

What You Don't Know Can Hurt You: Keeping Track of Risks in the Financial System*

BY LEONARD NAKAMURA

The financial crisis of 2007-2008 left in its wake new responsibilities for regulators to monitor the economy for risks to financial stability. The new task of monitoring financial stability includes tracking the risks of financial instruments and learning where these risks are located within the financial marketplace. One way to do this is to track the quantities of financial instruments and which institutions hold them. In this article, Leonard Nakamura discusses some limitations of the current data and the current data framework and the extent to which we can use the Flow of Funds for understanding and monitoring the risk of the broad range of financial instruments, focusing on residential mortgages as an example.

You undoubtedly don't need to be reminded of the financial crisis that engulfed the world in 2008 and that we hope is not repeated in our lifetimes. Policymakers are still working out how to best reduce the likelihood that such a crisis will recur while mini-



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mizing the regulatory burden on the economy. During the financial crisis, massive losses occurred both at closely regulated depository institutions and at investment banks, mortgage companies, special investment vehicles, and subsidiaries such as AIG's special financial products group in London — all institutions that were only lightly regulated, the so-called “shadow banking” sector. New institutions and new instruments are constantly being introduced by our creative and dynamic financial market. How can regulators — who must oversee the broad consequences of financial risks

*The views expressed here are those of the author and do not necessarily represent the views of the Federal Reserve Bank of Philadelphia or the Federal Reserve System.

— identify and keep track of the risks of new financial instruments and of new financial institutions?

A lack of key financial information contributed to the depth and sharpness of the financial crisis of 2008. Private investors and government regulators did not know enough about the riskiness of financial institutions, and moreover, even the institutions themselves did not know enough about their own portfolios or the risks of other institutions they were doing business with.

The 2010 Dodd-Frank Wall Street Reform and Consumer Protection Act created a Financial Stability Oversight Council, whose voting members include nine financial regulators and an independent insurance expert; the council has the responsibility to respond to threats to financial stability and resolve gaps in regulation.¹ Among its many duties, the council is charged with overseeing the Office of Financial Research, which will collect and analyze data to identify and monitor emerging risks to the economy and make this information public in periodic reports and testimony to Congress every year. The new task of monitoring financial stability is thus mandated to include tracking the risks of financial instruments and learning where these risks are located within the financial marketplace.

One important tool for regulators to be able to do this is to track the quantities of financial instruments and

¹ For a summary of the Dodd-Frank legislation, see *Banking Legislation and Policy*, Second Quarter 2010, at <http://www.philadelphiafed.org/research-and-data/publications/banking-legislation-and-policy/2010/blpq210.pdf>.

which institutions hold them. In my 2011 working paper, I suggest a framework for doing this and also within this framework creating a database that could be useful in estimating the risks of instruments.

Here, I will discuss some limitations of the current data and the current data framework that hamper financial market participants' and regulators' ability to judge the risks of mortgages and where the risks are held within the financial system. I will discuss the extent to which we can use a particular framework — the Flow of Funds — for understanding and monitoring the risk of the broad range of financial instruments, focusing on residential mortgages as an example. The Flow of Funds is, as we shall see, a system of financial accounts that broadly captures the set of financial assets and liabilities owed to or by U.S. businesses, governments, and individuals.

While this article focuses on how to set up a system that will help both financial market participants and financial market regulators learn what the risks of financial instruments are and which institutions are holding those risks, it is only one, albeit important, source of information. Information available from the marketplace and financial institutions themselves will complement the information I will discuss here. I will focus on home mortgages, which are an important part of the financial system, but only one part, as an example of how these data might be collected and some of the difficulties involved in collecting them.

FRAMEWORKS TO COLLECT INFORMATION TO ENHANCE FINANCIAL STABILITY

How can information about financial assets be better organized and more readily available? Financial regulators already collect a substantial amount of data on the activities and holdings of the financial institu-

tions they regulate. For example, all depository institutions are required to file Call Reports, which provide accounting data about the institutions' financial assets and liabilities and their income and expenses. These reports are sent to and stored at the Federal Financial Institutions Examination Council. Similarly, firms that wish to issue debt or equity to be publicly traded are required to file with the Securities and Exchange Commission

emerged. As a result, regulators have been given new mandates for collecting and analyzing financial information, particularly in an effort to understand risks that might arise outside the more tightly regulated financial institutions. These data would ideally help regulators to (1) identify financial institutions that pose systemic risk and (2) identify new instruments and activities that pose uncharted risks to the financial system.

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balance sheets showing assets and liabilities and income statements showing revenues and expenses. In addition, particularly for banks, supervisors can request a vast array of information to verify whether a bank's activities and portfolio and their riskiness are adequately documented and correctly reported. For example, when examining institutions, bank supervisors typically request random samples of documents of healthy loans — weighted toward market segments that are particularly at risk — as well as full documentation on troubled loans.

Despite the availability of these data, a major financial crisis emerged in 2008. One contributing factor was that regulators lacked a comprehensive view of financial instruments, particularly those instruments held by lightly regulated or unregulated financial institutions. Another was that regulators lacked easy access to detailed data that would have given them better measures of the underlying risks of the financial instruments. So regulators did not have good measures of risk until the crisis

The Squam Lake Proposal.

What sorts of information might regulators use to aid them in this task? The Squam Lake Report — recommendations in the aftermath of the financial crisis written by 15 leading U.S. financial economists — called for a new information infrastructure for financial markets. The authors of the report specifically recommended that all large financial institutions report information on their asset positions and risk, in fine-grained detail, to regulators each quarter. They further argued that these factors need to be measured in a standardized way.² However, economist Charles Goodhart has criticized this recommendation as possibly causing information overload. Goodhart questions whether a methodology exists for “sorting the wheat from the chaff,” so that the information is useful. The framework I discuss here is intended to help provide the necessary methodol-

² See Kenneth French et al., recommendations 1 and 2, pp. 49-50.

ogy for organizing the data coherently so as to facilitate risk analysis.

Comovements in Stock Prices May Be Informative About Systemic Risks. Economists believe that financial market prices are generally good sources of information, informing us of the true underlying value of the financial firms whose instruments are being bought and sold. After all, if the price is inaccurate, it will usually be profitable to buy when the price is too low and sell when it is too high, a process that provides profits that create incentives to collect better information and push prices toward underlying values. In particular, the ways in which security prices typically move relative to one another (“price comovement”) can help us learn which financial firms are most closely tied to aggregate financial risks, that is, risks that affect the economy as a whole. In their study, Viral Acharya, Lasse H. Pedersen, Thomas Philippon, and Matthew Richardson recommend looking at measures obtained from the stock market, in particular, *marginal expected shortfall*, which they define as the expected drop in a financial institution’s stock price when the overall stock market falls by more than 2 percent.

The underlying point is that a financial institution that falls considerably in value when the overall stock market falls sharply is likely to fall to a very low value if there is a prolonged stock market drop, as occurs during financial crises. That would indicate that the financial institution is likely to fail in a financial crisis and, thus, that that institution would likely contribute to the failure of the financial system; that is, the institution contributes to systemic financial risk. One limitation of this approach is that while comovements in stock prices may indicate firms that contribute to systemic fragility, they do not explicitly highlight the actual or likely interactions between financial institutions.

Scenario Analysis by Financial Institutions May Be Informative.

Another key element of systemic risk measurement is knowing how financial institutions interact. In principle, the interactions can be stabilizing or destabilizing. If, when one bank wants to sell bonds, there is another bank standing ready to buy the bonds, the second bank has a stabilizing effect. From the standpoint of the systemic risk regulator, the destabilizing interactions are the ones to worry about. For example, when one bank wants to sell bonds, another bank might decide that the bond sale will lower the value of the bonds. In that case, the second bank might decide to sell its bonds before the first bank does, causing the value of the bonds to fall even further. This would mean that the first bank loses more money, and this loss might further destabilize it.

Obtaining information about how banks might interact could perhaps be obtained from the financial institutions themselves: information about how institutions anticipate they would react to a given risk scenario.

financial institution holds. The second kind of information is how the given stress would cause the bank to behave — what the bank would do if home prices fall 10 percent.

If the financial institutions would operate in ways that are complementary — let’s say some would sell mortgages and others would buy them — then it’s possible that the market would behave more or less as the financial institutions hope. But if many of the institutions plan to sell the mortgages at the same time, it’s likely that the value of the mortgages would fall substantially, and the financial institutions’ plans will be frustrated. In this case, the regulators would know that under this scenario market risks might be greater than market participants would normally anticipate.

TRACKING FINANCIAL ASSETS AND FINANCIAL RISKS WITHIN THE FLOW OF FUNDS

In 1955, the Board of Governors of the Federal Reserve System began publishing the U.S. Flow of Funds accounts, a statistical system that tracks

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This is a key ingredient in the risk topography framework of Markus Brunnermeier, Gary Gorton, and Arvind Krishnamurthy. They suggest that regulators obtain two kinds of information from financial institutions about potential financial stresses. The first is how a given stress will likely affect their net worth. For example, one could ask how much a 10 percent decline in home prices would affect the value of the home mortgages the

the flow of financing from ultimate lenders — those households, corporations, and others that have more income than they wish to spend this year — through the financial system and to the ultimate borrowers who wish to invest and need to borrow to do so. Each quarter, the Board of Governors publishes the net quarterly aggregate lending or borrowing of financial instruments and the resulting accumulated financial assets and liabilities

held by types of borrowers or lenders. The Flow of Funds is related to the national income accounts (the quarterly measures of U.S. gross domestic product and income) in that it keeps track of the financing needs of sectors of the economy, relating how saving leads to investment in the national income accounts by accounting for the instruments that finance investment.³

Mortgages in the Flow of Funds: An Example. To understand the Flow of Funds more concretely, it helps to take a specific example. In our case, the obvious example is housing finance, the major source of the risks that resulted in the recent financial crisis.⁴

Most residential housing consists of owner-occupied housing, and most of this residential housing is purchased with the aid of borrowed money, predominantly in the form of home mortgages. The majority of this debt consists of first liens, that is, mortgages that have the senior, or first, claim on the house in the event that the borrower defaults on the loan. In addition, homeowners sometimes take on second mortgages, additional home equity loans and lines of credit that are also secured by the house but which, in the case of default, are paid off only after the first lien holder has been paid. Landlords also take out residential mortgages to buy rental properties. Tables 1 and 2 show data from the Flow of Funds: annual stocks of

³ An online guide to the Flow of Funds can be found at <http://www.federalreserve.gov/apps/fof/>. Additional detail on the housing finance accounts can be found at <http://www.federalreserve.gov/releases/z1/about/kennedy-fof-20120628.pdf>.

⁴ I do not take this example because I believe that the next financial crisis is likely to resemble the last one; indeed, each crisis is likely to be unique. Rather, I do this to extract some lessons, which I hope may help us collect better data for understanding the myriad aspects of finance, any of which might contribute to the next crisis.

TABLE 1

Home Mortgages: As Liabilities (Debtors), billions of dollars

| | 2008 Year-End Stock | 2009 Net Flow | 2009 Year-End Stock |
|----------------------------------|------------------------|------------------|------------------------|
| Total Liabilities | 11,069.1 | -210.0 | 10,859.2 |
| Households | 10,495.5 | -155.7 | 10,339.8 |
| Businesses | 573.6 | -54.3 | 519.4 |
| Memo: | | | |
| Home Equity Loans included above | 1,114.3 | -82.2 | 1,032.1 |

Source: U.S. Flow of Funds, F.218 and L.218, March 10, 2011

residential mortgages for year-end 2008 and year-end 2009, and the net flows of home mortgages for 2009, which is the difference between those two.

There was \$10.9 trillion outstanding in mortgages on one- to four-family homes and home equity loans at the end of 2009. Home equity loans represent roughly \$1 trillion of the total. Table 1 provides details on who the debtors are: households and businesses. The debtors are mainly households (95 percent of the total). Most of the rest are nonfarm, noncorporate businesses that usually rent out the homes.

Who are the holders of home mortgages, as listed in the Flow of Funds? One substantial set of holders is depository institutions, including commercial banks, savings institutions, and credit unions, which collectively hold \$3.2 trillion worth of mortgages directly.

A more complicated case is represented by securitized mortgages. These come in two main types: agency and private. Agency pools include mortgages that are securitized by government-sponsored enterprises, primarily Fannie Mae and Freddie Mac, and agency mortgages, such as FHA and VA mortgages. All of these mortgages are protected from default, either by

an agency or a government-sponsored entity, and collectively totaled \$5.3 trillion at the end of 2009. The *private* pools, called asset-backed securities, include jumbo, subprime, and alt-A mortgages, which collectively totaled \$1.5 trillion in 2009; these are mortgages that are either too large or too risky to be securitized by the government-sponsored enterprises. The risks of private mortgage-backed securities (MBS) fueled many of the losses that led to the financial crisis.

Mortgages Are Subject to a Number of Risks. Although mortgages are subject to interest rate risk and inflation risk, here I will focus on credit risk, that is, the risk that the borrower may fail to make the contractually agreed-upon payments in a timely fashion, thereby sending the mortgage into default or even foreclosure.⁵ It is credit risk that caused most

⁵ Interest rate risk is the risk that interest rates will change. If interest rates drop, borrowers may prepay and refinance, in the process returning money to the lenders, who will have to find new borrowers. If interest rates rise, the existing lenders will not receive as much as new loans are paying. Inflation risk is the risk that inflation rises unexpectedly, so lenders are repaid in dollars that are worth less than they had expected. Credit risk is described in greater detail in Ronel Elul's 2006 *Business Review* article.

TABLE 2

**Home Mortgages: As Assets (Lenders),
billions of dollars**

| | 2008 Year-End Stock | 2008 Net Flow | 2009 Year-End Stock |
|--|------------------------|------------------|------------------------|
| Total Assets | 11,069.1 | -210.0 | 10,859.2 |
| Households | 91.2 | -8.0 | 83.2 |
| Businesses | 34.5 | -5.7 | 28.7 |
| Governments | 103.4 | 10.5 | 114.0 |
| Depository Institutions | 3,229.1 | -201.3 | 3,027.8 |
| Life Insurers and Retirement Funds | 13.5 | -2.5 | 10.9 |
| Government-Sponsored Enterprises (GSE) | 455.9 | -11.8 | 444.1 |
| Agency and GSE-Backed Mortgage Pools | 4,864.0 | 402.5 | 5,266.5 |
| ABS Issuers | 1,865.4 | -336.8 | 1,528.6 |
| Finance Companies | 375.4 | -47.8 | 327.7 |
| REITS | 36.7 | -9.1 | 27.5 |
| Memo: | | | |
| Home Equity Loans | 1,114.3 | -82.2 | 1,032.1 |
| Depository Institutions | 994.3 | -57.9 | 936.3 |
| ABS Issuers | 45.0 | -14.7 | 30.3 |
| Finance Companies | 75.1 | -9.6 | 65.5 |

Source: U.S. Flow of Funds, F. 218 and L.218, March 10, 2011

of the problems for mortgage holders in the financial crisis. The credit risk of mortgages is a compound of two types of risks. One concerns the borrower's ability and willingness to make the contractually agreed-upon payments. The other concerns the loan-to-value ratio: how well the collateral value of the house (what the house would fetch in the marketplace if it had to be sold) protects the lender. Note that two things have to go wrong for the mortgage lender to lose money due to default: The borrower has to fail to make payments, and the collateral has to be worth less than the mortgage principal.

In the lead-up to the financial crisis, because home prices rose steadily, only rarely was the collateral insufficient to pay the mortgage principal, and a borrower's failure to pay rarely wound up harming the mortgage lender.

In addition, the lenders typically transfer credit risk to the government home mortgage agencies. If the borrower meets standard criteria related to the ability to pay and the amount of the down payment — and if the mortgage amount does not exceed statutory limits — the mortgage becomes eligible for securitization by Fannie Mae or Freddie Mac. When Fannie Mae or

Freddie Mac accepts a loan, the agency agrees to guarantee the loan; therefore, if the borrower does not repay the loan, the lender will be repaid. Borrowers who do not meet these standards could sometimes turn to private mortgage insurance companies, which would guarantee loans in return for a mortgage insurance payment. In addition, when the Veterans Administration or the Federal Housing Administration accepts a loan, the agency guarantees the loan as well, paying off the guarantees from the premiums the agency charges. All agency-backed loans free the lender from credit risk. Thus, holders of agency-backed securities only have to be concerned about interest rate and inflation risks.

Prior to the financial crisis, the private sector started issuing non-agency mortgages — jumbo, alt-A, and subprime⁶ — in increasing quantities. Although the borrowers in these cases were often riskier than borrowers of conventional mortgages in terms of being more likely to fall behind in their payments, rising house prices ensured that these mortgages rarely lost money. But for these mortgages, the mortgage holder does hold the credit risk.

The Flow of Funds Tracks Assets But Not Risks. The Flow of Funds as designed provides a statistical picture of the kinds of mortgages in use and their quantity and the sectors that hold them but does not provide detail on the risks embedded in these mortgages or precisely which entities hold these risks. For example, the Flow of Funds reports that commercial banks and thrifts held \$256 billion of nonagency MBS as of the end of 2009 but does not report detail on who else held them. It would be desirable

⁶ Jumbo loans, as their name implies, are too large to qualify for agency loans. Subprime loans have borrowers with bad credit ratings; alt-A loans are loans that also don't qualify for agency loans, often for reasons other than very bad credit ratings.

to have greater detail on the specific holders of the individual instruments.

In addition, it would be desirable to have more detailed information about how large these risks are. One method would be to use information from markets. The data in the Flow of Funds are reported at book values — the principal value of the debt — which tend to provide a backward-looking view of the value of assets and liabilities and do not provide information about changes in the value of the assets as their risk of default changes. One desirable extension of the Flow of Funds would be a set of mark-to-market prices for the assets that are reported at book values. These would not replace the book value prices but would serve to indicate how these asset values have evolved over time and suggest the risks that the holder would face if the mortgage needed to be sold.

If the instruments are traded regularly, then mark-to-market pricing can be done by finding the prices of representative instruments. For example, for prime 30-year mortgages issued in a given year with a given fixed interest rate, there are securities that bundle groups of mortgages that are bought and sold in secondary markets, so that the prices of the underlying mortgages can be inferred. Pricing may be updated on a daily or monthly basis.

It should be noted that an asset's market price is not always or necessarily a better measure of value than its book value. Not all instruments are actively traded, so obtaining market prices may not be easy and prices may not reflect underlying value. Indeed, illiquidity is an additional risk that instruments face; illiquid instruments tend to require higher rates of return. And illiquidity often worsens dramatically in a financial crisis. As markets themselves falter, the prices may no longer be good measures of underlying value. Nonetheless, market prices will usually provide useful information

about changes in asset values as the economic environment changes.

Improving Measures of Risk Under Stress-Test Scenarios. How do the risks of mortgages and other instruments change when some kind of change in the market environment occurs? This is important when regulators engage in stress testing, that is, determining how vulnerable financial institutions are to specific risk scenarios. For example, one risk scenario could be a severe recession with high unemployment; another, a sharp fall in house prices; and a third, inflation and a steep rise in interest rates.

Counterparty risks — the contagious consequences of dealing with other financial firms that may go bankrupt — can be explicitly accounted for in stress tests. That is, if a given financial firm is at risk in a stress scenario, risks will arise for other firms that do business with that firm, particularly if they hold the liabilities of that firm. But this too requires quantification of risk.

For this, sample micro-data — data on individual financial instruments such as particular mortgages — can be very useful. These data can be used, for example, in default analyses to show how likely it is that a default will occur under a given assumption about declines in house prices.⁷

How Micro-Data Sets Can Be Linked to Make Them More Useful. Relevant financial data on a particular mortgage include the borrower's income, the likelihood that the borrower may become unemployed, other loans taken out by the borrower, the current value of the home that is serving as collateral, and so forth. For example, Jane Doe can take out a second mortgage against her home, called a home equity line of credit. If she needs ad-

ditional cash, she can draw on this line of credit. If, at a later point in time, the price of her house falls, the combined debt on the house may exceed the value of the house, making the mortgage far riskier. Since Jane has not yet sold her house, we can only infer its value from other homes that have been sold in her neighborhood. In order to understand the magnitude of the risk to any mortgage, it is important to understand the evolution of the borrower's debts and house prices in the borrower's neighborhood. But these disparate kinds of information are unlikely to come from a single data set.

For example, credit bureau data, such as the FRBNY Consumer Credit Panel (see <http://www.newyorkfed.org/creditconditions/index.html>), tell us about the mortgage obligations of a given individual, but they do not tell us about the characteristics of the house that is the collateral for the mortgage. The data sets that mortgage servicers can provide on individual mortgages supply information about the sale value of the house when the mortgage was first entered into, but they do not allow us to track any changes in the house price since that time. House price indexes at the county or zip code level, combined with the mortgage service data and with the credit bureau data, can help provide a full picture of the risks of individual mortgages.

To combine these, one needs to link data across data sets, a technique called record linkage. In record linkage, one needs to identify, for example, the Jane Doe listed in the records of a credit bureau with the Jane Doe listed in the records of a mortgage lender. But to protect borrowers' privacy, regulators must typically work with databases from which the names, addresses, and Social Security numbers of the borrowers have been removed. Fortunately, individuals do not need to be identified; for almost all purposes, what is needed is a composite

⁷ This is an alternative, and perhaps complementary, method to conduct the analyses suggested by Brunnermeier et al.

picture of the distribution of mortgage risks. And that can be done by linking Jane Doe's mortgage with Jane Doe's other borrowings or, perhaps, with other borrowers who have similar mortgages (because they are likely to have similar risks) and with a neighborhood house price index that can be obtained based on the zip code in which the mortgaged house is located. In turn, linking up these data would help regulators know the likelihood of mortgage borrowers being in economic straits, say, unemployed, and also have a house whose value is less than the mortgage principal owed on it — that is, when there will be a heightened risk of default.

This linking is currently being done by individual groups of researchers; see, for example, the article by Elul et al., on the determinants of mortgage default. But research projects are done once, and they are seldom repeated. Regulators need to have the linked data available on an ongoing basis to evaluate these risks on an ongoing basis.

A better way to link instruments across data sets is to have *unique identifiers* for the individual instruments. For example, when corporations issue bonds, they are typically assigned a CUSIP number that uniquely identifies that bond. Then when the bond is traded or included in a portfolio of assets, it can easily be traced. Regulators and private businesses are working together to develop a process to set up unique identifiers and make these identifiers part of data sets on financial instruments. If the same unique identifier were used by credit bureaus and mortgage servicers, record linkage would be greatly facilitated without compromising individual privacy. For example, a unique registry of legal entity identifiers is in the process of being adopted internationally — these will permit regulators and financial entities to identify the parties to a transaction

with much greater certainty.⁸

The instruments in these linked data sets can then be linked to the Flow of Funds. This would permit detailed identification of the risks in the financial system as a whole and perhaps the ability to trace portfolios of individual instruments to the securities they are part of and to the ultimate holders of these instruments.

An important side benefit of having an industry-wide system of identifiers for individual instruments is that financial institutions themselves would benefit. For example, when financial institutions buy or sell parts

the regulatory database. But mortgages are an important financial instrument in terms of their size, and the principles used for meshing micro-data and the Flow of Funds data from mortgages can be used for a broad array of instruments.

The macro-data in the Flow of Funds can also be elaborated by adding micro detail, both as to the specific asset holders and the specific debtors. This can be accomplished in large part by using micro-data sets and by linking individual instruments across the micro-data sets, and then linking the data sets to the corresponding

The macro-data in the Flow of Funds can also be elaborated by adding micro detail, both as to the specific asset holders and the specific debtors.

of their portfolios or financial subsidiaries, a major expense is that the computer systems and nomenclature are incompatible. With a standardized system of identifiers, such costs would be diminished. Part of the Office of Financial Research's strategic plan and mandate includes the establishment of these sorts of efficient financial data standards.

IMPLEMENTING A DATABASE FOR FINANCIAL REGULATION: BROADENING BEYOND MORTGAGES

I have discussed setting up a database using the example of mortgages within the Flow of Funds.⁹ Mortgages are only one of the myriad financial instruments that need to be tracked by

entries within the Flow of Funds. Just as with mortgages, regulators, market participants, and policymakers need to understand the detailed risks and the micro-data help them do that.

Limitations to Data Collection and the Flow of Funds. Although this data collection will help financial regulation, it will always be incomplete. First, the Flow of Funds is typically better at capturing financial information from nonfinancial than from financial institutions. Financial markets operate at a very high speed; financial trades can be executed at a time scale of a thousandth of a second. By contrast, the Flow of Funds, because it is tied to the quarterly national income accounts, is based on quarterly data, taking a snapshot every three months.

Since securities can be traded, quarterly reports on them are not as valuable compared with information on what is held in an institution's portfolio. Nevertheless, the quarterly reports do tell us where instruments are located as of that date. Risk can

⁸ More information about the international efforts to implement legal entity identifiers can be found at http://www.financialstabilityboard.org/publications/r_120608.pdf.

⁹ See my working paper for more details.

also be hedged. Thus, the holder of the security doesn't necessarily bear the risk; it can be transferred. That is, a financial firm that is holding a set of mortgages can buy a financial instrument that will pay off if the mortgages go into default; so the firm does not lose money in the event of a mortgage default. Some other firm now holds the hedged risk, and that firm may be vulnerable if a mortgage default occurs. But which firm is it? Hedges represent transfers of risks, and they are not reported in the Flow of Funds. However, once regulators know what the risks are and where they are held prior to hedging, they will be much better positioned to ask about hedges and where the risk has been transferred. For example, when AIG was threatened with bankruptcy, one important factor was that it had insured other firms against mortgage default risks. Tracing the transfer of risks — through hedges and including instruments such as options and swaps — beyond those that appear in the Flow of Funds is an important task and one that has not been fully worked out. Increased use of organized exchanges for derivatives rather than over-the-counter trading will facilitate tracing these risk transfers.

Data collection is expensive, requires hard work, and necessitates robust safeguards. While some micro-data are collected by the government, many are collected by private third parties that sell the data to recompense the work of assembling, cleaning, warehousing, and providing the data. The quality of these data will be improved and the data made more valuable as financial regulators link them with other data sets and vet their quality. In particular, to the extent that regulators are using the data for regulatory purposes, the regulated private firms are likely to want to obtain the same data in their desire to understand and anticipate regulation. This is likely to make the data still more valuable — and costly.

Under the Dodd-Frank Act, the Office of Financial Research is explicitly mandated to help financial regulators collect and organize data to improve financial stability. The OFR's strategic plan centers on establishing a central data storage facility that will obtain detailed data on financial instruments and entities, from financial regulators where available, but also by purchasing data from third-party vendors and, where necessary, using subpoena powers it has been granted to require financial institutions to provide information.

The OFR will also take steps to improve the standardization of data more generally, determining how best to follow up on the legal entity identifiers with other data standards.

At the same time, maintaining the privacy of those whose data are collected in the micro-data sets is important. Doing so requires that researchers not be permitted to identify individuals in the data even though identifying data are used in the background to create the computerized data linkage. The confidentiality and licensing requirements of the third-party data gatherers (and the institutions providing data to the third parties) will also need to be respected.

Note that, in many cases, financial regulators are, in principle, allowed complete access to the micro-data of regulated financial institutions. Thus, the third-party provision of micro-data could be viewed as an efficient means by which regulators obtain the data they need to carry out their responsibilities for monitoring systemic risk.

Another limitation is that to the extent that financial instruments are liabilities of foreign businesses and institutions, U.S. data collection will be incomplete. The hope is that regulators in foreign countries will assemble similar databases to fill this gap. In some countries, such as Sweden, regulators have micro databases that

are more detailed and already inter-linked. International cooperation on collecting and sharing data will be an important step forward in the global regulatory process.

CONCLUSION

In this article I have reviewed some ways in which regulators can build upon existing data to support financial stability. I have focused on the specific case of the Flow of Funds, which, while useful in helping us know the approximate size of financial risks, does have some limitations.

If data on pricing and micro-data are added to the Flow of Funds data, regulators will have a means by which they can both follow risk more closely and learn more quickly the consequences of looming risks. This additional information would greatly increase the Flow of Funds' utility in risk monitoring and stress testing.

The combined data set would be used in several ways. It would encourage empirical research on risk measurement and analysis. This expertise could then be brought to bear to identify changing risks for financial instruments and institutions as the financial and macroeconomic environment evolves. From the top down, systemic regulators could use these studies to help identify stress scenarios. The database would allow them to quickly look at the details of the financial instruments and make a first judgment as to where the risks of these instruments are being held. From the bottom up, the regulatory supervisors of individual financial institutions could identify concentrations of specific kinds of financial risks and financial instruments at a given institution. If regulators and policymakers can also understand something of the dynamic interactions of financial institutions that might ensue in a given scenario, they can then draw on both approaches to have a more robust understanding of the risks

that financial institutions may be subject to and perhaps provide incentives for them to reduce their risks. All of these are likely to contribute to greater financial stability.

Making these data available to academic researchers and to businesses — to the extent compatible with privacy and intellectual property rights

— will also further help to stabilize the financial system. First, making the data available to academic researchers is likely to refine the economic and financial science that underpins our understanding of the data and of how risk scenarios are constructed. Second, giving businesses a better ability to price and understand risk — and to as-

certain the risks of their counterparties — will also help avoid future crises.

In brief, such a framework can facilitate the identification of emerging risks in financial instruments and where those risks reside, and that ability will improve prospects for financial stability. 

REFERENCES

Acharya, Viral V., Lasse H. Pedersen, Thomas Philippon, and Matthew Richardson. “Measuring Systemic Risk,” New York University Stern School of Business Working Paper (2010).

Bond, Charlotte Ann, Teran Martin, Susan Hume McIntosh, and Charles Ian Mead. “Integrated Macroeconomic Accounts for the United States,” *Survey of Current Business* (February 2007), pp. 14-31.

Brunnermeier, Markus, Gary Gorton, and Arvind Krishnamurthy. “Risk Topography,” in Daron Acemoglu and Michael Woodford, eds., *NBER Macroeconomic Annual*. Chicago: University of Chicago Press, 2011.

Cho, Man, and Isaac F. Megbolugbe. “An Empirical Analysis of Property Appraisal and Mortgage Redlining,” *Journal of Real Estate Finance and Economics*, 13 (1996), pp. 45-55.

Coval, Joshua, Jakub Jurek, and Erik Stafford. “The Economics of Structured Finance,” *Journal of Economic Perspectives*, 23 (Winter 2009a), pp. 3-25

Coval, Joshua, Jakub Jurek, and Erik Stafford. “Economic Catastrophe Bonds,” *American Economic Review*, 99 (June 2009b), pp. 628-66.

Covitz, Daniel M., Nellie Liang, and Gustavo Suarez. “The Evolution of a Financial Crisis: Panic in the Asset-Backed Commercial Paper Market,” Working Paper (2010).

Demyanyk, Yuliya, and Otto Van Hemert. “Understanding the Subprime Mortgage Crisis,” *Review of Financial Studies*, 24:6 (2011), pp. 1848-80.

Eichner, Matthew J., Donald L. Kohn, and Michael G. Palumbo. “Financial Statistics for the United States and the Crisis: What Did They Get Right, What Did They Miss, and How Should They Change?” Federal Reserve Board Finance and Economics Discussion Series Working Paper 2010-20 (2010).

Elul, Ronel, Nicholas S. Souleles, Souphala Chomsisengphet, Dennis Glennon, and Robert Hunt. “What ‘Triggers’ Mortgage Default?,” *American Economic Review*, 100:2 (May 2010), pp. 490-94.

Elul, Ronel. “Securitization and Mortgage Default: Reputation vs. Adverse Selection,” Federal Reserve Bank of Philadelphia Working Paper 09-21 (2009).

Elul, Ronel. “Residential Mortgage Default,” Federal Reserve Bank of Philadelphia *Business Review* (Third Quarter 2006).

Engle, Robert. *Anticipating Correlations: A New Paradigm for Risk Management*. Princeton, NJ: Princeton University Press, 2009.

French, Kenneth R. et al. *The Squam Lake Report: Fixing the Financial System*. Princeton, NJ: Princeton University Press, 2010.

Garmaise, Mark. “After the Honeymoon: Relationship Dynamics Between Mortgage Brokers and Banks,” UCLA Working Paper (2008).

Goodhart, Charles A.E. “Squam Lake Report: Commentary,” *Journal of Economic Literature*, 49:1 (March 2011), pp. 114-19.

Herzog, Thomas N., Fritz J. Scheuren, and William E. Winkler. *Data Quality and Record Linkage Techniques*. New York: Springer, 2007.

Jacobson, Tor, Jesper Linde, and Kasper Roszbach. “Internal Rating Systems, Implied Credit Risk, and the Consistency of Banks’ Risk Classification Policies,” *Journal of Banking and Finance*, 30 (2006), pp. 1899-1926.

Keys, Benjamin J., Tanmoy Mukherjee, Amit Seru, and Vikrant Vig. “Financial Regulation and Securitization: Evidence from Subprime Loans,” *Journal of Monetary Economics* (July 2009), pp. 700-20.

Nakamura, Leonard. “Durable Financial Regulation: Monitoring Financial Instruments as a Counterpart to Regulation Financial Institutions,” National Bureau of Economic Research Working Paper 17006 (May 2011).

Nakamura, Leonard. “How Much Is That Home Really Worth? Appraisal Bias and Home-Price Uncertainty,” Federal Reserve Bank of Philadelphia *Business Review* (First Quarter 2010), pp. 11-22.

Nakamura, Leonard, and Kasper Roszbach. “Credit Rating and Bank Monitoring Ability,” Federal Reserve Bank of Philadelphia Working Paper 10-21 (2010).

Shiller, Robert. *Irrational Exuberance*, 2nd edition. Princeton, NJ: Princeton University Press, 2005.

The Economist. “The Global Housing Boom: In Come the Waves,” June 16, 2005. http://www.economist.com/node/4079027?Story_ID=4079027.