satisfies

$$\frac{p_{CDS}}{10000} = \pi(1 - \text{recovery rate})$$

where π is the (risk neutral) probability of default and the recovery rate is the proportion of the value of the debt recovered in the event of a default. As long as the haircut is predetermined, the CDS prices will reflect the (risk neutral) probability of default.

To understand how our mechanism works, consider Figure 2, where we have split up the interval between date 1 and date 2 into subintervals. Suppose that, after the realization of the first shock at date 1, the manager has the chance to raise equity. After he decides how much equity to raise the CDS market price is observed. At this point, if the CDS price is "too high", the regulator intervenes before the second shock is realized. At date 2 the second shock is realized.

Figure 2: Timing

First shock is realized at date 1	LFI decides whether to issue equity	Market price of CDS observed	Regulator decides whether	Second shock is realized

to intervene at date 2

The regulator's intervention, if it occurs, takes the following form:

(1) The regulator first determines whether the LFI debt is at risk – in effect, she carries out a stress test. If she finds that the debt is not at risk (i.e., the CDS prices were inaccurate), then the regulator declares the company adequately capitalized, and leaves management in place. To support her finding the regulator injects a predetermined amount of cash (as a percentage of assets) in the form of debt that is pari passu with respect to existing financial debt.

(2) If the regulator determines that the debt is at risk, the regulator eliminates all the debt except for the systemic obligations (derivative contracts, bank deposits, etc.), and replaces the CEO with a receiver (or trustee). The receiver's job is to sell the LFI for as much cash as possible within a reasonable period of time (alternatively, he may recapitalize the firm and raise cash by carrying out an IPO). The receiver distributes the proceeds from the sale according to absolute priority, except that he ensures that creditors are not fully repaid --the rule might be that they receive the smaller of what's available and 80% of what they are owed; that is, they receive a haircut of at least 20%-- and that shareholders receive nothing (anything left over goes to the government). [12]

In the remainder of this section we assume that the regulator intervenes if and only if the CDS price is greater than zero, i.e., any strictly positive CDS price is "too high". (This is obviously unrealistic. We discuss more realistic rules in Section 5.) We also suppose that the regulator has the same information as the CEO when she intervenes—she learns which branch of the tree the firm has gone down. Finally, we assume that, if the firm fails the stress test, the regulator-appointed receiver cancels *all*

[12] It is not essential that the receiver raises cash, e.g., he could carry out a Chapter 11-type reorganization via a debt-equity swap. Our early warning system, based on a threshold for the CDS price, generalizes to such an approach.

the debt (recall that we are not distinguishing between systemic and non-systemic debt in the model).

Proposition 1:

Suppose that the state of the world is observable but not verifiable, and the sequence of events is as described above. Assume $D \leq V_4 + p_2(1-\lambda)(V_3 - V_4)$. Then the equilibrium price of a CDS p_{CDS} will be greater than zero at date 1 if and only if the lower branch of the tree is followed and the LFI raises equity with value less than $D - V_4$ at date1.

Proof:

Suppose that the lower branch is followed and the LFI raises equity less than $D - V_4$. Then it cannot be a rational expectations equilibrium for the regulator not to intervene. The reason is that there is then a positive probability that the debt will not be paid at date 2, and the CDS price will reflect this. Suppose instead that the market expects the regulator to intervene. The regulator will find that the LFI is under-capitalized, and so she will send in a receiver who will reorganize the LFI, imposing a haircut on the creditors. Since the creditors receive a haircut, the CDS price will be positive. Thus the unique rational expectations equilibrium is for the CDS price to be positive and for the regulator to intervene.

Consider next the case where the lower branch is followed and the LFI raises equity greater than or equal to $D - V_4$. Then if the regulator intervenes she will find that the debt is not at risk and she will invest some funds in the form of debt, which is pari passu with respect to the existing financial debt. The injection of cash will make the debt even safer. The debt is also not at risk if the regulator does not intervene. Thus the unique rational expectations equilibrium in this case is for the CDS price to be zero and for the regulator not to intervene.

Consider finally the case where the upper branch of the tree is followed. Then the debt is not at risk, and so the unique rational expectations equilibrium is one where the CDS price is zero and the regulator does not intervene. Q.E.D.

It is worth high-lighting how both the stress test and the haircut play important roles in the proof of Proposition 1. First, the stress test rules out a bad equilibrium of the following form: the CDS price is positive in spite of the fact that the LFI is not financially distressed; this triggers regulatory intervention; because, say, receivership is on average value-destroying, creditors are not fully repaid; this sustains the positive CDS price. Given the stress test, if the LFI is not financially distressed and the regulator intervenes, she will discover the truth and will not send in a receiver. Thus there is no bad equilibrium.

Second, the haircut rules out a situation where even though the LFI is financially distressed and intervention should occur the CDS price is zero and so intervention does not occur. This could happen because the market thinks that the receiver is better than current management and hence creditors will be fully repaid under receivership. With a haircut even the anticipation of a super-efficient receiver will lead to a positive CDS price.

Proposition 1 ensures that the CDS price is a perfect indicator of when the regulator needs to intervene. Anticipating the behavior of the CDS price and hence of the regulator, the CEO of a LFI will always prefer to issue equity of value $D-V_4$ when the first period realization is negative. If he does not, the CDS price will be positive, the regulator will intervene, and the CEO will lose his job (and his ability to steal). The equity-holders will agree to let him issue equity since they will be wiped out if he does not; and, as long as D is slightly less than $V_4 + p_3(1-\lambda)(V_3-V_4)$, their shares will still have positive value if the new equity is issued. Thus it is an equilibrium for a CEO to issue equity of value $D-V_4$ as long as $D \leq V_4 + p_3(1-\lambda)(V_3-V_4)$. (Below we discuss whether there can be multiple equilibria.)

Note that if the CEO tries to issue equity when the first period realization is positive--which he would like to do since this increases slack and stealing possibilities--the equity-holders, knowing that the CDS price will be zero even without the new equity, will turn him down.

It follows from Proposition 1 that the optimal debt level for shareholders to put in place at date 0 is $D = V_4 + p_3(1-\lambda)(V_3 - V_4)$, as in Section 3.1. Note that if they set $D > V_4 + p_3(1-\lambda)(V_3 - V_4)$, then the market will realize at date 0 that there is a risk of bankruptcy, the date 0 CDS price will be positive, and the regulator will intervene right away.[13]

Proposition 2 summarizes the above discussion.

Proposition 2:

Under the CDS trigger mechanism described above, the shareholders will choose a debt level $D = V_4 + p_3(1-\lambda)(V_3 - V_4)$ at date 0 and will permit the CEO to issue equity of value $D - V_4$ at date 1 if and only if the first period realization is negative. The trigger is not activated, and on the equilibrium path bankruptcy is avoided with probability 1. The second-best is achieved.

Let's return to the issue of multiple equilibria. Suppose that even though $D \leq V_4 + p_3(1-\lambda)(V_3 - V_4)$ some investors fear that not enough equity will be raised; the CDS price will be positive; and the regulator will therefore intervene and wipe out all the equity-holders. This fear will generate a bad equilibrium in which investors do not underwrite the equity offering and regulatory intervention occurs even though it should not.[14] One way to eliminate this equilibrium is to guarantee that if the regulator takes over an LFI shortly after an equity offering, the money invested in the offering (plus a small amount of interest) will be considered senior to all the non-systemic obligations and returned to the investors. This additional provision makes investing a dominant strategy, ruling out the bad equilibrium.

3.3 Systemic and non- systemic debt

Let us return to the issue of systemic versus non-systemic debt. As we have noted, in our formal model we do not distinguish between the two. One way to introduce a

[13] In our model, the government wants to limit the debt that the LFI issues. However, one can also imagine scenarios where the LFI doesn't want to issue financial debt and the government forces it to issue some in order that the CDS price can be used to assess the risk of default of the systemically relevant debt. See later in this section.

[14] We would like to thank Ken Ayotte for alerting us to the possibility of this bad equilibrium.

difference is to suppose that systemic debt can be issued at a lower interest rate than non-systemic debt, and so, ceteris paribus, an LFI would always like to issue 100% systemic debt equal to $D = V_4 + p_3(1-\lambda)(V_3 - V_4)$, unless prevented from doing so by a regulator. (To make the algebra simple, suppose that the difference in interest rates between the two types of debt is negligible, so that none of the formulae change.) How does our analysis change?

Note first that, if our CDS mechanism works perfectly, the regulator should not fear the issuance of 100% systemic debt since in equilibrium the mechanism is never triggered, and the debt is perfectly safe. However, this may be too rosy a perspective. Suppose that we are concerned about an "out of equilibrium" sequence of bad outcomes: the manager for some reason is unable to, or does not, issue equity at date 1 along the lower branch; the regulator is also unable to issue equity; and the regulator is unable to sell the company. One way to think about this is that the regulator may be forced to take over the company and run it until date 2 without changing its capital structure. If V_3 occurs, of course, there is no problem since the debt $D = V_4 + p_3(1-\lambda)(V_3 - V_4)$ can be fully repaid. However, if V_4 occurs, then the firm will default on its systemic debt, possibly leading to a public bail-out.

How can such a scenario be avoided? Our view is that a simple way to do this is to (a) limit the fraction of total debt that can be systemic; (b) make the systemic debt senior. In the above example, the most systemic debt that can always be paid back at date 2 is V_4, and so the fraction of systemic debt should be limited to

$$\frac{V_4}{V_4 + p_3(1-\lambda)(V_3 - V_4)}. \tag{5}$$

Requiring that an LFI issue non-systemic junior long- term debt has another benefit. For CDS prices to provide useful information, the underlying instrument should face the risk of default, at least out of equilibrium. Junior long-term financial debt plays this role. In theory, it is irrelevant how much junior long-term debt there is, as long as there is some. In practice, the amount is important for two reasons: it determines the

thickness of the market for the security underlying the CDS;[15] and it provides an extra cushion for the systemic obligations in case the regulator is slow to intervene. Suppose we want to make sure that each institution has a sufficient cushion to endure a delay of six months: It would be reasonable for us to set the rules such that after an institution has exhausted its equity layer, the probability of its running through the junior debt layer in six months is less than 5%. If asset volatility is around 8% per year, our calculations suggest that maintaining a layer of junior long-term debt worth roughly 11% of assets will offer the necessary protection. By today's standards, this figure is hardly high: For the eight largest banks, the long-term debt-to-asset ratio in September 2008 was 19%. A new regulatory system that required a CDS rate below 100 and a long-term debt layer of at least 11% would therefore not be a great burden for the major banks today.

3.4 Why Not Short-Term Debt?

As an alternative, regulatory intervention could be made contingent on the interest rate at which short-term debt is refinanced. While in many cases, this is equivalent, in what follows we will show that sometimes an intervention contingent on the short-term debt rate will not prevent a LFI from going bankrupt.

To analyze this possibility, let's allow the LFI to issue short-term debt, which the LFI has to roll over at time 1 (since there is no cash flow at time 1). As long as the debt is less than or equal to V_4 the debt is riskless and at time 1 it can be refinanced at the riskless rate (which we assumed to be zero). If the amount of short term debt is $V_4 < STD \leq p_3 V_3 + (1-p_3)V_4$, then it can be issued at the riskless rate at time 0, but in the lower branch it can be refinanced only at a rate above zero. Finally, if $STD > p_3 V_3 + (1-p_3)V_4$, the debt cannot be issued at the riskless rate even at time 0 and the regulator will always intervene. So the only contingent intervention occurs for $STD = p_3 V_3 + (1-p_3)V_4$.

[15] Since our rule is meant to apply only to very large financial institutions (let's say with more than $100 billion in assets), a 10% requirement, which implies at least $10 billion in bonds, seems reasonable. From a casual inspection, this amount appears sufficient to generate an active CDS market, since several companies with less than that amount of outstanding bonds have actively traded CDSs. Yet, before implementing this rule, an in depth study is needed.

Now consider what happens if $STD = p_3 V_3 + (1 - p_3) V_4$. If the first realization is good, the debt is risk free and no intervention will occur. But if the first realization is bad, the debt can be refinanced only by promising the entire firm to the debt-holders (i.e., $STD = V_3$). After observing a positive refinancing rate, the regulator will intervene, but it will be too late, since the LFI has already pledged all its assets, making it impossible to avoid default if V_4 occurs.

Therefore, either the LFI adopts a non-contingent capital structure with D=V_4, or bankruptcy cannot be avoided with probability one, making this system undesirable.

4. Endogenizing LFI activities

So far we have taken the LFI's activities as given. One concern is that our mechanism may encourage the LFI to take on inappropriate obligations or engage in excessively risky behavior, particularly if it is in danger of being taken over by the regulator ("gambling for resurrection"). To investigate this possibility we introduce an investment opportunity at time 1, which can have positive or negative net present value. The investment has a cost of I and return R with probability π and r otherwise. For simplicity, we consider only the case where the realization of this investment opportunity is perfectly correlated with the value of the underlying assets (so $\pi = p_2$ in the upper branch and $\pi = p_3$ in the lower branch). For simplicity and without loss of generality we suppose that r =0. We also assume that the ranking of the states is unchanged by whether the investment project is undertaken and succeeds or fails:

$$V_3 + R < V_2 .$$

Note that a risky investment opportunity at time 1 has the potential to introduce an additional agency problem. While the manager captures a fraction of the upside of any investment (in the form of stealing), he suffers no downside cost. Hence, in the presence of date 0 debt a manager may choose to undertake some negative present value investments, as in traditional risk shifting models.

Given these various agency problems, in the absence of regulation it is optimal for the shareholders to set the initial long-term debt level at D=∞, but to allow the manager to raise short-term senior debt at time 1. (We go back to ignoring the distinction between

systemic and non-systemic debt, and so none of the initial debt is senior.) With a D=∞ debt level, the initial shareholders will eliminate any stealing, since there will be no equity payoff. An infinite level of debt also eliminates any incentive to risk shift, again because the manager cannot steal any of the returns from a successful project. Finally, D=∞ will not prevent any positive NPV project from being undertaken since, by raising short-term debt senior to the long-term debt, the manager will always be able to finance such a project. If $V_4 \geq i$, the short-term debt is riskless, and so the face value of the senior debt will be i. If $V_4 < i$, the short-term debt is risky, and so the face value of the senior debt will exceed i.

The manager is completely indifferent about which projects to finance, given that there is nothing for him to steal at date 2, and we suppose that he is therefore willing to act on behalf of shareholders, undertaking positive NPV projects and not negative NPV ones (he can always be given a small equity stake to break his indifference).

Since with D=∞ the systemic obligations are always dragged into a bankruptcy procedure, triggering significant social costs, we assume that the regulator will want to intervene and limit the debt level D.

4.1 CDS mechanism

Consider now the case in which our CDS trigger mechanism is in place. Then the regulator will intervene whenever the CDS price is positive. We now solve the problem backward. We start from time 1 and we consider first the upper branch. Assume that $D < V_2$ (see below). The manager has to decide whether to invest or not. Since the investment opportunity requires a cash outlay, the manager can undertake it only if he can raise i. We assume that the manager has to get approval from shareholders to raise new funds, and that he has all the bargaining power in this negotiation, i.e., he makes a take- it- or- leave- it offer to shareholders. We denote by d the face value of short- term debt issued at time 1 and by y the amount of equity issued at time 1.

Given that the CDS mechanism is in place, the new senior debt must be riskless, otherwise the mechanism would be activated, forcing the LFI to raise more equity. For the investment to take place three conditions must be met: i) the manager is able to raise

enough funds to undertake the investment; ii) the shareholders are willing to approve the fund raising; iii) the manager's payoff from raising the funds and investing should be higher than his payoff from doing nothing;

The first condition is simply that

$$d + y \geq i.$$

The second condition is tantamount to saying that shareholders should not be made worse off from the fund- raising and investing. In the absence of the investment opportunity, the equity value is given by

$$(1-\lambda)[p_2 V_1 + (1-p_2)V_2 - D].$$

The solvency constraint also implies $V_2 + (d + y - i) \geq d + D$ or

$$V_2 + y \geq i + D.$$

If the project is undertaken and financed with the pair (d, y) the value of the old equity will be

$$(1-\lambda)[p_2(V_1 + R + y - i) + (1-p_2)(V_2 + y - i) - D] - y.$$

The shareholders will approve the project iff

$$y \leq \frac{1-\lambda}{\lambda}(p_2 R - i). \tag{6}$$

Finally, the manager's payoff if no money is raised is

$$\lambda[p_2(V_1 - D) + (1-p_2)(V_2 - D)].$$

If he raises the necessary funds and invests his payoff is

$$\lambda[p_2(V_1 + y + d - i + R - D - d) + (1-p_2)(V_2 + y + d - i - D - d)].$$

Hence, the manager is better off if

$$y + (p_2 R - i) > 0. \tag{7}$$

Condition (7) is very intuitive. The manager is better off under one of two conditions. Either the investment is positive net present value $(p_2 R - i > 0)$, so that he can steal a fraction of it; or new equity is issued ($y > 0$), so he can steal a fraction of this. If neither of these two conditions is satisfied, he has no interest in going ahead. If we combine (6) and (7), we obtain

Proposition 3:

Under the CDS trigger mechanism described above, no negative NPV investments will be undertaken.

If (6) and (7) are satisfied, then the manager will choose $y = \frac{1-\lambda}{\lambda}(p_2 R - i)$ and $d = i - y = i - \frac{1-\lambda}{\lambda}(p_2 R - i)$.

Let's now consider the lower branch. Given that the CDS mechanism is in place the short-term debt of face value d must again be riskless and so the manager will be able to undertake the investment if and only if

$$d + y \geq i.$$

Shareholders will automatically give their permission since otherwise the mechanism will be triggered and they will be wiped out. The solvency constraint requires that $V_4 + y \geq i + D$ and the ability to raise capital is limited by the value of equity that can be diluted, i.e.

$$y \leq (1-\lambda)[p_3(V_3 + R + y - i - D) + (1-p_3)(V_4 + y - i - D)].$$

Rewriting this as

$$(8) \qquad y \leq \frac{(1-\lambda)}{\lambda}\left[p_3(V_3 + R) + (1-p_3)(V_4) - i - D\right],$$

we can use $V_4 + y \geq i + D$ to obtain

$$(9) \qquad D \leq V_4 + (1-\lambda)[p_3(V_3 - V_4 + R) - i].$$

The manager's payoff is

$$(10) \quad \lambda[p_3(V_3 + y - i + R - D) + (1-p_3)(V_4 + y - i - D)].$$

This is increasing in y and so the manager will ensure that (8) holds with equality. Substituting for y in (10), we can easily show that the manager is better off undertaking the project as long as $p_3 R > i$.

We see from (9) that, if the project has positive net present value, i.e., $p_3 R > i$., then the initial debt level can be set higher than in Section 3. This allows the investment to occur and increases the ex ante market value of the firm. Note that, given our

assumption that $V_3 + R < V_2$, D will lie below V_2, as we supposed in our analysis of the upper branch. On the other hand, if the project has negative net present value, then the debt level will be as in Section 3 and the investment will not occur.

In sum, in spite of the additional agency problem introduced by the time-1 choice of debt, endogenizing the activity level of the LFI does not change our results in any significant way. Not only is our CDS mechanism able to avoid bankruptcy in equilibrium, but it also eliminates any risk-shifting incentive.

4.2 The CDS rule and the agency cost of debt

One interesting byproduct of our rule is that it eliminates all the agency costs of debt. First, it eliminates the incentives to undertake negative NPV investments for traditional risk-shifting reasons. Indeed we saw above that no negative NPV projects will be undertaken.

Second, by forcing equity-holders to issue equity every time the debt becomes risky, our rule eliminates the Myers (1977) debt overhang problem. Either the debt is safe (and thus there is no transfer of value between equity-holders and debt-holders), or the debt is risky and the equity-holders have to issue equity not to be expropriated by the regulator. Either way there is no chance that a positive investment opportunity will be forgone to avoid the transfer in value associated with an equity issue.

Finally, while there is no asymmetry of information in our model, it is easy to see how, if such an asymmetry were present, our rule would eliminate any adverse selection in equity offerings a la Myers and Majluf (1984). In fact, by forcing an LFI to raise equity when the CDS prices reaches a threshold, our rule eliminates any discretion in the decision, removing any signal associated with it.

In sum, the endogeneization of the activity level does not change the nature of our results. In fact, it highlights the power of our mechanism, which not only eliminates the moral hazard problem introduced by the too-big-to-fail policy, but also removes the distortions created by two other agency problems: risk shifting and debt overhang.

5. Discussion

5.1 Why CDS?

In the previous section we have shown how to implement a state contingent capital structure in a world where the states are not verifiable by using CDS prices. Most LFIs, however, have several claims traded, for example, bonds or stocks, so why not use one of these other instruments?

Equity prices are not a good instrument. While equity is very liquid and its market price hard to manipulate, it does not provide a good indicator of the probability of default. Equity is insensitive on the downside (because of limited liability) and very sensitive on the upside, thus a small probability of a positive event can sustain significant equity prices even in the presence of a high probability of default.[16]

By contrast, any debt-related price is more suitable to the task, since debt is insensitive to the upside, but very sensitive to the downside. Instead of the CDS price, we could use debt prices or debt yields. For example, Taylor and Williams (2009) use the difference between the Libor rate and the overnight index swap (OIS) as an indicator of the aggregate credit risk of the interbank market. The idea is that the Libor at a certain maturity is a function of both the average of expected future overnight rates over the same maturity and the risk of credit, while the overnight index swap is a function only of the former. A similar indicator can be established for each individual institution. This indicator can replace or supplement the CDS price.

As we have shown in section 3.4, however, short-term debt yields run the risk of signaling the problem too late. By contrast, bond prices suffer from the problem of market segmentation and illiquidity. Bond issues differ along several dimensions: promised yield, maturity, covenants, callability, etc. As a result of this lack of standardization, the market for each bond issue tends to be rather illiquid, with most bond issues trading only occasionally. This illiquidity makes bond prices a less reliable indicator than CDS prices. In fact, the success of CDSs is mainly due to their standardized nature, which ensures greater liquidity.

[16] This difference is not apparent in our simplified model, since the equity price will perfectly distinguish the upper branch of the event tree from the lower branch. This coincidence, however, is not generic. Imagine, for instance, that $V_3 > V_1 > V_2 > V_4$. Then, the value of equity in the lower branch can be higher than the value of equity in the upper branch, invalidating the role of equity as an indicator. By contrast, the CDS price, capturing the downside risk, will correctly signal when to intervene.

The CDS market has also been shown to lead other markets in terms of information discovery. It leads the stock market (Acharya and Johnson (2007)), the bond market (Blanco et al. (2005)), and even the credit rating agencies (Hull et al. (2004)).

Given the size of the stakes at play, one might worry about the temptation for a bank to manipulate its own CDS price. For this reason, and more generally to provide greater transparency, we believe that it is important for CDSs to be traded on an organized exchange, with all the rules that usually apply on such exchanges. There could also be an additional prohibition against firms trading in their own CDSs. A further important benefit of having CDSs traded on an exchange is that counterparty risk will be minimized, if not eliminated, and the positions of the various parties will be disclosed. Without such disclosure, the market would find it very difficult to assess the riskiness of individuals LFIs.

5.2 Did CDS predict the 2008 crisis?

Many critics (e.g., Anderson, 2009) argue that CDS price changes are mostly affected by variations in risk aversion and do not contain much information about the actual probability of default. One way to check this claim is to analyze the behavior of CDS rates for the nation's largest financial institutions throughout the 2008 crisis. Table 1 shows the one-year CDS rates ((in basis points) at various key moment during the crisis (the default of Bear Sterns hedge funds, the end of 2007, the collapse of Bear Sterns, and the rejection by Congress of the first version of Tarp).

While it is true that the CDS market did not anticipate any problem until the summer of 2007, after that the market provided a remarkably accurate indicator of the eventual fate of the major financial institutions. As the table makes clear, the market early on singled out Washington Mutual and Bear Stearns as the two most problematic institutions. In fact, if one had to predict in August 2007 the five institutions that would go under first on the basis of their CDS prices, one would be correct in four out of five cases. By the end of 2007, the data showed a decisive worsening of the situation for the investment banks and Washington Mutual. In late December, the market put the probability of Washington Mutual's defaulting within a year at 10%. By March 2008, that estimate had risen to 30%—and yet the regulator waited until September 25 to take over the bank.

The history of the 2008 crisis can also help us determine where the CDS-rate trigger should be set. Let's say our goal is to intervene between six and nine months in advance of a genuine failure: We can go back and see how high the CDS rates of failed institutions were six to nine months before the failures occurred. We can then determine the false positive rate by looking at how many stable institutions the trigger mechanism would have flagged as questionable.

In this analysis it is important to appreciate that the CDS rates are endogenous with respect to the default rule we choose. On the one hand, this endogeneity implies that there is no guarantee that CDS rates will perform in the same way as in the past under our proposed rule. In particular, the 20% haircut will impact the size of the potential loss and hence the price of the CDS. On the other hand, the continuous government interventions, which led to the rescue of Bear Stearns, AIG, Citigroup, and Bank of America, have certainly affected the reliability of CDS rates as an indicator of the probability of financial insolvency.

Table 2 presents a one-month average of one-year CDS rates six months and nine months before the "failure" of major institutions. We use failure here loosely, because Bear Stearns, Merrill Lynch, AIG, and Citigroup did not fail—they were of course rescued by the government, either through a shotgun wedding or direct taxpayer bailout. The classification "surviving" is also open to debate, since Goldman Sachs and Morgan Stanley could also be said to have been saved by the government. But these labels generally correspond to how the practical fate of these institutions has been understood.

As the table demonstrates, all the "failed" institutions had CDS rates above 100 basis points six months before their demise; only Lehman Brothers and Washington Mutual had CDS rates above 100 nine months before their collapse. With the exception of Bear Stearns, though, all of the institutions had CDS rates above 40 nine months before their demise.

In Table 3 we look at the false positives: examining when the institutions that did not fail would have first set off our market-based trigger. For the commercial banks—Bank of America, J.P. Morgan Chase, and Wells Fargo—the 100 basis points threshold would have been triggered only after the Lehman failure that sent the financial industry into a panic. For the two investment banks—Goldman Sachs and Morgan Stanley—it

would have been triggered in February '08 and in November '07, respectively. It is unclear, though, whether these are really false positives: One could easily argue in retrospect that these two institutions needed more capital back then. The 40 basis points threshold, by contrast, definitely seems to generate too many false positives—since it would have triggered an intervention in Wells Fargo back in November 2007. A trigger at 100 basis points therefore seems roughly appropriate.

Nevertheless, CDS rates do also reflect variations in risk aversion. Should we then have the trigger fixed in nominal terms or adjustable to sterilize the effect of these changes? The answer depends upon our view of what drives these changes. If the changes are due to some irrational exuberance or panic, then it would be reasonable to adjust the trigger to variation in the risk aversion. This can be done by eliminating the common component in the CDS prices. Yet, if we regard fluctuations in the risk premium as indications of changes in the marginal utility of wealth, then when the risk premium increases, it means that the welfare cost of a possible bankruptcy increases as well. Hence, the fact that our mechanism endogenously becomes tighter when the cost of a bankruptcy increases is a positive, not a negative, feature.

5.3 The Regulator's time inconsistency

In our analysis we have ignored political economy considerations. But too-big-to-fail is not just an economic problem, it is mainly a political economy problem. A benevolent government, who trades off the macroeconomic costs of restructuring or liquidating an LFI with the distortion in the ex ante incentives a bailout generates, will be systematically biased in favor of the bailout. The possibility of not being reelected reduces the government discount rate, biasing it in favor of the action that has the lower immediate costs, i.e. a rescue. In other words, the government faces a standard time-inconsistency problem a la Kydland and Prescott (1977). No matter how tough the ex ante rules are, when the problem arises, the government will cave in and modify these rules ex post. The anticipation of this behavior will destroy any desirable incentive effects.

In this context, our mechanism can be seen as a way to address this time-inconsistency problem by forcing the government to intervene earlier, at a time when the cost of intervention is substantially reduced, given that the systemic obligations are not at

risk and thus there is no danger of a catastrophe. The credibility of intervention could be further enhanced with additional provisions. For example, the regulator's budget could be derived from an endowment that the regulator uses to invest in institutions that are deemed safe, in spite of having a CDS price that triggered an intervention. If this is the case, the regulator would be very afraid of investing in risky debt, because any loss will impact her own budget.

The risk of empowering a regulator with the right to intervene is twofold. On the one hand, the regulator can arbitrarily close down perfectly functioning financial institutions for political reasons. On the other hand, the regulator, under intense lobbying by the regulated, can be too soft, a phenomenon known in the banking literature as "regulatory forbearance". Our mechanism, which bases intervention on a market-based signal, removes most of this discretion. The regulator cannot intervene if the market prices do not signal a situation of distress and cannot avoid intervention when they do.

While we made mandatory a regulatory intervention in case of high CDS prices, we deliberately did not require the regulator to fire the CEO and cancel debt as an automatic consequence of the triggered event, but only after the failure of a "stress test" performed by the regulator. While this discretion may run the risk of inducing some regulatory forbearance, it is designed to avoid another risk: of self-fulfilling panics. Every time we take away regulatory discretion and rely on market signals, we bear the risk of making the wrong decision if market signals are not perfect.

How worried should we be that our mechanism makes it too easy for the regulator to declare that an institution has passed the stress test? We think this risk is not too great because the regulator has to stick her neck out and assert that a firm that the market thinks is at risk of default is in fact perfectly safe. This risk is further reduced by the requirement that the regulator must invest some money in the LFI if she declares it to be adequately capitalized. This requirement has several benefits. First, it makes it politically costly for the regulator to forbear. Second, increasing the solvency of the LFI makes bear raids even less profitable, since the CDS price will drop further. Third, it makes the system robust to regulatory mistakes. If the regulator incorrectly concludes that the LFI is adequately capitalized, the LFI's solvency will be improved by infusing some liquidity.

The regulator faces two types of pressures: the industry pressure to bail out the LFI and the pressure from Congress to minimize the taxpayers' money at risk. Our choice of making new government debt pari passu tries to balance these opposing forces. On the one hand, we want to make it politically costly for the government to validate as adequately capitalized firms that are not. This cost would be maximized by making the government claim junior to everybody else's. On the other hand, we want to make it difficult to succumb to the industry pressure to bail out the LFI, which would be very strong if the regulator could inject funds in exchange for a junior claim on the LFI. Pari passu debt strikes a reasonable balance. If the firm is insolvent pari passu debt does help the existing creditors, but it is sufficiently junior to make the government suffer some pain.

One can argue that the government might always change the rules ex post, and waive its obligation to invest money. In this case, however, the underwriter of the CDS contracts would be able to sue the government for damages, since the government behavior would cause their price to rise.

An alternative approach would be to fix a price to insure LFI debt and require a private insurance company to audit the LFI and decide whether or not to insure the debt at that price. If the insurance company accepts the insurance, this supports the idea that the LFI is adequately capitalized; if it does not then we can be confident that the LFI is at risk and the regulator should feel no qualms about taking it over. Unfortunately, such a mechanism would be more likely to fail in a systemic crisis, where more LFIs would be audited and the capacity of any private insurer to absorb risk would be limited.

Some people may view our mechanism as a market-based nationalization. But it is no more a nationalization than is a bankruptcy. And the market-based trigger may provide a political cover for an early intervention, avoiding costly delays. In fact, during the recent crisis the political stigma associated with nationalization has delayed necessary interventions in the banking sector at considerable cost.

5.4 Macroeconomic effects

Our proposal follows the micro approach to prudential regulation in so much as it deals with the perverse incentives at the company level, but it does not address the

possible underinvestment problem that will occur at the macro level if all financial institutions find themselves in trouble and try to deal with this by shrinking their lending rather than raising new equity.

In the macro approach to prudential regulation (e.g., Kashyap and Stein, 2004), the reluctance to raise equity is generally justified by appealing to the Myers' (1977) debt overhang problem or to some adverse selection in equity offering (Myers and Majluf, 1984). If either of the forces behind these two models is the reason for the scarcity of capital in the banking industry, then our rule will automatically take care of this problem. As discussed in Section 4.3, our rule eliminates the negative effect of both debt overhang and adverse selection.

If the scarcity of capital is the result of other factors, however, our rule is subject to the same criticism as that of all micro-based prudential rules. To address the macro problem Kashyap and Stein (2004) propose an adjustable capital requirement, which depends on the business cycle or the price of certificates allowing banks to violate the standard capital requirement. Our proposal can easily be merged with theirs, since the CDS trigger can be indexed to macroeconomic factors.

5.5 Feasibility under the Dodd-Frank Bill

Our mechanism can be easily implemented under the provisions of the "Dodd-Frank Wall Street Reform and Consumer Protection Act" approved in July 2010. Title II of the Act provides the Financial Stability Oversight Council (FSOC) with the authority to "orderly liquidate" systemically relevant financial institutions. The Act does not require that this intervention follows a stress test triggered by a market indicator, but it does not prevent it. More importantly, the Act provides FSOC with the authority necessary to implement the steps requested by our model: fire the CEO, change the capital structure, impose a haircut on non-systemic debt.

Under Section 115 of the Act the FSOC can make recommendations on capital requirements and on the maximum amount of short-term debt for systemically relevant institutions supervised by the Fed. Capital requirements can be risk-based and thus can be contingent on the price of CDS. These requirements can also include a minimum amount of junior long-term debt.

Not only is our mechanism fully within the power of the FSOC and the Fed under the new legislation, it is also easy to implement. First, it would be simple, and not very different from the system of capital requirements currently in place. Second, it would be easily applicable to diverse financial institutions—such as hedge funds and insurance companies, as well as banks—if policymakers wanted to expand its reach. Many mechanisms designed explicitly for banks would be difficult to adapt to other financial institutions, but our system is based on three simple concepts that are easily portable: an equity cushion, a junior-debt cushion, and a CDS trigger. Last but not least, unlike non contingent capital requirements our mechanism will not have deflationary effects when applied. The key to our mechanism is not the toughness of the initial rules, but rather the promptness of the corrective action triggered by a market signal. This lack of a harsh crackdown means that the transition to our system would be relatively painless for the banks.

5.6 Comparison with the Main Alternatives

An alternative idea to deal with the too big to fail problem which has received a great deal of attention is to introduce some debt in the capital structure of banks that converts into equity when the bank is facing financial distress (Squam Lake Report). This debt (called contingent capital or CoCo) has some benefits. If, in extreme downturns, the conversion is triggered, debt-holders would be forced to absorb some losses without dragging other obligations (such as derivatives or repo contracts) into a lengthy bankruptcy process, an event that could trigger a systemic panic. This, in turn, will save taxpayers large amounts of money and will create the right incentives for creditors to monitor the issuers, instead of lending freely under the assumption that the government will bail them out.

This approach, however, has several shortcomings. A much discussed problem is the conversion trigger. If the trigger is based on accounting numbers, it might not be activated when it should be. The trigger set by Lloyds in the first Coco bonds (less than 5% Tier 1 capital) would not have been activated even at the peak of the crisis. If instead the trigger is activated when equity prices are low, the manager could deliberately talk down the value of the bank to activate the trigger and obtain equity on the cheap.

There is, however, a much larger problem, which has been largely ignored. If a bank is losing money because of its bad investments, a Coco bond will not prevent the bank from defaulting on derivative and repo contracts. It will only delay the timing of that default. In fact, one of the advantages of debt is that it puts a limit on the amount of resources an inefficient manager can waste: A default forces inefficient businesses to restructure and incompetent managers to be replaced. By eliminating the possibility of default, Coco bonds will increase the inefficiency in the banking industry, without preventing the possibility of a default on systemic obligations, and thus the risk of systemic crises.

By contrast, our mechanism is designed to force equity issues when a bank is undercapitalized, well before a major crisis occurs, boosting the protection offered to systemic claims (such as deposits and short term borrowing).

Our idea is similar to the approach, proposed by Duffie (2010), to mandate an offer to existing shareholders to purchase new equity at a low price when a financial institution fails to meet a stipulated liquidity or capital requirement. In fact, we provide a market-based trigger for such requirement. Furthermore, our provision to make the new equity funds invested senior, in the event that the LFI is taken over by the regulator shortly after the equity issue, eliminates the risk of multiple equilibria, to which Duffie's mechanism is subject.

6. Conclusions

The too-big-to-fail problem arises from a combination of an economic problem – the cost of defaulting on systemic obligations is too large to bear—and a political economy problem – a time inconsistency problem induces the government/regulator to sacrifice the long-term effect on incentives to avoid the short-term costs of a possible systemic collapse.

In this paper, we design a mechanism to address both these problems. This mechanism is similar to existing capital requirements in that it creates two layers of protections for systemic obligations, represented by equity capital and junior long-term debt. The first key difference is that the equity capital requirement relies on credit default swap prices, instead of the credit rating agencies, as the trigger mechanism. The second

key difference is in the way the government intervenes, which is designed to preserve the systemic obligations, but to penalize the long-term debt-holders if the company is too risky. We have shown that this mechanism ensures that LFIs do not face any risk of bankruptcy, while preserving some of the disciplinary effects of debt.

By triggering an early intervention (when the LFI is still solvent, the systemic obligations are not at risk, and only the junior debt starts to face a small chance of not being repaid in full), our mechanism is able to shift the government trade-off between restructuring and bailout in favor of the former. In so doing, it provides a way for the government to commit to tougher rules, overcoming its time inconsistency.

More generally, beyond the too-big to fail problem, our CDS-based capital requirement can be seen as mechanism to address possibly the fundamental agency problem generated by debt: i.e., the perverse incentives managers and shareholders have to "gamble for resurrection" when a company approaches default. Equity can be seen as an option on the value of the underlying assets, with a strike price equal to the value of the face value of debt (Black and Scholes, 1973). Much of the agency costs of debt arise from the fact that some actions (such as undertaking negative NPV risky investments) can increase the value of this option, while decreasing the value of the underlying assets. Our CDS-based capital requirement eliminates the divergence of interest between shareholders and creditors by forcing the equity-holders to exercise this option when it starts to become valuable (i.e., when a company is close to default). As a result, no negative NPV project will be undertaken, in spite of the risk-shifting possibility present.

Finally, our mechanism highlights the important role that credit default swaps can play in regulation. CDSs have been demonized as one of the main causes of the current crisis. It would be only fitting if they were part of the solution.

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Table 1: CDS rates of the main financial institutions at key dates during the crisis

These 1-year CDS rates are in dollar of premium to insure $10,000 of notional amount. When an institution filed for bankruptcy (as Lehman) the last CDS price before the filing is reported. Source: Datastream.

Financial Institution	8/15/2007	12/31/2007	3/14/2008	9/29/2008
BoA	11	29	93	124
WELLSFARGO	23	45	113	113
JPMORGAN	19	32	141	103
CITI	15	62	225	462
WACHOVIA	14	73	229	527
WAMU	44	422	1,181	3,305
GOLDMAN	28	78	262	715
MORGAN	31	129	403	1,748
MERRILL	29	159	410	666
LEHMAN	38	100	572	1,128
BEAR STEARNS	113	224	1,264	118
AIG	31	59	289	821

Table 2: Simulation of different trigger rules

These 1-year CDS rates are in dollar of premium to insure $10,000 of notional amount. The averages are over a calendar month 6 months or 9 months before the "default" date. The trigger date is the first date when the previous month average of CDS rates exceeded the threshold. Source: Datastream.

"Failed" institution	Date of Default	Average CDS 6 months before	Average CDS 9 months before
BEAR STEARNS	3/14/2008	121	10
LEHMAN	9/15/2008	288	106
WAMU	9/25/2008	957	430
WACHOVIA	9/30/2008	176	45
MERRILL	9/15/2008	282	177
AIG	9/16/2008	234	70
CITI	9/30/2008	162	44

Table 3: Simulation of false positives with different trigger rules

These 1-year CDS rates are in dollar of premium to insure $10,000 of notional amount. The trigger date is the first date when the previous month average of CDS rates exceeded the threshold. Source: Datastream.

"Surviving" Institutions	False Positive Date with a Trigger at	
	100 bps	40 bps
BoA	9/22/2008	1/22/2008
WELLSFARGO	9/18/2008	11/23/2007
JPMORGAN	9/29/2008	2/15/2008
GOLDMAN	2/14/2008	8/20/2007
MORGAN	11/13/2007	8/22/2007

PREPARED STATEMENT OF SIMON JOHNSON

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JANUARY 8, 2014

A. Summary [1]

1. The U.S. Government Accountability Office Report "Government Support for Bank Holding Companies: Statutory Changes to Limit Future Support Are Not Yet Fully Implemented" (GAO-14-18) provides some useful detail on the wide variety of support provided by the official sector to large bank holding companies during the financial crisis of 2007–10. The GAO is also correct that, even under the most favorable interpretation, there has been slow implementation of various key measures designed subsequently to make the financial system less risky. More than 5 years after the worst crisis since the 1930s, it is remarkable how little has been achieved by regulators.

[1] Simon Johnson is also a member of the Systemic Risk Council, a member of the Congressional Budget Office's Panel of Economic Advisers, and a member of the FDIC's Systemic Resolution Advisory Panel. All views expressed here are personal. For additional affiliations and disclosures, please see this page: *http://BaselineScenario.com/about/*.

2. The GAO report makes it clear that official sector support was provided disproportionately to some of the largest bank holding companies (and other large financial institutions) in the United States, because these firms faced very large (relative to firm size and relative to the macroeconomy) liquidity and solvency issues.
3. However, the report has seven prominent limitations that should be considered when we reflect on potential policy for the future:

   a. There is insufficient consideration given to risk-adjusted returns. The GAO seems to accept at face value the Federal Reserve and Treasury position that "all of the Federal Reserve and FDIC assistance was fully repaid with interest." But evaluating any such support as an investment should also involve consideration of the risks involved. For example, we could reasonably ask—what would the private sector have charged to provide this amount of funding under such terms, and on a risk-adjusted basis, what was the effective subsidy provided to big banks?

   b. It does not consider the full scope of support provided by the Federal Reserve System, including the dollar value of allowing some financial sector firms to convert to bank holding companies at the height of the crisis.[2]

   c. It is also mostly silent on the ways in which monetary policy has become a mechanism for transferring wealth from savers to financial intermediaries, through very low interest rates.

   d. There were alternative ways for the Government to support the economy, including through "liquidity loans" to households who were underwater on mortgages. Was it cost effective for the Government support banks directly and not provide substantial assistance to homeowners—many of whom would have experienced a recovery in asset values if they had been afforded loans on the kinds of terms available to large complex financial institutions?

   e. It does not fully explore the full scope of U.S. official support provided more indirectly to large foreign banks (e.g., through ensuring that AIG counterparties were paid in full), and the ways in which this did or did not help parts of the U.S. financial sector.

   f. It does not integrate a full analysis of the fiscal costs of the crisis, i.e., how much the Government's debt increased as a result of lost revenue and other impacts.[3] The GAO report should therefore be read as measuring some "direct" costs of intervening to help large financial institutions, rather than as measuring the full cost to the taxpayer of the downside insurance provided by the official sector.

   g. Perhaps most worryingly for the validity of future analysis, the GAO seems to weight all "expert" opinion equally, irrespective of whether the work in question was undertaken by people who work for big banks. In this context, I would flag the specific mention of work by the Bipartisan Policy Center on p. 51, but this issue seems to come up throughout the report. If the GAO cannot sort out sensible analysis from sophisticated lobbying, then its important follow-up report on the current value of implicit subsidies to large banks is unlikely to have much value. The negative reputational effect on the credibility of the GAO, Congress, and the executive branch (including the Fed) would be considerable and most unfortunate.
4. To understand the full fiscal impact of the deep finance-induced recession, look at changes in the CBO's baseline projections over time. In January 2008, the CBO projected that total Government debt in private hands—the best measure of what the Government owes—would fall to $5.1 trillion by 2018 (23 percent of GDP). As of January 2010, the CBO projected that over the next 8 years debt will rise to $13.7 trillion (over 65 percent of GDP)—a difference of $8.6 trillion. Over the cycle, therefore, these CBO projections imply that debt relative to GDP will be 50 percentage points higher than it would be otherwise, as a direct result of the severity of the crisis.[4]

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[2] This point is mentioned in the report, but there is no attempt to provide a quantitative value for this important dimension of support. The firms involved, including Goldman Sachs and Morgan Stanley, may well have failed without this change in their legal status, which signaled that it would now be much easier for them to borrow from the Fed.

[3] In fairness, the GAO has attempted to deal with this broader issue in other work (e.g., see *http://www.gao.gov/products/GAO-13-180)*.

[4] Most of this fiscal impact is not due to the Troubled Assets Relief Program—and definitely not due to the part of that program which injected capital into failing banks. Of the change in CBO baseline, 57 percent is due to decreased tax revenues resulting from the financial crisis

5. Excessive risk taking by large financial firms—including but not limited to U.S. bank holding companies—was a central element of both the global credit boom in the years prior to 2008 and why the U.S. (and the world) experienced such a severe crisis after the collapse of Lehman Brothers.
6. Bailouts and myriad forms of downside protection extended to creditors, shareholders, and executives of large bank holding companies—and to nonbanks that were allowed to become bank holding companies during the crisis—confirmed that some of these firms have become "too big to fail." In the fall of 2008, top officials became convinced that allowing these firms to default on their obligations and potentially go bankrupt would worsen the global panic and damage the U.S. real economy.
7. Measures taken subsequently—including the Dodd-Frank financial reform legislation and actions by regulators—have been intended to reduce systemic risk and end the phenomenon of "too big to fail." Unfortunately, as the GAO points out, relatively little progress has been made even within the framework of Dodd-Frank.
8. The remainder of this testimony assesses what should be done within or beyond the Dodd-Frank framework. Specifically, what we have learned over the past decade suggests that:

   a. Requiring that all failing financial institutions go through bankruptcy, without any form of Government support, is appealing but not likely to work with the current scale, scope, and complexity of large international financial institutions. Changing the bankruptcy code is unlikely to provide the kind of systemic stability that is desirable in a crisis—unless the official sector is again willing to step in with financing.

   b. The Federal Deposit Insurance Corporation has made some progress with its Single Point of Entry approach to bank resolution. This could be helpful in some situations, but the FDIC is also likely to encounter serious implementation problems due to the difficulties of cross-border cooperation.

   c. The living wills provision of Dodd-Frank has so far been interpreted very narrowly by regulators. The intent of the law is that every financial institution should be able to go bankrupt within the existing code, without that destabilizing the world economy. This is already the case for small and medium-sized financial institutions in the U.S.; the problem is the largest handful of banks.

   d. The logical requirement is that these banks should be limited in their scale, with a cap on the size of their nondeposit liabilities as a percent of GDP. There are some encouraging indications that the Federal Reserve is moving in this direction, but the pace of sensible change remains glacial.

B. The Problem With Bankruptcy

It is very appealing to simply say: we will never provide support to a failing financial company; all such companies must go through bankruptcy, just as nonfinancial companies do. And this is exactly the intent of Title I in Dodd-Frank.

Unfortunately, with the current scale, scope and complexity of very large financial institutions in the United States, this threat is not credible—meaning that it will likely not be carried out because it is not "time consistent." Promises made today will not be implemented in a serious crisis because the consequences of following through would be too severe—and therefore officials will seek alternatives that involve some form of bailout.

These points became clear beyond a reasonable doubt at a public meeting at of the Federal Deposit Insurance Corporation's Systemic Resolution Advisory Committee on December 11, 2013. Proponents of bankruptcy-as-a-viable-option acknowledged that this would require substantial new legislation, implying a significant component of Government support (or what would reasonably be regarded as a form of "bailout" to a failing company and its stakeholders).[5]

In other words, as matters currently stand—under the existing code or under any potential version of a "Chapter 14" that would preclude official financial support—bankruptcy for a big financial company would imply chaotic disaster for world markets (as happened after Lehman Brothers failed).

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and recession; 17 percent is due to increases in discretionary spending, some of it the stimulus package necessitated by the financial crisis (and because the "automatic stabilizers" in the United States are relatively weak); and another 14 percent is due to increased interest payments on the debt—because we now have more debt.

[5] I'm a member of the committee, and these points were covered in the first session of the committee's discussion on that day.

The proponents of bankruptcy readily acknowledged that handling the collapse of such a company in an "orderly" fashion—i.e., without causing global panic—would require a large amount of credit being made available to the relevant bankruptcy judge (or to some form of a court-appointed trustee).

But who could possibly provide the amount of credit necessary to be stabilizing, particularly at a moment of systemic nervousness or potential panic? The only potential credit source available would be the United States Government, either through the Treasury Department or the Federal Reserve.

Under current legislation, providing such funding to a specific firm would be illegal. It would also be very awkward politically. Remember the justifiable resentment when Congress was asked to fund the $700 billion Troubled Asset Relief Program in September 2008, to be run with the Treasury—initially with very little accountability. Now we are being asked to fund activities that are being overseen by bankruptcy judges (and trustees), who could decide, for example, to keep on current management. How would that play politically?

One argument is that such official loans would be "safe" because the Government will definitely not lose the principal of its loan. But such assertions are not justified. Sometimes Government emergency financial support can earn a decent risk-adjusted return, if troubled assets sufficiently recover their value. More often, the Government ends up handing over a very large subsidy.

Bankruptcy cannot work for big banks—the largest half-dozen or so—at their current scale and level of complexity. It is not a viable option under current law. And changing the law to add a bailout component to bankruptcy—but only for very large complex financial institutions—does not pass the laugh test.

It is completely unrealistic to propose "fixing" this problem with legislation that would create a new genre of bailouts (or the pretense of "no bailout", until the next crisis, where there would again be bailouts of the Paulson-Bernanke-Geithner variety).

Under current law—and as a matter of common sense—the Federal Reserve should take the lead in forcing megabanks to become smaller and simpler.

The legal authority for such action is clear. Under Section 165 of the 2010 Dodd-Frank financial reform legislation, large nonbank financial companies and big banks are required to create and update "the plan of such company for rapid and orderly resolution in the event of material financial distress or failure." The design is that this plan—known now as a "living will"—should explain how the company could go through bankruptcy (i.e., reorganization of its debts under Chapter 11 or liquidation under Chapter 7 of the Bankruptcy Code) without causing the kind of collateral damage that occurred after the failure of Lehman Brothers.

This bankruptcy should not involve any Government support. It is supposed to work for these large financial companies just as it would for any company, with a bankruptcy judge supervising the treatment of creditors. Existing equity holders, of course, are typically "wiped out"—the value of their claims is reduced to zero.

The full details of these living wills are secret, known only to the companies and the regulators. (The Systemic Risk Council, chaired by Sheila Bair, has called for greater disclosure of important details. I am a member of that Council.)

The discussion at the FDIC in December helped make clear that these living wills cannot be credible—either from a bankruptcy or resolution perspective—because the big banks are incredibly complex, with cross-border operations and a web of interlocking activities.

When one legal entity fails, this leads to cross-defaults—and then the seizure of assets around the world by various authorities and enormous confusion regarding who will be paid what. When any single megabank starts to go down, others will certainly come under intense market pressure, in part because the value of their assets will fall and in part because a sense of panic will spread—this is how such crises become "systemic."

All of these effects are exacerbated by the fact that these companies are also highly leveraged, with much of this debt structured in a complex fashion (including through derivatives). The bankruptcy experts at the FDIC meeting stressed these points in fascinating detail.

What then are the implications? The Dodd-Frank Act has some specific language about what happens if the resolution plan of a nonbank financial company supervised by the Board of Governors or a bank holding company described in subsection (a) is not credible or would not facilitate an orderly resolution of the company.

Cross-border issues would be an insurmountable obstacle for bankruptcy with the current structure of large global financial firms. They would likely also create a

major problem for any attempt to apply the FDIC's preferred Single Point of Entry approach.[6]

Not unreasonably, under Section 165 of Dodd-Frank, the Fed and the FDIC may jointly impose more stringent capital, leverage, or liquidity requirements, or restrictions on the growth, activities, or operations of the company, or any subsidiary thereof, until such time as the company resubmits a plan that remedies the deficiencies.[7]

The company may also be required "to divest certain assets or operations identified by the Board of Governors and the corporation, to facilitate an orderly resolution."

The retort of the big banks is, "We can skip bankruptcy and go directly to Title II resolution," which allows the FDIC to step in and take charge of a failing financial company. But the Title II (of Dodd-Frank) authority is intended as a back-up—to be used only if, contrary to expectations, bankruptcy does not work or chaos threatens.

If it is clear ex ante that bankruptcy cannot work—and this is now completely clear—then the implications of the statute are not controversial. The Fed and the FDIC must require remedial action, meaning that something about the size, structure, and strategy of the megabanks must change.

This is the logic of our current situation. Section 165 is potentially valuable, but only if the relevant officials recognize this reality and act on it—precisely with the goal of making bankruptcy under the existing code into a feasible option for all firms in the U.S. economy.

C. Assessment of the Volcker Rule

The announcement in December 2013 of the Volcker Rule, restricting proprietary trading and limiting other permissible investments for very large banks, is a major step forward. Almost exactly 4 years after the general idea was first proposed by Paul A. Volcker, the former chairman of the Federal Reserve, and nearly 3½ years since it became law, the regulators have finally managed to produce a rule.

This rule could be meaningful, and this is why there has already been so much pushback from the big banks. Their main strategy so far—denial that there is a problem to be addressed—has failed completely. Their legal challenges are also unlikely to succeed. The main issue now is whether the regulators force enough additional transparency so that it is possible to see the new ways that proprietary bets are hidden.

The Volcker Rule is intended to impact only the very largest banks—the material impact will be mostly on JPMorgan Chase, Bank of America, Citigroup, Goldman Sachs, and Morgan Stanley. The goal is simple and sensible. Given that these banks are supported by large implicit Government backstops (e.g., from the Federal Reserve), they should be more careful in their activities and should not engage in large-scale bets that have the potential to cause insolvency for them and disruption for the rest of the global financial system.

These companies could choose to become smaller, with the constituent pieces operating under fewer restrictions. But their managements want to stay big, so they should face additional constraints.

The first pushback strategy—and the main focus of big bank efforts to date—is to deny that the Volcker Rule is needed at all. This line has been pushed hard over the last 4 years, including at a Senate hearing in February 2010.

Barry Zubrow, then chief risk officer at JPMorgan Chase, testified that the Volcker Rule was not needed, as risk controls in big banks were sufficient to the task. (I also testified at the hearing, in favor of the rule.) The extent to which JPMorgan Chase subsequently managed its own risks—including proprietary trading-type activities run out of its chief investment office—has been called into question. Mr. Zubrow retired at the end of 2012, telling his colleagues, "We have learned from the mistakes of our recent trading losses."

I hope that is true, but it seems unlikely, because the name of the game for very large banks is leverage, i.e., taking big bets using a lot of borrowed money and very

[6] The FDIC has received an expression of potential cooperation from the Bank of England. Unfortunately, this and other vague statements are unlikely to hold up under the pressure of many real world situations. Only a binding treaty on cross-border resolution could really make a difference and this is unlikely for the foreseeable future.

[7] For the FDIC's approach to resolution to work, there has to be enough "bailinable debt" and equity at the holding company level. The Federal Reserve has yet to issue proposed rules for comment on this key topic—and their slowness on this issue is a matter for grave concern. It is also remains to be seen what is really "bailinable debt"—what kinds of investors can own this without raising concerns of contagion and systemic risk when and if this debt is converted to equity (or is just wiped out) in a crisis.

little equity.[8] This is how to boost your return on equity, unadjusted for risk, which is what financial analysts (and the related news coverage) focus on. Most regulators now have this point much more clearly in their minds.

At the same time, Mr. Zubrow and others asserted that the introduction of any kind of Volcker Rule would have a big negative effect on financial markets and the economy. But as the adoption of the rule has approached, financial markets have taken that news completely in stride. Yes, we have lower employment levels than we would like, but that's primarily due to the large financial crisis since the Great Depression, brought on by excessive risk-taking (for example, at Citigroup).

The conceptual fight against the Volcker Rule has been lost by the big banks, at least in part because of the London Whale losses overseen by Mr. Zubrow and his colleagues—but also because enough regulators have finally wised up to how the big banks really operate and why that can damage the real economy.

Treasury Secretary Jack Lew also deserves credit for pushing the rule toward the finish line and for insisting that top management be held accountable for whether companies comply with the law.

The second pushback strategy is legal—to bring one or more cases through the courts that will challenge key aspects of the Volcker Rule. Eugene Scalia, the son of Supreme Court Justice Antonin Scalia, has had some success with this strategy on other financial regulatory matters.

But, as former Congressman Barney Frank has pointed out, the new Senate rules mean that we should expect confirmation of three new judges on the U.S. Court of Appeals for the District of Columbia Circuit, which is where the Volcker Rule would need to be challenged. The chances of a successful legal case have therefore receded, although what happens when and if such a matter reaches the Supreme Court remains unclear.

The third strategy is to find new ways to hide the essence of proprietary trading—and this is an important open issue. Will there be enough disclosure and observable behavior for either the regulators or people on the outside to see whether the spirit of the Volcker Rule is being followed? For example, how exactly will traders be compensated and how much of this will be disclosed? Will data be available on trading activities, allowing independent researchers to look for patterns that might otherwise elude officials?

The Volcker Rule could be a major contribution to financial stability. Or it could still flop. The devil now is in the details of implementation and compliance—and how much of this becomes public information and why what time lag.

D. Some Limited Grounds for Optimism

There are some recent indications of changes in thinking at the most senior levels of the Federal Reserve System.

Specifically, beginning in October 2012, Governor Daniel K. Tarullo has articulated the potential case for limiting the size of our largest banks, measured in terms of their nondeposit liabilities as a percent of GDP.[9]

First and foremost, the Fed has begun to recognize and discuss publicly the implicit subsidies that large banks continue to receive,

> To the extent that a growing systemic footprint increases perceptions of at least some residual too-big-to-fail quality in such a firm, notwithstanding the panoply of measures in [the] Dodd-Frank [Act] and [Federal Reserve] regulations, there may be funding advantages for the firm, which reinforces the impulse to grow. There is, then, a case to be made for specifying an upper bound [on size].

The implication is that we should not allow the size of our largest bank holding companies to increase further, although Mr. Tarullo seems to want to pass the buck back to Congress.

> In these circumstances, however, with the potentially important consequences of such an upper bound and of the need to balance different in-

[8] On this point, see Anat Admati and Martin Hellwig, "The Bankers' New Clothes: What's Wrong With Banking and What To Do About It", Princeton University Press, 2013. A close reading of this book suggests that the recently proposed supplemental leverage ratio is a step in the right direction—but only a small step that is likely to prove insufficient. The increase in capital requirements under Basel III is also unlikely to make much difference—one senior official recently described this as moving maximum permissible leverage (debt relative to total assets) from 98–99 percent pre-2008 to around 97 percent for the future.

[9] See *http://www.federalreserve.gov/newsevents/speech/tarullo20121010a.htm.* He made similar points in a speech at the Brookings Institution in December 2012 and in testimony before the Senate Banking Committee in February 2013.

> terests and social goals, it would be most appropriate for Congress to legislate on the subject. If it chooses to do so, there would be merit in its adopting a simpler policy instrument, rather than relying on indirect, incomplete policy measures such as administrative calculation of potentially complex financial stability footprints. *The idea along these lines that seems to have the most promise would limit the nondeposit liabilities of financial firms to a specified percentage of U.S. gross domestic product, as calculated on a lagged, averaged basis.* In addition to the virtue of simplicity, this approach has the advantage of tying the limitation on growth of financial firms to the growth of the national economy and its capacity to absorb losses, as well as to the extent of a firm's dependence on funding from sources other than the stable base of deposits. While Section 622 of Dodd-Frank contains a financial sector concentration limit, it is based on a somewhat awkward and potentially shifting metric of the aggregated consolidated liabilities of all 'financial companies.' [emphasis added]

Hopefully, there will be support for legislation along exactly these lines—as proposed by Senator Sherrod Brown and by Senator Brown with Senator David Vitter. [10]

The Federal Reserve could help articulate the case for such legislation with greater clarity.

It would also be most helpful if a vice chairman for supervision could be appointed to the Federal Reserve Board. The creation of this position is a requirement of the Dodd-Frank Act that, rather inexplicably, remains completely unaddressed by the Obama administration.

PREPARED STATEMENT OF HARVEY ROSENBLUM

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JANUARY 8, 2014

Chairman Brown, Ranking Member Toomey, and Members of the Subcommittee: I am pleased to testify on Too Big to Fail (TBTF) subsidies and related issues stemming from the 2008–09 Financial Crisis. In doing so, I will indirectly comment on some of the more glaring inadequacies of the Dodd-Frank Act which, though well-intentioned, simply will not end TBTF. [1] Dodd-Frank leaves the U.S. and global financial systems more crisis-prone than previously. To end TBTF and the financial instability it engenders, it is necessary that Congress amend the laws and incentives governing the provision of financial services by following a few basic principles.

First, incentives matter. Dodd-Frank has done little to alter the widespread perception that the U.S. Treasury and the Federal Reserve will once again provide extraordinary Government assistance to giant financial institutions that get themselves into financial trouble. Promises to end TBTF are easy to make, but like all promises, are difficult to keep in the face of a financial crisis. The stockholders, creditors, and other counterparties of giant financial institutions know this—and act accordingly. This perception enables giant financial institutions to grow faster, larger and more dangerously than smaller institutions and provides a distinct cost advantage to the giants. This is the source of a huge $50–100 billion annual subsidy that flows to the giant financial institutions in perpetuity [Bank for International Settlements, 2012].

Congress has never voted to approve this annual expenditure; it came about inadvertently as technology changed, Congress allowed interstate banking, and Congress ended the separation between investment banking, insurance and commercial banking. The net result is that public policy now subsidizes the growth of large, risky, and unmanageable financial institutions that create systemic financial instability, the opposite of what public policy professes to seek to achieve.

Second, initial conditions matter. Fewer than a dozen giant banking institutions control around 70 percent of industry assets, up considerably from the years just prior to the financial crisis. Our financial services industry has gotten more concentrated; the playing field is less level; and Government policy, perhaps unintentionally, will continue to foster ever more consolidation, concentration, and reduced

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[10] See the proposed SAFE Banking Act proposal and TBTF Act.

[1] The views expressed are my own and are not necessarily those of the Federal Reserve Bank of Dallas or the Federal Reserve System where I worked for over 40 years before retiring on Nov. 1, 2013.

competition in financial services. To believe otherwise requires a willful blindness to what should be obvious to observers of our financial system. As Yogi Berra once said: "Sometimes you can observe a lot, just by looking."

Competition is being further reduced by a merger and acquisition wave among small-to-medium size banking institutions in response to the enormity of the regulatory compliance costs of dealing with Dodd-Frank. In addition, new entry into banking has been at a near-standstill for the last 5 years. In these circumstances, it would be wishful thinking on my part to believe that the normal forces exerted by capitalism and free markets are capable of reversing these competitive imbalances.

Economics 101 teaches us that proper incentives and competition allow market forces to solve most economic problems. Banking is plagued by the perverse incentives of TBTF, combined with ever-diminishing competition.

When all of the costs of the 2008–09 Financial Crisis are added up, the costs to the United States will amount to $15–30 trillion [Atkinson, Luttrell, and Rosenblum, 2013]. Yes, I said trillion. This is 1-to-2 years of U.S. output down the drain. Allow me to translate this into everyday language the average person can understand; a conservative estimate is that the crisis cost $50 thousand to $120 thousand for every U.S. household [Luttrell, Atkinson, and Rosenblum, 2013]. Many of these costs were largely avoidable. What is worse, unless Government policies and incentives on TBTF subsidies are changed, another financial crisis, likely worse than the last one, may occur in the not-too-distant future.

The TBTF Subsidy. I commend the recent GAO study of the TBTF subsidy [GAO, 2013]. As you know, the GAO's study is part one of a two-part study quantifying the subsidy received by the surviving TBTF firms. The study quantifies the financial benefits conferred on the TBTFs during the financial crisis. Part two, the more important study, will measure the ongoing subsidy received by the TBTFs postcrisis.

This subsidy is large, though its exact size varies from year-to-year and business cycle to business cycle. The subsidy grossly distorts normal market forces. As one observer has noted, the subsidy serves as a "shadow poison pill" not only making the TBTF firm immune to corporate threats but degrading the customary governance forces that would lead to the rightsizing of the firm [Roe, 2013].

The subsidy, moreover, enables the giant banks to grow larger and more dangerous to our economic system; but it is difficult to measure precisely. There is no line item on a bank's balance sheet or income statement labeled "TBTF Subsidy". But it exists and it is pernicious in its impact. It is legal; the giant financial institutions are merely responding to the incentives presented to them, not necessarily violating any laws.

The TBTF subsidy, in theory, should accrue to the equity shareholders of the giant banking institutions. In practice, a substantial portion of the TBTF subsidy is dissipated away in the form of higher management salaries, bonuses, and perquisites; inefficient operations; and corporate waste. Unlike other industries, hostile takeovers by corporate raiders, hedge funds, and private equity firms are impossible in the case of giant banking institutions. Short of a Government-ordained merger in the face of an impending failure, there is simply no market mechanism to effectuate a change in corporate control at the largest banking institutions.

Restoring Competition and Reducing TBTF Subsidies. Recently, I was the coauthor of a plan that sought to utilize market forces to reduce the TBTF subsidy, level the competitive playing field in banking, and most importantly, lessen the likelihood of incurring another round of horrendous costs from another avoidable financial crisis [Fisher and Rosenblum, 2013a]. As a Nation, we simply cannot afford to repeat previous mistakes.

The reform plan we advocated—which has since become known as "the Dallas Fed Plan"—would: (1) restrict the Federal safety net of deposit insurance and access to the Federal Reserve's lender of last resort facilities to traditional depository institutions; (2) require every customer of nonbank financial institutions to acknowledge in writing that the U.S. Government provides absolutely no backstop or financial guaranty for their transactions; and (3) call for Government policies that strongly encourage the managements of the Nation's largest banking institutions to streamline, simplify, and downsize their companies so that any and all banking affiliates of the financial holding company would be certified by the FDIC as "Too Small to Save" in the event of failure. These three steps would realign incentives away from the current perverse TBTF mindset and would reestablish a more competitive framework within the banking industry. Dallas Fed President Richard Fisher continues to advocate the Dallas Fed Plan. To some extent, several of the giant institutions have begun downsizing and streamlining, but at a snail's pace [Fisher and Rosenblum, 2013b], a process that the stock market, by way of price-to-tangible book value ratios, is urging management to pursue [Fisher and Rosenblum, 2013c].

Would the Dallas Fed Plan end banking and financial crises? Probably not; financial crises have characterized the global banking and financial system for over three centuries and will likely continue to do so. However, I firmly believe that the Dallas Fed Plan, which operationally could be thought of as a plan to mitigate moral hazard, would considerably reduce the frequency and severity of financial crises in the United States. No financial reform plan is perfect, but we should not let our quest for perfection distract us from making significant improvements to the architecture of our financial system.

Alternative Means to Reduce the Impact of TBTF Subsidies. I believe the Dallas Fed Plan is the best financial reform plan. But there are several other good reform plans worthy of consideration. I will mention two that would reinforce the virtues of the Dallas Fed Plan by helping to get the incentives right and by having the additional benefit of enforceability due to their transparency and simplicity.

One is the Subsidy Reserve Plan advocated by Boston University Professor Cornelius Hurley. This plan is the subject of legislation (H.R. 2266) filed by Congressman Michael Capuano in 2013.

Professor Hurley's plan would require the GAO, together with the Federal Reserve and the Office of Financial Research to determine the size of the TBTF subsidy for each of the giant banking institutions, and then lock up that amount so that it could only be distributed to shareholders and other stakeholders in connection with the downsizing of the TBTF firms [Hurley, 2013]. The appeal of this plan is its reliance on market discipline as opposed to arbitrary break-up plans and caps on growth.

While I can imagine intense debate over determining the acceptable methodology for measuring the TBTF subsidy, I still believe the Subsidy Reserve Plan has a lot of merit. Part two of the GAO's study due later this year may be an important milestone in advancing our understanding of the TBTF subsidy.

In any event, recent-day banking regulation is plagued by endless debate over how much bank capital is "adequate," as well as which categories of capital qualify for covering losses. After more than a century, measuring the adequacy of bank capital remains a continuing debate. As with capital requirements, the most important thing is not that we measure the subsidy with scientific precision but that we ensure that our quantification of the subsidy is directionally accurate.

In this context, I should mention the Brown-Vitter Bill, which seeks to impose a 15 percent capital-to-assets ratio on all giant banking institutions, a ratio much higher than has been imposed or voluntarily adhered to by banking institutions for over half a century, if not longer [Brown and Vitter, 2013]. For most banking institutions, a 15 percent capital-to-assets ratio seems to me to be too high. For the giant banking institutions, however, a 15 percent capital-to-assets ratio seems to be barely adequate given the systemic repercussions that would follow the failure of such a giant banking institution.

We sometimes set different highway speed limits for 18-wheelers carrying hazardous substances than we do for automobiles carrying a few passengers. We also do not encourage self-regulation of speed limits by drivers. Perhaps this analogy provides some lessons for the necessary transparency, simplicity, and enforceability of capital regulations for banks. Let me conclude with a sweeping but appropriate generalization: when it comes to regulation of the banking industry in general, and capital in particular: complexity is the enemy. Complexity makes regulation unintelligible and thereby unenforceable; it can sometimes be worse than no regulation at all. Let me be more specific—the Basel rules on bank capital regulation and Dodd-Frank have caused more harm than good. Basel rules have encouraged institutions to load up on "safe" assets like mortgage securities and sovereign debt, and Dodd-Frank, 3½ years after being signed into law, is only about halfway through its regulation-writing phase and has already produced more than 14,000 pages of proposed regulations.

Back to the Drawing Board: If It Is Not Workable, It Simply Will Not Work. I know it is difficult for those who supported Dodd-Frank to acknowledge its largely unworkable nature. Delegating rulewriting responsibility to more than a dozen agencies has produced irrational unaccountability. The perverse incentives of TBTF have been perpetuated and hidden within thousands of pages of inscrutable regulations confounded by conflicts and complexity. The regulations are simply a kaleidoscopic reflection of the underlying statutes.

There is a simpler and better alternative. The Dallas Fed Plan, perhaps combined with the Subsidy Reserve Plan and the Brown-Vitter Bill, could postpone the next financial crisis for a decade or two. This would require, however, that the resulting statute is no more than about 10 pages long, with the added requirement that its resulting regulations must be written using fewer words than the statute.

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PREPARED STATEMENT OF ALLAN H. MELTZER

THE ALLAN H. MELTZER UNIVERSITY PROFESSOR OF POLITICAL ECONOMY, CARNEGIE MELLON UNIVERSITY TEPPER SCHOOL OF BUSINESS

JANUARY 8, 2014

I am very pleased to testify on financial soundness before this Committee. Much has changed since the financial crisis of 2008. I will comment on the adequacy of some of the measures and propose some more effective procedures including passage by the Congress of the Brown-Vitter legislation.

Let me begin by stating two principles that should guide your efforts.

First principle: legislation should increase incentives by bankers and financial firms to act prudently. In an uncertain world, we cannot always know the prudent course. Owners and managers are most likely to act prudently, if they bear the cost of errors, mistakes, and unforeseen events. They will be more willing to cushion risks and uncertainties.

Second principle: regulation must provide rules that prevent single bank failures from threatening the financial system. More than a century ago, careful analysts understood that the public responsibility was to protect the payments system because a breakdown of the payments system stops all or most economic activity. Fear and uncertainty cause banks to refuse to accept payments drawn on other banks.

That is what happened in the Great Depression. That was what started to happen in 2008 after Lehman Brothers failed. Timely, aggressive action by the Federal Reserve prevented the payments breakdown.

The second principle has wrongly devolved into actions to protect banks. There is no economic justification for that as a public responsibility. I repeat: *The public responsibility is to protect the payments system, not the banks or bankers.* The proper way to separate the two is to impose procedures that prevent a failing bank from threatening the payment system. That requires four or five actions.

1. A clearly stated announced rule for the lender-of-last resort. A well-known rule that has been used successfully calls for the Federal Reserve to lend freely on good collateral at a penalty rate. In its first hundred years, the Federal Reserve has often discussed its lender-of-last-resort policy internally, but it has never announced its policy. Announcement is important, indeed crucial. It tells potential users well in advance how to prepare their balance sheets and to hold collateral against which they can borrow from the Federal Reserve in a crisis. It avoids panic by enforcing it announced rule.
2. It does not wait to choose action until the panic is upon us.

3. The lender-of-last-resort policy prevents crises from spreading and stopping the payments system. It does not save or help troubled banks that lack acceptable collateral.
4. Require equity capital at banks sufficient to absorb all anticipated losses. The Brown-Vitter bill requires a minimum of 15 percent equity capital for all banks that hold $500 billion in assets. Capital is assessed against all assets, no exceptions or adjustments for risk. This avoids circumvention.
5. If a bank's equity percentage falls to 10 percent due to losses, it must cease paying dividends until the 15 percent equity ratio is reached.
6. All money market funds should be marked to market. Recent reform required mark-to-market for institutional funds but exempted individual funds. The problem of runs is not avoided unless all money market funds are covered by a mark to market rule. The purpose is to prevent depositor runs.

Community banks and all banks with less than $500 billion in assets should hold a lower equity capital percentage, say 8 percent, because they are protected by deposit insurance.

Banks as a group pay the cost of deposit insurance. It has worked well for all but the largest banks.

The Brown-Vitter bill recognizes that the way to prevent bailouts using taxpayer funding is to make the bankers have an incentive to be prudent. The 15 percent equity requirement is based on the minimum equity capital ratio held by major New York City banks during the worst financial crisis in our history, 1929–32. By requiring banks to pay for their mistakes, the system gave bankers strong incentives to lend prudently. No major New York bank failed.

Bankers make two principal arguments against this proposal. They say it would reduce credit availability and would encourage greater risk taking to restore earnings. Both claims are wrong. The Federal Reserve determines the volume of lending; banks decide who gets the credit. As to increased risk taking, the banks bear the cost of bad decisions, not the public. Large stockholders would quickly replace managers who caused them heavy losses and jeopardized their dividend.

Dodd-Frank gives the Treasury Secretary the power to decide too-big-to-fail. Since TBTF started, it has always been the Treasury Secretary. The mistake in Dodd-Frank is that the Treasury Secretary makes the decision in the midst of a crisis. That's much too late. No one should believe that any Treasury Secretary will risk a bigger crisis at that time. The only way to end too-big-to-fail is to adopt and enforce rules that give the bankers much greater incentives to be prudent and avoid failure. The Brown-Vitter bill does just that.

Finally, consider the complex Volcker rule that requires regulators to decide what is a hedge done to reduce risk and what is a speculation that banks choose to increase risk. Compare that to the much simpler Brown-Vitter requirement that makes the bankers pay for their mistakes and gives them a strong incentive to avoid making them. Which do you think is mostly likely to prevent crises and to reward safety and soundness?

RESPONSES TO WRITTEN QUESTIONS OF SENATOR VITTER FROM LAWRANCE L. EVANS, JR.

Q.1. One of the criticisms of this study is despite the fact that there are a number of tables in the back, there are not easy top line numbers as to how much economic assistance each large financial institution (over $500 billion in assets) received and what discount of the market rate was provided to those large financial institutions by the taxpayers. Why did you not provide those top line numbers in the study and can you do so now for the record?

A.1. Our decisions about how to present data on the amount and pricing of the emergency Government assistance reflect our judgments about how best to present informative measures while being mindful of the limitations of these types of measures. Appendix IV of our report contains data tables and figures intended to facilitate a comparison of the amount of assistance received by banking organizations of various sizes. For the six largest bank holding companies (over $500 billion in assets), table 7 shows the total dollar amount outstanding at year-end for 2008 through 2012 for programs administered by the Federal Reserve System, the Federal Deposit Insurance Corporation (FDIC), and the Department of the Treasury (Treasury). For these dates, this table also shows this total amount outstanding under each program as a percentage of the institution's total consolidated assets. This percentage calculation provides a measure of assistance that is more comparable across institutions of different sizes by showing how much of the institution's balance sheet was assisted by each program. In table 7 and other figures in this appendix, we did not sum program totals across the different programs to arrive at a "top line" measure. Such an aggregate measure, presented on its own, would obscure important differences in the composition of assistance across firms and the value provided by different forms of assistance (i.e., loans, liabilities guaranteed, and capital investments). Accordingly, in figures 3, 4, and 5 in appendix IV, we aggregated measures of total assistance from programs that provided similar forms of assistance, but not measures of the total assistance from all of the programs.

In response to your request for more information on the total assistance provided to the largest bank holding companies, in Table 1 below, we show the total term-adjusted assistance provided to these six firms through selected programs. These term-adjusted measures account for differences in the time period over which assistance was outstanding by multiplying the dollar amount of the assistance by the number of days it was outstanding and dividing this amount by the number of days in a year (365). While the term-adjusted amounts provide one measure of the total assistance received under these programs, they have limitations. For example, they do not account for differences in firm size that could have contributed to differences in the dollar amounts firms received and therefore do not allow for a fair comparison of the relative amounts of assistance received by firms of different sizes. In addition, as with the measures shown in our report, totaling these measures across programs that provided very different forms of assistance would give an incomplete picture of the composition and value of assistance received by different firms.

With respect to our analyses of emergency program pricing, these analyses cannot be used to calculate a "top line" estimate of the total dollar value benefit for individual bank holding companies. For selected programs, we compared program pricing to indicators of pricing for market alternatives. The market interest rates we used as benchmarks provide a general indication of market alternatives that could have been available to program participants. As our report notes, however, these market rates are unlikely to reflect available alternatives for all participants at all points in time during the crisis and cannot be used to produce a precise quantification of the benefits that accrued to individual participating institutions. In addition, pricing data were not available for market alternatives to all programs, such as interest rates for many types PDCF and TSLF collateral. To soundly estimate the benefits to individual institutions, we would need to know the individual counterfactual prices for each institution for each program, and that information is not observable.

Table 1: Total Term-Adjusted Government Support for Largest Bank Holding Companies for Selected Programs

(Dollars in billions)

	Federal Reserve System Borrowings[a]					FDIC Guaranteed-Liabilities[b]			Treasury TARP Equity Investments[c]		
	TAF	PDCF	TSLF	CPFF	Total Fed loans	DGP	TAGP	Total Guarantees	CPP	TIP	Total TARP equity
Bank of America Corporation	$48	$6	$8	$6	$67	$138	$152	$290	$17	$18	$35
Citigroup Inc.	15	8	27	8	58	195	65	260	***19	20	***39
Goldman Sachs Group, Inc.	-	2	17	0	20	65	2	67	6	-	6
JP Morgan Chase & Co.	13	0	3	-	16	121	129	250	16	-	16
Morgan Stanley	-	8	8	1	17	71	9	80	6	-	6
Wells Fargo & Company	25	-	-	-	25	29	89	118	29	-	29

Sources: GAO analysis of Federal Reserve System, FDIC, and Treasury data.

Note: Dollar amounts are rounded to the nearest billion and zeroes indicate participation that was greater than zero but less than $500 million. Dashes indicate that a firm did not participate in the program.

[a]The dollar amounts borrowed for each loan were term-adjusted by multiplying the loan amount by the term to maturity for the loan and dividing by 365 days. Term to maturity is calculated as the difference between the original loan maturity date and the trade date and does not reflect repayments of loans that occurred before the original loan maturity date. Total borrowing is aggregated at the parent company level and generally includes borrowing by branches, agencies, subsidiaries, and sponsored ABCP conduits that we could identify. Total borrowing for each parent company consolidates amounts borrowed by acquired institutions following the completion of acquisitions. PDCF totals include credit extensions to affiliates of some primary dealers and TSLF totals include loans under the TSLF Options Program (TOP).

[b]FDIC-guaranteed liabilities are term-adjusted by multiplying the dollar amount of the liability guaranteed by the term over which the liability was guaranteed (in days) and dividing by 365 days.

[c]TARP equity investments are term-adjusted by multiplying the dollar amount of the capital investment by the number of days the capital investment was outstanding divided by 365 days. On October 28, 2008, Treasury made CPP investments of $25 billion in Citigroup, JP Morgan and Wells Fargo; $15 billion in Bank of America, and $10 billion in both Goldman Sachs and Morgan Stanley. ***Citigroup's term-adjusted CPP amount is calculated using a repayment date of July 30, 2009, when Treasury completed its exchange of Citigroup's preferred shares for common stock.

Q.2. How have you explored whether these studies and reports you are relying on been "sponsored" by entities that, directly or indirectly, have a financial interest in the outcome of the Part II study?

A.2. GAO operates under strict professional standards that require our staff to exercise objectivity and professional skepticism in all the work that they do. Simon Johnson's written statement and opinions expressed during the hearing reflect a fundamental misunderstanding of how GAO does its work. To be clear, GAO adheres to generally accepted Government auditing standards (GAGAS) in developing its products.[1] Among other things, these standards require GAO staff working on audit engagements to consider possible bias in the sources of the evidence collected. We take steps to identify and address bias and other threats to independence throughout all of our audits—including threats resulting from undue external influence from interested parties.

It is important to emphasize that GAO is relying principally on its own empirical research for the Part II study. We plan to supplement our analyses with documentary evidence (studies) and testimonial evidence (interviews). To the extent we leverage outside research, quality, validity, and reliability will determine whether a study is included in our findings. As we indicated during the hearing, rigorous review of methodologies, assumptions, and limitations of each study allows us to distinguish high-quality studies from weaker ones. Any review will be conducted in accordance with our professional standards that require us to plan and perform the audit to obtain sufficient, appropriate evidence that would provide a reasonable basis for our findings and conclusions. The staff assigned to the Part II study collectively possesses adequate professional competence and technical skill needed to undertake this difficult study, including exercising judgment on the quality of external research. The exercise of this professional judgment allows us to review the relevant literature including studies conducted by interested parties and eliminate those where bias compromises the validity of the study.

The same is true with respect to stakeholders we identify for interview purposes. For example, Mr. Johnson—who does not have an empirical study relevant to Part II of our engagement and is not among those experts reviewing our model—is among a number of interested parties we have approached who are knowledgeable and have strong views on one side of the issue. We routinely engage such interested parties to gather information and opinions on any number of matters. Meeting with interested parties that span the ideological spectrum helps to ensure that we are balanced and objective in our approach, while our professional standards and ethical principles assure that we retain professional skepticism and weigh evidence appropriately.

Q.3. You have indicated that with respect to persons consulted in connection with the study, "one of the things that we explored was conflicts of interest." Please describe for the Committee how you went about the task of unearthing potential conflicts of interest involving those individuals with which you and your staff have interacted.

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[1] See Government Auditing Standards: 2011 Revision, GAO-12-331G.

A.3. To be clear, these interactions refer to external experts we sought out to review aspects of our model and identify threats to validity or otherwise opine on ways to improve the robustness of our methodological approach. Utilizing experts in this manner is an important quality assurance step we take when appropriate. When external experts contribute to the planning and conducting of our engagement, in accordance with our professional standards, we are required to assess their independence and apply and document any safeguards deemed necessary to mitigate any threats. In this specific case, we reviewed the external experts' affiliations, activities, and research where appropriate. We also asked the academic experts to raise any potential conflicts of interest that might impinge upon their ability to render impartial conclusions about our empirical work.

When we interview individuals and they are used as sources of testimonial or other evidence, GAO's standards of evidence also apply. Among other things, these standards require that we consider possible bias in the source of the evidence. While we do background research on the individuals we contact for interviews, we do not necessarily ask the external sources questions about funding or sources of income. In most cases, their biases and interests are quite clear. As discussed above, in cases where we are merely seeking views or opinions, information from these individuals is used in ways that does not require a rigorous evaluation of independence. In fact we may reach out to interested parties to ensure we heard perspectives from a balanced group of experts.

Q.4. Are any of the members of your staff who are working on the Part II study customers of or investors in any of the financial institutions with assets in excess of $500 billion?

A.4. As mentioned above, GAO adheres to GAGAS in developing its audit products, including this engagement. These standards require that GAO staff working on audits maintain both independence of mind and independence in appearance. Correspondingly, none of the staff working on the Part II study have direct investments in bank organizations. We do note, however, that a GAO employee with direct investments in banks with assets below $500 billion or even in nonbank financial companies could also have a threat to independence. As a result, no employee on this engagement has any reported direct investment in any financial company, and employees working on GAO's financial markets work are generally prohibited from holding any asset in the financial sector. As a result of these and other actions we take to preserve our independence, we believe our opinions, findings, conclusions, judgments, and recommendations are impartial and can be viewed as impartial by reasonable and informed third parties.

GAO is not only concerned with actual independence but also how others might perceive our independence. However, it is important to emphasize that the reference point for "independence in appearance" is a reasonable objective third party. We don't believe that maintaining a customer relationship with a financial institution on the same terms as are available to the general public threatens the independence of auditors assigned to this engage-

ment or should be perceived to be a threat by a reasonable, objective third party.

Q.5. Does GAO have a policy in place that would preclude anyone working on the Part II study from accepting employment at an institution with assets in excess of $500 billion?

A.5. Although there are no postemployment restrictions on our employees that would prevent GAO's auditors from seeking private employment with one of these institutions, no employee who is seeking employment with one of these institutions would be permitted to work on the Part II study. Our policies require employees who are seeking employment with an entity that could be affected by an engagement to notify management so that any threat to independence can be evaluated and if significant, an appropriate safeguard applied—often the reassignment of the employee to other duties. In addition, most senior GAO employees are required by law to file a statement within three calendar days after beginning job negotiations or after entering into an employment agreement with a private employer.

ADDITIONAL MATERIAL SUPPLIED FOR THE RECORD

STATEMENT OF THE INDEPENDENT COMMUNITY BANKERS OF AMERICA, SUBMITTED BY CHAIRMAN BROWN

ICBA
INDEPENDENT COMMUNITY BANKERS of AMERICA®

January 8, 2014

Too-Big-To-Fail Subsidies Exacerbate Regulatory Burden

On behalf of the nearly 7,000 community banks represented by the Independent Community Bankers of America, thank you for convening today's hearing titled: "Examining the GAO Report on Government Support for Bank Holding Companies." Government subsidies for a small number of too-big-to-fail firms increase systemic risk and pose a direct threat to our economy and to taxpayers. What's more, a neglected consequence of these TBTF subsidies is their contribution to community bank regulatory burden. Today's megabanks continue to be fueled by government subsidies. When they misuse their size and market power, the rules enacted in response too often sweep in community banks.

A timely example of this phenomenon is the agencies' final Volcker Rule, issued December 10. A provision of the final rule unfortunately requires divestiture, by banks of all sizes, of trust preferred securities backed by collaterized debt obligations. Accounting standards require these banks recognize immediately an impairment of their investments. This impairment will be exacerbated by the divestment requirement, resulting in write downs based on fire sale prices. Left unaddressed, this requirement could cause a significant, immediate and permanent loss of capital to hundreds of community banks still recovering from the financial crisis. This is another direct blow to community banks, linked to the abuses of too-big-to-fail banks, whose growth is fueled by government subsidies. ICBA urges this committee to promptly consider legislation to exempt community banks from this provision of the final Volcker Rule and demand the bank regulators effectively fix this problem.

An end to the subsidies and a definitive resolution of the too-big-to-fail problem is vital to the creation of a sensible, balanced and proportionate regulatory regime that will promote true and robust competition in the market for financial services. ICBA is pleased to present the community bank perspective on this critical issue in the following statement for the record.

Government-Subsidized Industry Concentration Continues Unabated

According to recent data provided by SNL Financial, the five largest U.S. banks now control 44.2 percent of the industry's assets, a share that has steadily increased in recent years. In 1990, the five largest banks controlled only 9.7 percent of all bank assets.[1] The greatest threat to the safety and soundness of our financial system today is the dramatic concentration of assets in a small number of megabanks.

How do we account for accelerating industry concentration? The exponential growth of these large firms is a direct result of government support and its distortionary impact on competition. Too-big-to-fail is explicitly recognized by the bond rating firms who give the largest, most interconnected firms a ratings lift based on their implied U.S. support.[2] Bond buyers accept lower returns from megabanks because they assume the government will support them if they

[1] "Biggest Lenders Keep on Growing," Shayndi Raice. Wall Street Journal, January 3, 2014.
[2] "No Lehman Moment as Biggest Banks Deemed Too-Big-To-Fail." Bob Ivry. Bloomberg Markets Magazine. May 10, 2013.

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falter. ICBA is encouraged by the GAO's pending second study in which they will work to value the government subsidy. Notably, a previous study by two IMF economists estimated the value of the too-big-to-fail subsidy at $83 billion a year.[3] Various cost-of-funds studies estimate the megabank subsidy as being anywhere from 20 basis points to 80 basis points. ICBA has reviewed 15 studies that examine the question of whether a significant too-big-to-fail subsidy exists. All but one – which was conducted by a megabank – confirmed that a significant subsidy does exist.

Lower borrowing costs give the too-big-to-fail firms a clear competitive advantage, fueling yet more industry concentration, increasing systemic risk, and further entrenching the policy of too-big-too-fail. This trend can only be broken by a decisive change in policy. Tinkering with existing rules will not suffice.

Too-Big-To-Fail and Community Banks

Community banks are particularly vulnerable to the risk of too-big-to-fail. Over 400 community banks failed in the wake of the financial crisis fueled largely by the reckless behavior of mega financial firms. They were too small to save! And while these community banks were not deemed systemically important, at least on a national level, their failures continue to have a painful and lingering effect on the communities they served, as well as a lasting impact on the competitive landscape.

A less noted legacy of the financial crisis is the onslaught of new regulations enacted in response to the irresponsible actions of the too-big-to-fail banks. The arbitrary impact of the final Volcker Rule is a stark example, as is the plethora of new mortgages rules. Community banks are low-risk, community-based institutions that did not cause the crisis and pose no threat to consumers or the financial system. While the new regulations are aimed at large banks, they often sweep in banks of all sizes, creating a crushing new burden for community banks, layered on top of an already significant regulatory burden. Large banks may not welcome new regulation, but, with their sizable legal and compliance departments, they have ample resources to cope with them. For community banks, on the other hand, with their relatively small asset bases and compliance staffs, regulation is a disproportionate burden and poses a threat to their very existence. While we welcome efforts to recognize the distinct business model of community banks by tiering regulation, this tiering provides only partial relief. Costly new regulation inhibits new bank charters, prompts the sale of community banks and leads to more consolidation, which exacerbates the threat of too-big-to-fail. This is why ICBA has renewed its emphasis on eradicating too-big-to-fail. The problem is the most significant threat to the future of a strong, free-market, competitive banking system.

Potential Solutions

ICBA is open to considering any constructive proposal to address the too-big-to-fail problem. Among other proposals, ICBA has endorsed the Terminating Bailouts for Taxpayer Fairness (TBTF) Act (S. 798), introduced by Sens. Sherrod Brown (D-OH) and David Vitter (R-LA). S.

[3] "Why Should Taxpayers Give Big Banks $83 Billion a Year?" Bloomberg View Editorial, May 20, 2013.

798 takes a clean approach to the problem—requiring the largest, riskiest banks to hold more leverage equity capital will allow them to operate more safely, absorb more losses and avoid a government or taxpayer bailout. S. 798 can be implemented without complex new rules. Banks over $500 billion would be required to have a minimum of 15 percent leverage equity capital to reflect their scale and associated systemic risk. Banks between $50 billion and $500 billion would be required to have a minimum of 8 percent leverage equity capital. Banks under $50 billion will be subject to capital rules comparable to the risk-based and leverage ratios that apply today. S. 798 recognizes that community banks and larger banks with less than $50 billion in assets were not the problem. Importantly, there will be no complex risk weighting of the assets used to calculate the equity capital ratio. Risk weighting has been too easily gamed by the megabanks. In addition, off-balance-sheet exposures that sharply increase the risk level of megabanks would be included in total assets, as would certain derivatives exposures.

Additional proposals supported by ICBA include the plan put forth by Federal Reserve Bank of Dallas President and CEO Richard Fisher and the industry restructuring proposed by FDIC Vice Chairman Thomas Hoenig which would separate the core banking activities of deposit taking and lending, which are covered by deposit insurance, from dealing and market making, brokerage and proprietary trading, which would be pushed out. All of these proposals are thoughtful and constructive.

The Plan for Prosperity

In closing we note that regulation should be calibrated to reflect the true risk posed by a bank and the complexity of its balance sheet and activities. ICBA's Plan for Prosperity (PFP) would help offset the growing regulatory burden of too-big-to-fail on community banks and their customers. While too-big-to-fail is the ultimate source of the problem, and we urge this committee to pursue vigorous and practical solutions to too-big-to-fail, the regulatory relief provided by the PFP will help community banks promote entrepreneurship, economic growth, and job creation. ICBA is grateful to Senators Brown and Vitter for including a number of key PFP provisions in S. 798. ICBA encourages this committee to consider that bill and other legislation that embodies PFP provisions. In particular, the CLEAR Relief Act (S. 1349), introduced by Sens. Jerry Moran, Jon Tester, and Mark Kirk, contains four PFP provisions, including mortgage reform, an increase in the SOX 404(b) exemption, and other provisions.

Thank you again for the opportunity to submit this statement for the record. ICBA is committed to working with this committee to end the problem of too-big-to fail and to advance the provisions of the PFP.

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