

The Great Trade Collapse (and Recovery)*

BY GEORGE ALESSANDRIA

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he collapse and rebound in U.S. international trade from 2008 to 2010 was quite stunning. Over this period, the fluctuations in international trade were bigger than the fluctuations in either production of or expenditures on traded goods. These relatively large fluctuations in international trade were surprising to some, since international trade had been growing at a very fast pace for quite a long time. They were equally surprising for trade theorists, since these movements in trade arise in standard models of international trade only when the costs of international trade rise and fall substantially. In this article, George Alessandria places these recent fluctuations in international trade in historical context. He then considers some explanations for the relatively large fluctuations in trade related to the nature of trade, protectionism, and financial constraints.

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George Alessandria is a senior economic advisor and economist in the Philadelphia Fed's Research Department. This article is available free

of charge at www.philadelphiafed.org/research-and-data/publications/.

on traded goods. For example, from July 2008 to February 2009, U.S. real imports and real exports each fell by about 24 percent, while industrial production in manufacturing fell only 12 percent. The rebound was equally impressive, with real imports and real exports expanding about 20 percent between May 2009 and May 2010, while manufacturing production rebounded by only 10 percent. Most countries experienced similar outsized movements in international trade.¹

* 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.

These relatively large fluctuations in international trade were surprising to some, since international trade had been growing at a very fast pace for quite a long time. These fluctuations were equally surprising for trade theorists, since these movements in trade arise in standard models of international trade only when the costs of international trade rise and fall substantially. Thus, initially when trade was collapsing, many economic and financial analysts interpreted these movements in trade as either a sign of growing protectionism, making imported goods more costly, or a sign of a lack of available finance for international transactions. Indeed, the G20, a group of finance ministers and central bank heads from 20 major industrialized and emerging market economies, pledged to resist protectionist measures at a meeting in Washington, D.C. in November 2008. That same group met in London in April 2009 and pledged to provide about \$250 billion in support of finance for international trade.

In this article, these recent fluctuations in international trade are placed in historical context. We then consider

¹ According to the World Trade Organization (WTO, 2011), the nominal value of goods traded fell about 40 percent from the third quarter of 2008 to the end of the first quarter of 2009. Only by the first quarter of 2011 did the volume of trade recover to its pre-collapse level. The WTO is a multilateral agency that deals with global rules of trade between nations. For the euro area, a collection of 17 European countries that share a common currency, from July 2008 to February 2009, the volume of exports and imports fell 23.2 and 24.4 percent, while industrial production fell only 20.2 percent. From May 2009 to May 2010, exports and imports rebounded by 12.7 and 17.7 percent, respectively, while manufacturing production rose only 9.3 percent.

some explanations for the relatively large fluctuations in trade related to the nature of trade, protectionism, and financial constraints. These explanations shed light on the role of policy in fluctuations in trade.

A SIMPLE THEORY OF INTERNATIONAL TRADE

To put the movements in international trade in context, it is useful to start with a basic model of a country's demand for imported goods from the rest of the world. To make things simple, let's assume there are a home country, which we can call the U.S., and a foreign country, which we will call the rest of the world (ROW for short).

This theory assumes that the amount of goods, say, cars, imported by the U.S. depends on two things: the price of imported cars relative to the price of all cars and total spending on cars. In this theory, if the price of imported cars is high, so that imported cars are relatively more expensive, then consumers will buy fewer imported cars; they will substitute and buy more cars produced at home. Similarly, if consumers purchase more cars, as in boom times, then some of these purchases will also be on imported cars.

This theory is a good approximation of the level of imports. Over time, we can also use the theory to study the relationship between the changes in imports, import prices, and expenditures. To understand how changes in prices and expenditures affect imports, it is useful to define price elasticity and income elasticity. Price elasticity tells us how a change in the price of imported cars affects the importation of cars. For instance, if the price elasticity is -1.5, then a 1 percent increase in the price of imported cars will lower imports by 1.5 percent. Income elasticity tells us how a change in income or expenditures affects imports. For instance, if income elasticity is 2,

then a 1 percent increase in income will increase imports by 2 percent. Typically, we find that the volume of imports tends not to be very responsive to changes in import prices (a low price elasticity) and quite responsive to changes in income or expenditures (a high income elasticity).² We will consider in detail measures of these elasticities later.

We described our theory in terms of consumers buying cars, but it applies more generally to producers buying inputs for production or capital goods for investment. Indeed, this theory mostly applies to firms, since very few consumers directly purchase goods internationally. A similar import demand equation determines imports by the ROW. After all, exports from the U.S. to the ROW must equal imports by the ROW from the U.S.

a country in a particular period. It is a very broad measure of economic activity and includes the production of all goods in the U.S., even those that are difficult to trade internationally. Our second measure, which we call demand, is a measure of final expenditures that is weighted by the share of each good in trade. Specifically, our measure of demand is a weighted average of purchases of durable and nondurable goods by consumers and investment in equipment by businesses. The weights are based on the importance of each type of good in U.S. trade. Our third measure, industrial production of manufactured goods, is a measure of the amount of tradable goods produced in a country. The manufacturing sector is considered a better proxy for the production of tradables than GDP, since it accounts for nearly 80 percent

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PUTTING THE COLLAPSE IN CONTEXT

With our theory in hand, we can next explore to what extent the movements in trade in the most recent recession were unusual in either scale or historically. To say whether something is large or small, we need a reference point. Our theory says imports should move with expenditures, and so we consider how trade moved relative to different measures of expenditures.

We consider three measures of expenditures. The first is gross domestic product (GDP), the amount of all goods and services produced by

of U.S. international trade but only about 20 percent of U.S. GDP.

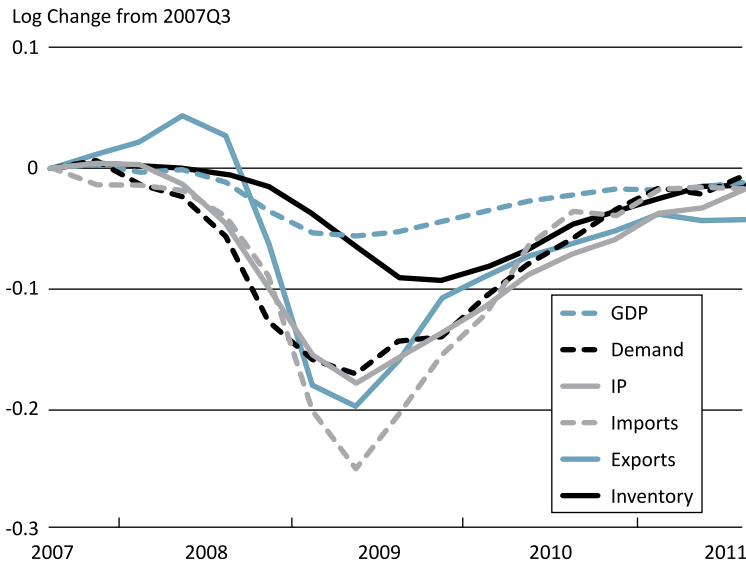
Last, because we are interested in the cyclical movements in trade and expenditures, it is useful to remove from these data series their long-run trends. This is particularly important for international trade, since international trade has grown, on average, about twice as fast as measures of production or spending.³ By doing this, we can more reasonably compare fluctuations in trade in both shallow and deep recessions.⁴ Figure 1 shows the move-

² See the recent work by Jane Haltmaier on these estimates.

³ The major reason that international trade has grown faster than production or expenditures is that the costs of international trade, such as tariffs and shipping costs, have fallen over time.

FIGURE 1

U.S. Trade and Expenditures



Note: Deviations from an HP trend removed from data from 1967Q1 to 2011Q3.

ments in de-trended exports, imports, and our three measures of expenditures from the quarter prior to the start of the recession, the fourth quarter of 2007, to the third quarter of 2011.⁵ At the start of the recession, imports fell slightly and exports expanded slightly. From the second quarter of 2008 to the second quarter of 2009, imports and exports fell dramatically, about 23 percentage points each. The sharp contraction in imports and exports was much larger than the fall in GDP (5.4 percent), demand (14.7 percent), or in-

dustrial production (16.5 percent) over the same period. Similarly, from the second quarter of 2009 the rebound in exports and imports was quite large compared with the rebound in GDP, demand, or industrial production.

To put the dynamics of trade in historical context, the table reports the peak-to-trough movements in imports and exports in each of the last seven recessions. For imports and exports, the declines in this downturn are comparable to those in previous downturns. For example, imports fell 4.4 times as much as GDP in 2008-09, which is about equal to the median decline of 4.6 over these seven recessions. Imports fell about 1.5 times as much as demand for tradable goods, which is a bit smaller than the median decline of 2.4. Similarly, exports fell about 1.3 times as much as manufacturing production in this recession, which is the median decline in these seven recessions.

Evidence on Auto Imports and Sales. One might be concerned that we have not properly accounted for the different composition of expenditures and trade flows. That is, our trade-weighted measure of expenditures does not accurately reflect the composition of trade. This clearly explains why trade falls more than GDP, since the goods that fluctuate the most over the business cycle, namely, consumer

TABLE

Peak Drop in Trade Relative to Absorption

		IMPORTS						
	Median	1971Q1	1975Q2	1980Q3	1982Q4	1991Q1	2001Q4	2009Q2
GDP	4.62	4.72	4.62	5.25	2.38	2.59	5.92	4.44
IP	1.56	1.17	1.64	2.44	1.17	1.56	2.00	1.40
Demand	2.41	2.50	2.41	2.84	2.39	1.55	5.46	1.47
		EXPORTS (peak to trough)						
	Median	1971Q2	1975Q2	1980Q4	1982Q4	1990Q4	2002Q1	2009Q2
IP	1.35	0.92	0.86	1.08	1.72	1.53	2.33	1.35

Notes: Measured from start of recession based on the NBER dates. The third panel measures the difference in exports between the peak and trough, where the peak is only the start of the recession if exports fall immediately. All data were HP filtered with a smoothing parameter of 1600, and so the drop is measured relative to the trend.

⁴ We remove a Hodrick-Prescott (HP) trend from each data series for the period first quarter of 1967 to the third quarter of 2011. The HP trend varies over time. We focus on removing those fluctuations that are greater than 32 quarters in duration. The finding of relatively large fluctuations in trade during recessions is robust to a variety of detrending measures.

⁵ The data on exports, imports, GDP, and expenditures are from the Bureau of Economic Analysis and are based on data through the "preliminary" estimates of data for the third quarter of 2011.

durables⁶ and business investment in equipment, account for a large share of international trade, while services, such as education and health care, tend to not fluctuate much over the business cycle and are a relatively small fraction of trade. To avoid this mismatch between the composition of imports and spending on tradable goods, we next consider the dynamics of imports and sales of imported motor vehicles. There is no compositional bias here.

Figure 2 plots the change in imports and sales of motor vehicles produced outside of North America⁷

⁶ Consumer durables are goods that are meant to last more than three years. Examples include automobiles, washing machines, and televisions.

⁷ These are motor vehicles primarily produced in Europe, Japan, and Korea. Because of data considerations, motor vehicles produced in Mexico and Canada are excluded from this measure. For our purposes, motor vehicles produced in the U.S. by foreign-owned firms are not considered imports, while vehicles produced outside of North America by U.S.-owned firms are considered imports.

from the beginning of 2008 to the end of 2010 relative to the averages in the second quarter of 2008.⁸ Sales of imported motor vehicles fell continuously from May 2008 to December 2008 before stabilizing at roughly 45 percent below the levels at the beginning of 2008.⁹ These declines in sales reflected the deepening recession in the U.S. Imports fell more or less in lock-step with sales of imported motor vehicles until January 2009, when they fell an additional 40 percent. Comparing imports and sales relative to the start of the recession, we see that from January to July of 2009, imports had fallen roughly twice as much as sales of imported motor vehicles. The relatively large drop in imports relative to retail sales of imported motor vehicles is

⁸ The data have been seasonally adjusted, but no trend has been removed.

⁹ The large spike in sales of imported cars in July 2009 was a result of the federal government's "cash for clunkers" program that essentially temporarily subsidized the purchase of new autos.

consistent with the more aggregate evidence we presented before.

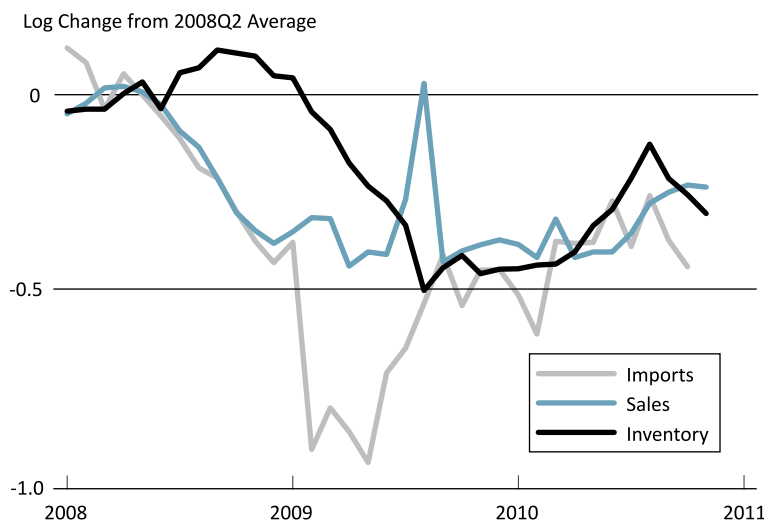
The import and sales data for motor vehicles show that car dealers were selling motor vehicles off their lots in 2009 out of their existing inventory and then not replacing those motor vehicles with new imports. Indeed, we see from Figure 2 that the stock of imported cars in inventory rose substantially through 2008 and then started declining when imports of motor vehicles collapsed. Only in August 2009 did we see that the change in inventory, sales, and imports was roughly in line.¹⁰ Thus, car dealers' inventory management decisions appear to be very important in explaining the dynamics of imports in the recent recession.

In summary, the data show that imports and exports generally fluctuate more than expenditures or production of traded goods over the business cycle. The evidence from motor vehicles shows that these fluctuations in trade do not represent a mismatch between the composition of trade and expenditures. The aggregate data show that the relatively large fluctuations in trade in the current recession were pretty typical for the U.S. What was unusual was that this was a deep recession so that economic activity fell more than is typical in a recession. The movements in trade relative to the decline in economic activity were of the same magnitude as previous downturns. The similarity of trade flows across different recessions suggests that any explanation of the movements in international trade should be generally related to the nature of international trade and not specific to the collapse and recovery in the most recent global recession.

¹⁰ There is a spike in sales of autos in June and July of 2009 that is related to the U.S. government's "cash for clunkers" program. This program provided an incentive for owners of old, energy-inefficient cars to purchase new cars.

FIGURE 2

Dynamics of Imported Autos



INVENTORIES AND CYCLICAL FLUCTUATIONS IN TRADE

Here we consider one possible explanation for the sudden, relatively large movements in international trade that is based on the idea that the inventory holdings of firms buying from abroad are different from the inventory holdings of firms buying locally. Our previous theory of final demand for imported goods still holds, but now we consider how imports and inventory holdings adjust to changes in final demand for imported goods. The key idea is that higher inventories of imported goods lead importers to respond differently in an economic downturn than buyers of domestically produced goods.

Inventories are products or inputs that firms hold in warehouses or in transit, such as cars in the belly of a ship, that have been produced and may be available to be sold or used but may not be sold or used in a particular period. A clear example of inventory holdings is the cars available on a dealer's lot. A dealer will tend to have many more cars available for consumers to inspect, test drive, or buy than the dealer will sell in any particular month. Inventories are held at all stages in the production process from inputs for production to finished goods.

While we focus on how this idea affected trade flows in the global recession, the same mechanism has been found to be important in explaining trade dynamics in emerging markets following large devaluations, that is, periods when a country's currency weakens. Under such circumstances, it takes more of the local currency to buy imported goods. This idea is explained in more detail in *Import Collapses and Devaluations in Emerging Markets*.

To build some intuition for how inventories might affect trade flows, let's consider a car dealer, whom we will call the ROW dealer. This dealer buys autos from a factory in the ROW, imports them, and then sells them

Import Collapses and Devaluations in Emerging Markets

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ere I describe how movements in exchange rates also affect trade flows, based on a paper I wrote with Joe Kaboski and Virgiliu Midrigan (2010a). In this paper, we studied the dynamics of imports in periods surrounding a large exchange-rate devaluation in six emerging markets (Argentina, Brazil, Korea, Mexico, Thailand, and Russia). A devaluation is a sudden, sharp worsening in the exchange rate of a country's currency that makes imported goods much more expensive compared with goods produced within the country. The devaluations in the six countries we studied occurred during times of very low economic activity.

We emphasize three salient features of imports and prices in large devaluations. First, the volume of imports falls sharply, particularly in the short run, say, the first few months following the devaluation. Second, the sharp drop in imports is largely accounted for by a reduction in the number of products imported. That is, goods that were previously imported are temporarily not imported at all. Third, exchange rate pass-through* is initially low. That is, the price that retailers charge for their imported products rises more gradually than the exchange rate or cost of their inputs.

Inventory considerations can help explain these three features. To make things concrete, consider a car dealer in Argentina that imports cars from the U.S. and then sells them in Argentina. The devaluation raises the dealer's cost of importing the cars. At this higher cost, the car dealer eventually would like to sell fewer cars at a higher price. However, initially when the devaluation occurs, since the car dealer did not anticipate the increase in the cost of imported cars, the car dealer may already have a lot of cars sitting on his lot. The car dealer will raise the price of these cars, since replacing a car in inventory has gotten more expensive. But he will not raise his price fully because if he did so, it would take a very long time to sell all the cars in inventory, and there are costs to carrying these cars in inventory that he would like to avoid.

At the higher price, the car dealer's inventory of cars will take longer to sell, and so the car dealer will not need to import any cars initially. After a few months and after the car dealer has sold some cars and lowered his inventory to levels more in line with the lower sales rate, the car dealer will start importing again. In this way, we see low pass-through and a sharp contraction in imports in the short run. The same mechanism holds for any firm that imports infrequently and holds inventories of imported inputs.

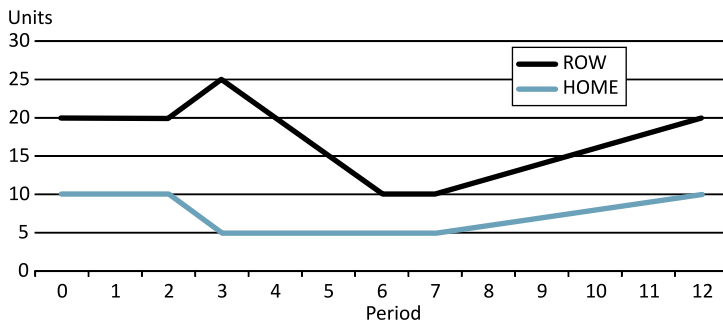
* For a discussion of exchange rate pass-through, see my *Business Review* article with Jarcy Zee.

to consumers at his car dealership in the U.S. We summarize the dealer's inventory, sales, and monthly imports in the top and bottom panels of Figure 3. Suppose that in normal times, described by months 0 and 1, consumers buy 10 cars per month from the car dealer. Also, suppose that to

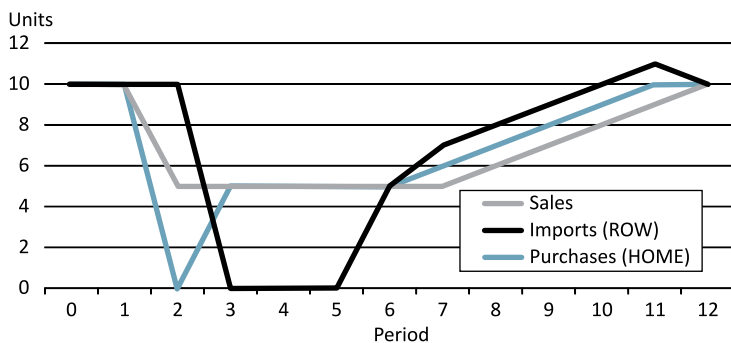
sell these 10 cars, the dealer needs to have twice as many cars available, or 20 cars, so that customers can kick the tires a bit. Let's also suppose the dealer orders cars from the manufacturer before he knows how many cars he will sell in the current month, since it takes a month to ship the cars from

FIGURE 3

Inventory



Sales, Purchases, and Imports



the ROW to his dealership in the U.S. This means he orders 10 cars a month and begins each month with 20 cars available, assuming he sold 10 cars as expected in the previous month.

Now suppose that after ordering 10 cars from the manufacturer, the dealer is surprised and there is a big recession. So in the current month (month 2) only five customers show up and buy five cars. He will now start the next month off with 25 cars: the 15 cars he didn't sell plus the 10 cars he imported. Suppose the dealer expects the recession to last a while so that only five cars are sold per month until month 8, at which point sales increase one unit a month until reaching 10 units in month 12. Since the dealer expects to sell only five cars in month 2, he would like to have only 10 cars

available on the lot instead of the 25 he currently has. Moreover, since the dealer likes to have twice the inventory on hand relative to sales, the dealer really only needs to have 10 cars available and would like to send 15 cars back to the manufacturer this month. If it's too costly to ship these cars back or the manufacturer won't take them back, the dealer can get inventory down to 20 cars by selling the five cars this month and not ordering any new cars. By not importing for three months, he can reduce his inventory to 10 cars in three months. In this way, we see a much sharper drop in imports than sales that is persistent.

Next, let's contrast the behavior of our ROW dealer with a car dealer, whom we call the HOME dealer, who is located next to the auto factory and

holds half the inventory, say, 10 cars per month and sells 10 cars per month. Also, suppose that because this dealer buys locally he can wait until after he knows how much he sells before he orders more cars. If the recession leads to a drop in sales from 10 cars per month to five cars per month, the dealer would like to lower his inventory to five cars per month. He can do this by temporarily lowering his purchases from 10 cars to 0 cars in month 2, since he already has five cars left over that did not sell in month 1. In month 3, the HOME dealer purchases five cars from the manufacturer. Thus, in a recession, we get a sharp temporary drop in purchases by the HOME dealer and a more persistent drop in imports by the ROW dealer.

Figure 3 plots the dynamics of inventory, sales, purchases, and imports by our two auto dealers in our simple example. Notice that even though both dealers sell the same number of cars each month, the purchases by the ROW dealer fall more than those of the HOME dealer in the recession.

The large movements in ROW imports relative to HOME purchases arise because the high inventory level of the ROW dealer leads to a stronger need to adjust inventory. The reasons the ROW dealer holds more inventory are discussed in greater detail below.

Implications for the Recovery. Inventory considerations also matter for imports and domestic purchases when sales rebound, since the ROW and HOME dealers have different needs to rebuild their inventories. Specifically, we see that both dealers start rebuilding their inventory in month 7 in anticipation of the increase in sales in month 8. However, the ROW dealer has a stronger incentive to rebuild inventory than the HOME dealer, since the ROW dealer likes to have more inventory on hand. Thus, we see that imports are higher than domestic purchases from period 7 to 11.

Implications for Trade in the Global Recession. Our discussion has mostly concentrated on explaining the dynamics of imports by ROW dealers selling in the HOME country following a decline in HOME sales or income as in a HOME recession. However, the trade collapse was global in nature. For instance, U.S. imports and exports both fell and rebounded tremendously. To understand how exports fall when a country enters a recession in our model, recall that imports by ROW dealers are equal to exports by producers in the ROW. Thus, a decline in sales in export markets will lead to a drop in exports by the producer and imports by the final consumer.

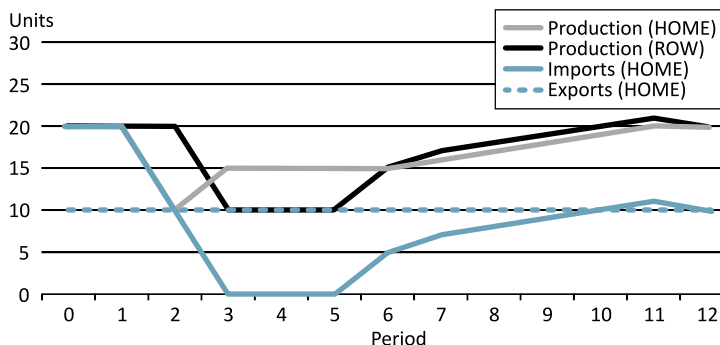
The simple model of trade and inventories can easily deliver a global collapse in trade when sales fall globally. To make things concrete, let's suppose that the HOME and ROW countries sell the same number of autos and ROW and HOME autos account for half of auto sales in each market. With this configuration of market share, in normal times HOME and ROW each import and export 10 units and produce 20 units.

The top panel of Figure 4 shows the impact on HOME imports, exports, and the production of autos when the HOME country enters a recession like the one described in Figure 3 while ROW sales are constant. Here we see that imports fall but exports remain constant. In this case, HOME production falls because of both lower sales at HOME and the need to adjust inventories. ROW production falls more than HOME production because the need to adjust inventories is stronger because of the higher stock of inventories held by ROW dealers.

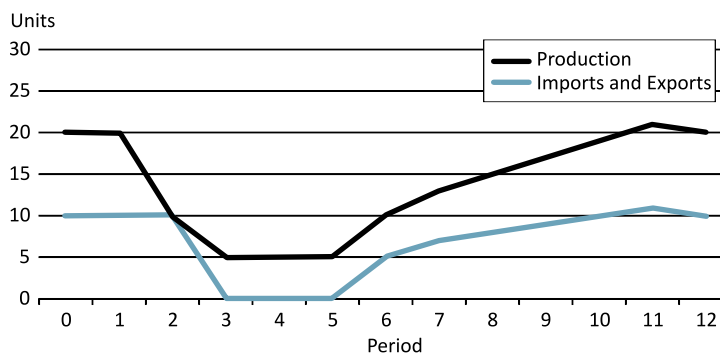
The bottom panel of Figure 4 shows what happens to production and trade when there is a global recession. Now, HOME imports and exports fall. The global nature of the recession leads to a very large and sustained

FIGURE 4

HOME Recession



Global Recession



decline in production. Thus, to the extent that there is a common downturn in economic activity, imports and exports will both fall in a recession.

In our work studying the dynamics of international trade in the global recession (Alessandria, Kaboski, and Midrigan 2010b) and over the business cycle (Alessandria, Kaboski, and Midrigan 2012), my co-authors and I find that between 75 to 90 percent of the fluctuations in international trade that the simple theory of international trade cannot explain (that is, those fluctuations not explained by the movements in expenditures or relative prices) can be explained by the inventory mechanism.

Inventory Holdings of Importers: Explanations and Evidence. Relatively large cyclical fluctuations in

trade arise when importers hold more inventory than nonimporters. We now describe some reasons that this may be the case and then present some empirical evidence supporting this view. Three main reasons stand out to explain why firms that are buying inputs from abroad may hold extra inventory compared with firms that transact only domestically. These reasons are all related to the fact that the costs of and barriers to international transactions are higher than those for domestic transactions.

First, importers have stronger incentives than nonimporters to use inventories to economize on shipping costs. For example, most people who shop at warehouse clubs tend to make large and infrequent purchases rather than going every day to buy small

quantities. Because the cost of each international transaction is relatively large, importers can save by placing a few large orders. The larger costs to international trade are primarily related to larger administrative requirements such as getting permits, undergoing inspections, and arranging financing and transportation.

Second, importers hold more inventories because it just takes longer to ship goods from distant international suppliers than local domestic suppliers. The extra time can add a month or two to the time it takes to get a product delivered once it is produced in a foreign factory. The delays arise because distances are longer and because there are more steps in the process. For instance, many products and countries require permits to export, and the products must pass through customs and ports on their way out of and into a country. This is somewhat mechanical, since imports in transit are included in inventory.

Third, because of the time and costs involved in international trade, there is greater uncertainty with international transactions than with domestic transactions. Two sources of uncertainty are particularly troubling. First, there are more opportunities for delays from inclement weather or even natural disasters as well as delays in getting processed through customs in both the exporting and the importing country. If an input from abroad does not show up on time, it can bring the production process to a halt, and this is quite costly. For instance, following the tsunami in Japan in March 2011, many auto manufacturers in the U.S. that used parts produced in Japan to assemble autos ran out of these parts and thus had to substantially curtail production. Importers also face greater uncertainty with their sales, since the delays in getting inputs from abroad might constrain an importer from filling an order from a customer. As a

precaution against these risks, firms will tend to hold extra inventory.

Evidence of Inventory Premiums of Importers. We now discuss some direct evidence that producers that are importing inputs from foreign suppliers tend to hold more inventory than those that are obtaining their products locally. In my work with Joe Kaboski and Virgiliu Midrigan (2010a), using data from manufacturing establishments¹¹ in Chile, we find that establishments that buy imported inputs tend to hold more inventory than those establishments that only buy inputs locally. Indeed, we estimate that establishments tend to hold, on average, 2.5 months of domestic inputs and

ALTERNATIVE EXPLANATIONS

Here we consider two common explanations to explain why trade fell more than spending on traded goods. Both explanations operate by making imported goods more expensive, thus shifting demand away from imported goods.

Protectionism. The first explanation for the fall in trade points to governments protecting their domestic industries by making trade more difficult by raising taxes on imported goods; erecting new barriers to international trade, such as making it hard to get permits and increasing the costs of getting goods through customs; or favoring certain domestic producers and

The inventory explanation for trade fluctuations implies that the large, sharp fluctuations in trade are the optimal response to the business cycle. Since firms are behaving optimally, there is no role for government action to encourage international trade.

4.5 months of imported inputs. Using aggregate data for the U.S., in another paper with Joe Kaboski and Virgiliu Midrigan (2010b), we also find that industries that import relatively more inputs tend to hold relatively more inventory.

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¹¹ An establishment is a physical location, or plant, where economic activity takes place, while a firm is a collection of establishments with the same owner. For instance, the Ford Motor Company owns a manufacturing assembly plant in Louisville, Kentucky, where about 4,000 workers assemble trucks. This assembly plant is an establishment.

products with subsidies, bailouts, and preferential government purchases.

There is certainly evidence of some increase in trade barriers (see the study by Simon Evenett) in some countries and some industries. Indeed, the Global Trade Alert, a publication coordinated by the Centre for Economic Policy Research, an independent academic and policy research think tank based in London, identifies approximately 2,000 changes in trade policy, and among these, about 1,500 worked to restrict imports from November 2008 to November 2011. Many countries, including the U.S., implemented some policy. An example of one of these policies is the Buy American provision in the American Recovery and Reinvestment Act of 2009 (section 1605 of Title XVI). This

provision required, with limited exceptions,¹² that none of the funds appropriated or otherwise made available by the act may be used for the construction, alteration, maintenance, or repair of a public building or public work unless all the iron, steel, and manufactured goods used are produced in the United States.

While there is certainly some specific evidence of trade barriers increasing in certain countries and industries, the impact of these policies on trade has been found to be relatively limited. In particular, a paper by Jonathan Eaton, Samuel Kortum, Brent Neiman, and John Romalis estimates that these rising international barriers to international trade had a relatively small impact on the collapse of international trade globally, accounting for less than 5 percent of the decline in trade in the period of the great trade collapse.

Tightening Financial Conditions. A second common explanation for the relatively large decline in international trade in the recent crisis attributes the decline to extreme difficulties in the financial sector. The simple idea is that international trade requires more credit from financial institutions than domestic transactions because it either takes longer or is harder to enforce international contracts than domestic contracts.¹³ Given the need for credit in order to carry out trade, the worsening credit conditions in recessions tend to hit trade harder.

There are two main approaches

¹² Waivers from this provision were possible if U.S. goods were not available, sold for an unreasonable cost, or were inconsistent with the public interest.

¹³ Enforcing contracts for international transactions can be particularly difficult, since buyers and sellers are located in different countries and thus subject to different legal systems. To overcome these problems, the buyer and seller often contract with banks to intermediate the transaction, with the banks essentially guaranteeing payment to the seller once the buyer fulfills the terms of the contract.

to finding evidence of this effect. The first, summarized in the work of Davin Chor and Kalina Manova, is to see whether exports of industries that are relatively reliant on extensive external financing, or borrowing from financial intermediaries like banks, fell by more than exports of industries that use less external financing. Likewise, it is also possible to study whether trade fell more in countries where credit conditions deteriorated the most so that the availability of finance for trade was relatively more restricted. Using this approach, Chor and Manova estimate that the increase in the costs of financing from September 2008 to August 2009 may have lowered U.S. imports by as much as 5.5 percent.

The second approach examines whether firms associated with a particular bank tended to export less if their bank performed worse. The idea is that banks that were in distress would provide their customers with less financing for international transactions. The lack of financing would make it harder for the customers associated with these banks to export at least until these customers could switch banks.

Using this approach there is some evidence of an impact of bank stress. Using a sample of Japanese firms matched to their primary bank, Mary Amiti and David Weinstein attribute between 19 and 23 percent of the decline in Japanese exports in 2008 and 2009 to the finance channel. Using Peruvian firms and banks, Daniel Paravisini, Veronica Rappoport, Philipp Schnabl, and Daniel Wolfenzon find that about 10 to 15 percent of the drop in exports in the 2008 and 2009 period can be attributed to credit frictions. Paravisini and co-authors also show that some biases in the empirical methodology used by Amiti and Weinstein may overstate the impact of credit on trade by 100 percent.

Overall, attributing the recent collapse in trade to problems in the

financial sector is quite appealing, given that many of the problems in the recent recession affected the financial sector the most. The empirical work finds some support for this channel. However, one concern with this explanation of a trade collapse based on financial considerations is that, for the U.S., movements in international trade in the current downturn were similar in magnitude to previous downturns in which the financial sector was less affected.

SUMMARY


International trade collapsed and rebounded strongly from 2008 to 2010 in the U.S. and the rest of the world. For the U.S., these relatively large fluctuations in international trade are quite typical of past U.S. recessions and recoveries. For the U.S., relative to the size of the downturn, the collapse and rebound were not unusual. What was unusual was the relatively deep recession.

In this article, we presented a simple theory that can explain these types of cyclical fluctuations in exports and imports based on the different inventory holdings of users/resellers of imported and domestic inputs. These different inventory holdings arise because importers and domestic buyers face different costs of buying inputs. In a recession, given the higher inventory holdings of importers, there is a stronger incentive to adjust inventories, and so trade falls and rebounds by more. When there is a global recession, this leads to very strong declines in both imports and exports.

This simple theory of inventory and trade suggests that the relatively large fluctuations in trade arise naturally as the response of shocks to the economy rather than policy-induced distortions such as an increase in protectionism. This suggests that there is a limited role for policy in responding to these cyclical fluctuations in trade.

Of course, other channels seem to have played a role as well. There is some evidence that some part of the contraction in international trade was attributed to increased protection-

ism. Reversing these policies would certainly increase international trade. Tightening credit may have also played a role in the collapse of trade, and the lowering of spreads may have

helped in the recovery of international trade. There is ongoing work to more precisely parse out the contribution of these different sources of cyclical fluctuations. 

REFERENCES

Alessandria, George, Joseph Kaboski, and Virgiliu Midrigan. "Trade, Inventories, and International Business Cycles," Working Paper (2012).

Alessandria, George, Joseph Kaboski, and Virgiliu Midrigan. "Inventories, Lumpy Trade, and Large Devaluations," *American Economic Review*, 100:5 (December 2010a), pp. 2304-39.

Alessandria, George, Joseph Kaboski, and Virgiliu Midrigan. "The Great Trade Collapse of 2008-09: An Inventory Adjustment?," *IMF Economic Review*, 58 (December 2010b), pp. 254-94.

Alessandria, George, and Jarcy Zee. "The Exchange Rate: What's In It for Prices?," *Federal Reserve Bank of Philadelphia Business Review* (Third Quarter 2009).

Amiti, Mary, and David Weinstein. "Exports and Financial Shocks," NBER Working Paper 15556 (2009).

Chor, Davin, and Kalina Manova. "Off the Cliff and Back? Credit Conditions and International Trade During the Global Financial Crisis," *Journal of International Economics* (forthcoming).

Eaton, Jonathan, Samuel Kortum, Brent Neiman, and John Romalis. "Trade and the Great Recession," unpublished manuscript, University of Chicago (2010).

Evenett, Simon. "Crisis-era Protectionism One Year after the Washington G20 Meeting: A GTA Update, Some New Analysis, and a Few Words of Caution," in *The Great Trade Collapse: Causes, Consequences, and Prospects*, R. Baldwin, ed., London: Center for Economic Policy Research, 2009.

Global Trade Alert. "Trade Tensions Mount: The 10th GTA Report," Simon Evenett, ed., London: Centre for Economic Policy and Research, November 2011.

Haltmaier, Jane. "Empirical Estimation of Trend and Cycle Export Elasticities," Board of Governors of the Federal Reserve System Discussion Paper (2011).

Paravisini, Daniel, Veronica Rappoport, Philipp Schnabl, and Daniel Wolfenzon. "Dissecting the Effect of Credit Supply on Trade: Evidence from Matched Credit-Export Data," National Bureau of Economic Research Working Paper 16975 (2011).

World Trade Organization. "Trade Growth to Ease in 2011, but Despite 2010 Record Surge, Crisis Hangover Persists," WTO press release, April 7, 2011.

The Political Economy of Balanced Budget Amendments*

BY MARINA AZZIMONTI

A

balanced budget amendment is a constitutional rule requiring that the government collect enough revenue to finance its expenditures every year. The motivation for introducing such a rule is the desire to restrict deficit spending and limit increases in government debt. However, policymakers strongly disagree about the rule's coverage and provisions. In particular, they disagree on how to define the terms revenue and expenditures and under which conditions exceptions to the rule should be allowed. In this article, Marina Azzimonti provides an overview of the arguments raised by proponents and opponents to the balanced budget amendment, emphasizing its economic consequences. She then describes recent findings in the academic literature that analyze the impact of similar rules at the state level. Finally, she summarizes theoretical findings that aim to compute the impact of a balanced budget rule on economic and policy variables, together with its effects on consumers' welfare.

A persistent debate in American politics is whether to have a constitutional amendment requiring the federal government to operate under a



Marina Azzimonti is a senior economist in the Philadelphia Fed's Research Department. This article is available free of charge at www.philadelphiafed.org/research-and-data/publications/.

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balanced budget. Although the Great Depression and the rise of the New Deal saw the first attempt to introduce a balanced budget amendment in 1936, the sustained accumulation of deficits over the last three decades has heightened concerns that limits need to be placed on the gap between federal government revenues and spending. The U.S. House of Representatives

*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.

approved a balanced budget amendment by 300 to 132 votes in 1995, but it fell short in the Senate by one vote. Efforts to pass an amendment have continued because of the high deficits incurred during the last economic recession. The latest attempt to reform the U.S. constitution with a balanced budget amendment was in 2011, with 261 votes in favor of implementing the reform. Although support was relatively strong in the House, it was 23 votes short of the two-thirds majority needed.^{1,2}

In general, a balanced budget amendment is a constitutional rule requiring that the government collect enough revenue to finance its expenditures every year. The motivation for introducing this rule is the desire to restrict deficit spending and limit increases in government debt. However, there is strong disagreement regarding its coverage and provisions among policymakers. In particular, policymakers disagree on how to define the terms "revenue" and "expenditures" and under which conditions exceptions to the rule should be allowed. By restricting deficits, the rule reduces the government's ability to face adverse shocks such as wars and natural disasters. By restricting debt accumulation, it prevents the public sector from financing long-term projects that foster growth

¹ A constitutional amendment requires a two-thirds vote of approval in both Houses of Congress and a ratification by three-fourths of the states before it can take effect.

² See the paper by James Saturno and Megan Lynch for a full summary of congressional hearings and floor action in consideration of balanced budget amendments.

and development. The trade-off between “discipline” and “flexibility” is at the core of the debate surrounding this rule.

In this article, I will provide an overview of the arguments raised by proponents and opponents to the balanced budget amendment, emphasizing its economic consequences. I will then describe recent findings in the academic literature that analyze the impact of similar rules at the state level. Overall, there is evidence that balanced budget rules do induce discipline in policymakers at the state level: The level of spending as a percentage of revenues (or output) is lower in states that have more stringent rules. In contrast, there is no conclusive evidence suggesting that the rules impose a significant loss in flexibility to face negative shocks or that they affect public investment at the state level. This is, however, a result of the particular form taken by budget rules at the state level. There are many reasons to question whether the results from the state-level studies would extrapolate to the federal level, but the state-level studies do suggest that when designing a rule at the federal level, policymakers should consider the provisions incorporated in the state rules.

Finally, I will summarize theoretical findings that aim to compute the impact of a balanced budget rule on economic and policy variables, together with its effects on consumers’ welfare (both in the short run and over a longer horizon). When considered at the federal level, imposing a balanced budget rule that takes a form similar to the one proposed in 1995 or 2011 is found to reduce welfare. There are welfare gains in the long run, but the transition costs overwhelm such benefits. The main reason behind this result is that, at current levels of debt, the loss in flexibility is greater than the benefits associated with smaller deficits and less debt.

The conclusion suggests several changes to the balanced budget proposal for the U.S. federal government that could potentially reduce welfare costs. These are based on inspection of alternative balanced budget rules imposed by several European countries that recently amended their constitutions.

the share of government spending to output) and the level of public debt. The increase in the size of the U.S. government is illustrated in Figure 1, which shows the share of government expenditures to total output in percentage terms between 1930 and 2011. Government spending represented only 10 percent of output in 1930 but

Advocates of a balanced budget amendment to the U.S. constitution consider it a necessary tool to limit the size of the government (measured as the share of government spending to output) and the level of public debt.

THE POLITICAL DEBATE

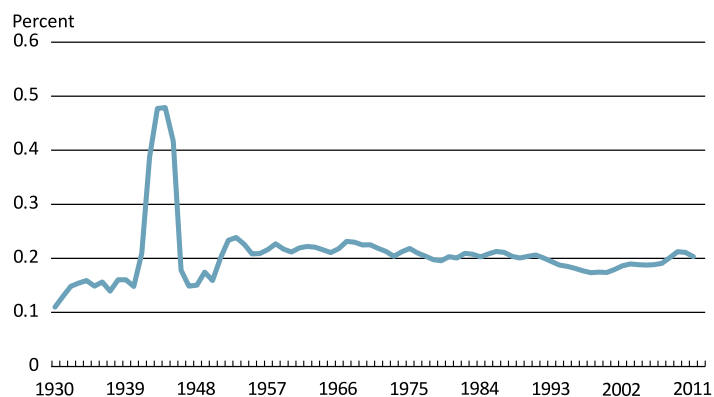
There are opposing views regarding the desirability of a balanced budget rule (BBR) that have been voiced in the political debate that took place in Congress and in the media over the last few years.

Advocates of a balanced budget amendment to the U.S. constitution consider it a necessary tool to limit the size of the government (measured as

grew substantially to about 20 percent after the 1970s. Moreover, a source of concern for supporters of this rule is the composition of these expenditures, since there has been a shift toward targeted spending and redistributive programs. While about 50 percent of expenditures were devoted to national defense in the 1960s, most spending was devoted to welfare programs in 2010. Unemployment, Social Secu-

FIGURE 1

Government Spending as a Percent of GDP



rity, health, and education were just 28.9 percent of expenditures in the 1960s, but their size had increased to 61 percent by 2010 (Figure 2). The composition of spending shifted from temporary to structural expenditures. A balanced budget rule is seen by proponents as a way to limit these expenditures. They argue that reducing debt will result in lower interest rate payments, higher savings rates, and hence more economic growth.

Opponents, on the other hand, argue that a BBR would restrict the government’s ability to use debt for beneficial purposes such as tax smoothing, fiscal stimulus (e.g., countercyclical fiscal policy), or public investment. Even if legislators tend to accumulate inefficiently high debt levels, this does not mean that they will not use debt on the margin in ways that enhance social welfare. The loss of flexibility associated with this rule dominates any benefits associated with it, according to the BBR critics. In the *Report on Public Credit*, Alexander Hamilton argued that public borrowing is to be undertaken to meet certain “exigen-

cies” or “emergencies” that inevitably arise in the life of nations — exigencies including, but not limited to, war. An example is given by the large and unexpected increase in government defense spending during World War II, as shown in Figure 1, which triggered a spike in government debt as a share of output (see also Figure 3). A balanced budget rule would also restrict the ability to trigger “automatic stabilizers” at the federal level, which, according to Congressional Budget Office Director Doug Elmendorf, risks making the economy less stable and exacerbating the swings in business cycles or financial crises.

Advocates respond that some flexibility may be preserved by allowing the BBR to be overridden in times of war or with a supermajority vote of the legislature. Sections 5 and 6 of the bill proposed in 2011 introduced “escape clauses” to that effect. For example, a bill to increase revenues may become law if two-thirds of the members (of each House) approve it. In addition, the provisions may be waived if a declaration of war is in effect or the coun-

try is under serious military threat. An alternative would be to balance the budget over the business cycle, rather than on a year-by-year basis. This is the approach followed by Switzerland’s and Germany’s reforms to their constitution. Finally, investment expenditures might be exempted from the rule by the creation of separate capital budgets such as those currently in place in many U.S. states (see the study by Marco Bassetto and Thomas Sargent).

A further argument against a balanced budget amendment is that the balanced budget rule will be circumvented by bookkeeping stratagems and hence will be ineffective. Such stratagems include the establishment of entities, such as government-sponsored enterprises, that are authorized to borrow but whose debt is not an obligation of the state.³ Another stratagem involves selling public assets and recording the proceeds as current revenue. The

³ Government-sponsored enterprises are not considered to be part of the federal government, so their transactions are considered nonbudgetary.

FIGURE 2

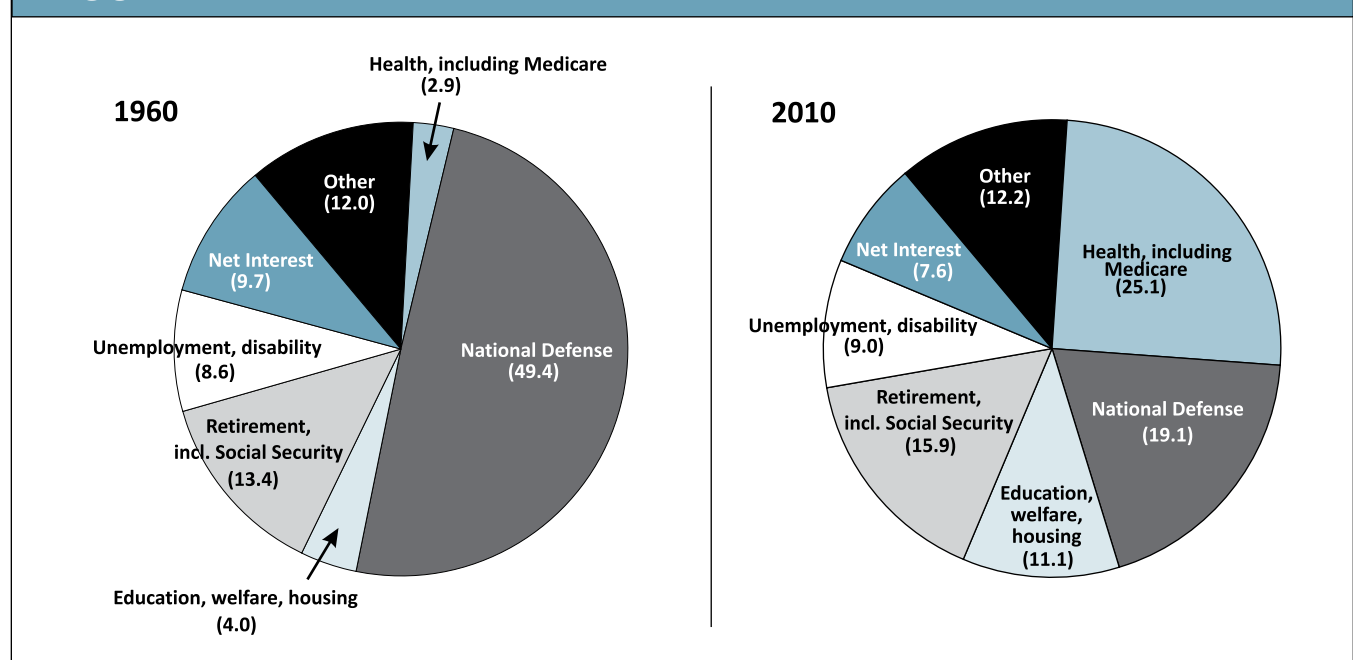
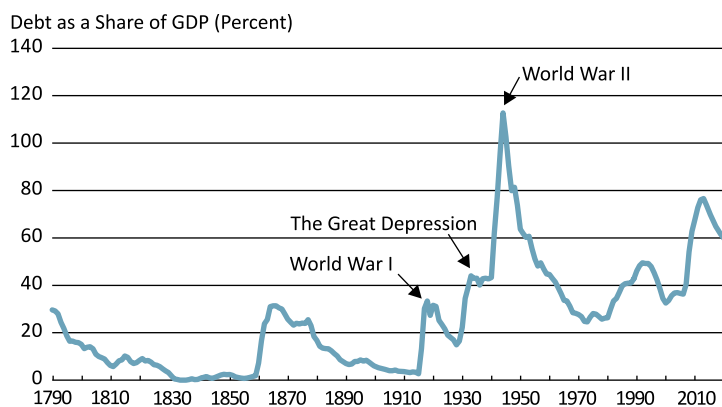


FIGURE 3**Federal Debt Held by Public**

government may also shift expenditure items off-the-budget or to local governments (which face lower borrowing restrictions). Finally, it could be possible to swap nonguaranteed for guaranteed debt when the borrowing limit becomes binding.⁴ This process of circumvention can create a lack of transparency and accountability, according to critics. Congress may rely on inefficient nonbudgetary measures by imposing mandates on state and local governments or additional regulations on the private sector. There is also some concern about the fact that enforcing the BBR may blur the line between legislative and judicial powers by delegating the final say on budgetary policy to unelected judges (see the article by Saturno and Lynch).

THE ACADEMIC DEBATE

Deficits, Debt, and Economic Outcomes. The emphasis on restricting deficits present in the political

⁴ Nonguaranteed refers to debt instruments not backed by the “full faith and credit” of the government. In other words, there is no explicit pledge to use government revenues to liquidate this debt.

debate implicitly assumes that debt accumulation is harmful for the economy. This is not necessarily the case, because governments often rely on public debt to finance infrastructure such as roads and bridges to promote growth. The contribution of public capital to private-sector productivity has been documented by David Aschauer, who estimated that a 1 percent increase in public capital raises output by 0.39 percent. This value is as large as the contribution of private capital to output.⁵ In addition, as pointed out by Giancarlo Corsetti and Nouriel Roubini, the level of real public debt that can be sustained increases over time in a growing economy due to increased economic activity. Finally, deficits during or shortly after a recession aid economic recovery. However, persistent deficits and continually mounting debt may have negative economic consequences over a longer horizon in these economies.

The beneficial effects of deficits in the short run were pointed out as early

⁵ Other studies have found estimates ranging from 0.05 to 0.4 percent.

as 1936 by John Maynard Keynes. During a recession, higher spending or lower taxes (which generate larger deficits) help economic recovery. The reason is that when workers are unemployed and capacity (equipment and buildings) is unused, higher government spending and lower tax rates usually increase the overall demand for goods and services. This implies that firms boost their output and hire workers, lessening the impact of the recession. Using a New Keynesian model, Lawrence Christiano, Martin Eichenbaum, and Sergio Rebelo show that the effectiveness of government spending (i.e., the size of the “multiplier”) depends on the magnitude of nominal interest rates. The largest impact is attained when short-term nominal interest rates are near zero. In this case, Christiano and co-authors estimate that output rises by 3.4 percent in response to a 1 percent increase in government spending. There is, however, some disagreement about the magnitude of the multiplier within the literature. There is some debate regarding how effective such policies are if they are used over longer horizons.

Neoclassical theories, in particular the “tax smoothing hypothesis” developed by Robert Barro in 1979, point to a different channel by which deficits are beneficial in the short run. During wars and recessions, revenues are low and spending needs are high. The government can smooth the negative effects of a bad shock by borrowing in bad times and paying back during better times, rather than having to increase taxes in an already depressed economy (see also the study by Robert Lucas and Nancy Stokey). This allows the government to spread the costs of a recession over time and reduce the size of the distortions associated with financing deficits with higher tax rates.

But those short-term benefits carry the potential of long-term costs. Persistent, large deficits that are not related

to economic slowdowns have a number of significant negative consequences. One of them is the crowding out of private investment by deficits. When the government runs persistent deficits, a growing portion of consumers' savings is devoted to purchasing government debt rather than to investment in private capital goods (such as factories or computers). This "crowding out" of investment leads to lower output and incomes in the future, as argued by Martin Feldstein and Otto Eckstein (see also the article by Michael Dotsey and the one by Rao Aiyagari and Ellen McGrattan).

A second argument relates to the repayment costs of growing debt. At some point, either tax rates need to increase, spending on government programs has to decrease, or a combination of both. Higher marginal tax rates discourage work effort and negatively affect private savings, which further reduces output. A study by Jerry Hausman and another by Martin Feldstein provide empirical evidence of the negative effect of larger payroll taxes on the supply of labor. The 1987 book edited by Martin Feldstein compiles a series of papers examining the negative influence of taxes on capital formation, savings, and the process of investing in plant and equipment. He also argues that anticipated future budget deficits affect long-term interest rates today, which can hamper economic activity in the short term. High long-term interest rates can also discourage investment (see the study by Olivier Blanchard).

Some economists argue that persistent deficits involve fairness considerations regarding the burden of debt. Bondholders do not bear a burden by financing today's public expenditures. Since bondholders will eventually be repaid from the proceeds of future taxes, future taxpayers pay for today's debt-financed public expenditures and bear its real burden. The real reduc-

tion of consumption is borne by the generation(s) alive at the time the loan is repaid (see the 1958 paper by James Buchanan and the paper by William Bowen, Richard Davis, and David Kopf). Fairness considerations arise when such expenditures do not benefit the generation carrying the burden.

A large stock of debt also reduces the government's ability to respond to domestic economic downturns or international crises. Aiyagari, Marcet, Sargent, and Seppälä argue that when markets are incomplete, it is welfare improving to repay debt during booms

and even to accumulate assets whenever possible. This would endow the government with a buffer stock of assets that could be used when a crisis arises.

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and even to accumulate assets whenever possible. This would endow the government with a buffer stock of assets that could be used when a crisis arises.

Finally, a growing level of federal debt increases the probability of a sudden fiscal crisis, as discussed in the 2009 book by Carmen Reinhart and Kenneth Rogoff. Such crises occur when debt levels become so large relative to the economy's output that the government has difficulty selling it. Current and potential bondholders lose confidence in the government's ability to raise enough resources in the future to pay off public debt. The government thus loses its ability to borrow at affordable rates. An abrupt rise in interest rates reflects investors' fears that the government would renege on the terms of its existing debt or that it would increase the supply of money to finance its activities or pay creditors and thereby boost inflation. Examples of this can be found during the debt crises of Argentina, Mexico, or Greece, where capital inflows in the form of bank loans dried up and inter-

est rates rose sharply. When a fiscal crisis occurs, the government is forced to increase taxes, enforce spending cuts, or both. These adjustments can be painful because when the necessary reforms are large, they must be enacted when the economy is under pressure (see the paper by Laurence Ball and Gregory Mankiw for an excellent discussion).

If tax increases or expenditure reductions are politically unfeasible, the government may be forced to restructure debt (which is equivalent to a partial default) or rely on inflationary

monetary policy. Even though when inflation rises the value of outstanding debt (which is mostly fixed in dollar terms) decreases relative to output (which would increase when measured in dollar terms), higher inflation increases the size of future budget deficits (see the article by Juan Carlos Hatchondo and Leonardo Martinez for a discussion of the literature). There is, however, little evidence that deficits lead to money creation in the United States for the post-war period, as shown by Robert King and Charles Plosser. Historically, fiscal and monetary crises in other countries occurred at different levels of government debt relative to gross domestic product (GDP). The tipping point is hard to predict because it depends on the long-term budget outlook, the near-term borrowing needs, and the state of the economy (i.e., whether the economy is experiencing a boom or a recession). Nonetheless, rising levels of debt may trigger such crises (see the 2011 article by Reinhart and Rogoff).

Summarizing, the economic effects of budget deficits and accumulat-

ing government debt differ in the short run and the long run. In the short run, deficits may be beneficial because governments can lessen the effects of recessions or negative shocks such as wars and natural disasters. However, these benefits may be reversed by the long-run costs associated with persistent deficits and high levels of debt.

Fiscal Rules and Balanced Budget Amendments. Fiscal rules have been proposed by policymakers and legislators as a way to overcome the negative effects of long-run deficits. These rules are constraints often imposed at the constitutional level, by which the legislature must abide. They involve restrictions on the levels of spending, deficits, or debt. In some cases, they take the form of caps on the nominal amounts spent or borrowed, and in other cases, they are expressed as a percentage of the economy's level of output. Exceptions are made for times of war, severe economic recessions, and natural disasters. Clauses that allow the legislature to suspend the rule by a super-majority are often introduced. *Fiscal Rules* (see the box at right) summarizes countries that have recently amended their constitutions to introduce fiscal rules, as well as restrictions that are currently in place in the United States (at both the state and the federal levels).

The academic literature studying the desirability of a balanced budget rule can be divided in two groups. One strand of the literature analyzes how these rules affect policy and economic outcomes in regions where such rules are in place. The approach aims to empirically assess the effects of fiscal rules. A second strand of the literature develops theoretical economic models that serve as artificial laboratories where alternative hypothetical rules are evaluated against the case where the government can freely run deficits and accumulate debt.

Empirical studies. There is a large

Fiscal Rules

S

everal European countries have adopted fiscal rules. In 2003, Switzerland's legislative body approved a constitutional amendment stating that the budget must be in balance every year, adjusted for economic conditions. The government can run a deficit in recessions but must save during booms. Germany's constitution was amended in 2009 to introduce the *Schuldenbremse* (debt brake), which restricts deficits to be smaller than 0.35 percent of output. It applies at the state and federal level. In 2011, Spain amended its constitution by restricting debt to be lower than 60 percent of GDP in any given year. European leaders signed a new fiscal pact in January 2012. As in previous agreements, the share of debt to nominal output is restricted to remain below 60 percent in each country. In addition, deficits have an upper bound of 0.5 percent of nominal GDP, unless economic conditions are adverse. In that case, deficits can reach 1 percent of output (as long as the share of debt is lower than 60 percent).

Examples of fiscal rules also abound in the United States. Every state in the country, except Vermont, has some form of balanced budget rule. The precise form in which they have been implemented varies from state to state. In some cases, the restriction applies to the total level of debt, while in others it refers to its short-run component. Some debt limits are issued in nominal terms; others are formulated relative to the size of the state's general fund or as a percentage of government revenues. Indiana cannot issue debt in general but allows an exception for "temporary and casual deficits." Oregon bans surpluses of more than 2 percent of revenue by refunding the money to taxpayers should such surpluses occur. Iowa's rule does not permit the state to run deficits. Moreover, it created a "rainy day fund" where the government deposits surpluses as a form of precautionary savings, to be used if adverse economic conditions arise. In addition, most states have separate capital accounts: Borrowing is allowed as long as it is used to finance investments in infrastructure.

Unlike the constitutions of most U.S. states, the United States Constitution does not require Congress to pass a balanced budget every year. This implies that projected income of the government through taxes, fees, and other revenues does not need to equal the amount proposed to be spent. Under federal law, however, the amount that the government can borrow is limited by a debt ceiling, which can only be increased with a vote by a super-majority in Congress. Historically, increasing the ceiling was a formality, until 2011, when reaching an agreement became almost infeasible. Since 40 percent of federal expenditures are financed by deficits, this caused a "debt-ceiling crisis," which raised concerns about the creditworthiness of the U.S. government and precipitated a ratings downgrade by S&P.

body of work devoted to the empirical question of whether the balanced budget rules (BBRs) used in practice actually have any effect. Empirical investigation is facilitated by the fact that BBRs with different degrees of strictness are common at the state level in the U.S. In addition, many of the states adopted their BBRs as part of their constitutions. Researchers have explored how the strictness of BBRs affects fiscal policy. These studies find that stringency does matter for fiscal policy. The most important aspect of stringent rules, according to Robert Inman, is the requirement that the budget must be balanced “ex-post” rather than “ex-ante.” Under ex-ante accounting, the BBR applies only at the beginning of the year and requires the governor or legislature to pass a balanced budget. Unexpected deficits at the end of the year may be carried over to the next budget cycle. Under ex-post rules, the budget must balance at the end of the year. These rules contain a “no-carryover” provision, whereby states are not allowed to carry deficits from one year to the next. The rule is most effective when enforced by politically independent agents, such as elected supreme courts, and when penalties associated with deficit violations are large. Henning Bohn and Robert Inman show that states where the constraints are stronger exhibit lower levels of expenditures as a percentage of gross state product (GSP), thus reducing the size of governments. In addition, states with a no-carryover BBR reduce deficits (or increase surpluses) by approximately 6 percent of the average state’s budget. Evi Pappa and Fabio Canova, using more recent data, find that limits on short-term debt tend to keep the debt-to-revenue and the debt-to-GSP ratios low. This evidence favors the view that fiscal rules may be beneficial, since they introduce discipline into government spending.

In two studies, James Poterba

shows that states with more stringent restraints were quicker in reducing spending and increasing taxes in response to negative revenue shocks than those without such rules. In other words, constraints limit governments’ ability to respond to business cycle fluctuations and increase the volatility of fiscal policy. This supports the views opposing the introduction of BBRs by showing that the government is limited in its ability to carry out a stabilization

the effects of negative economic or revenue shocks in the presence of state balanced budget rules. Because the federal government follows a stabilization fiscal policy when states are affected by adverse shocks, the states with strict balanced budget amendments do not suffer as much from the loss of flexibility as they would were the federal government not playing that role. Thus, introducing a balanced budget rule at the federal level will affect the

Formal models trying to account for the benefits and costs of balanced budget rules are scarce.

policy. The evidence on the effects of a BBR on the cyclicity of government spending and macroeconomic outcomes is, however, mixed. For example, Pappa and Canova find that the cyclicity of government spending is not affected by how strong these rules are. States anticipate that they will not be able to borrow in bad times, so they engage in precautionary saving in advance. They argue that creative budget accounting may explain some of their results. Antonio Fatas and Ilian Mihov provide empirical support for the hypothesis that restrictions, by reducing discretion in fiscal policy, can actually reduce macroeconomic volatility.

Extrapolating the findings on the impact of balanced budget rules at the state level to the federal government may, however, be incorrect. At the state level automatic stabilizers, such as unemployment insurance benefits, are financed via inter-governmental transfers. The federal government can redistribute resources across the states if some regions are worse off than others. It can also borrow funds abroad if the whole economy faces a downturn (as it did in 2009 during the recession). Both redistribution and borrowing allow the federal government to smooth

insurance channel implemented by inter-governmental transfers (which account for 30 percent of state revenues). Jeffrey Sachs and Xavier Sala-i-Martin (1992) show that more than one-third of a fall in state income is compensated by a net income transfer from the federal government. If the federal government was subject to a balanced budget amendment, it would suffer the full effect of lost flexibility.

Theoretical studies. Formal models trying to account for the benefits and costs of balanced budget rules are scarce. The difficulty lies in the fact that any model that aims to capture the basic trade-off associated with the rule needs to be very complex. For example, David Stockman studied the introduction of a balanced budget rule, but he assumed that policy choices were made by a “benevolent government.” This approach allows us to measure the flexibility costs associated with the rule, but not the benefits of disciplining excessive public spending. The reason is that a benevolent government chooses the best allocation of resources in the economy, and hence there is no excessive public spending. When policy choices are made under political frictions that naturally arise

in democratic environments, the size of the government may be inefficiently large (that is, public spending can be excessive). In contrast to traditional macroeconomic models that do not take into account the role of elected policymakers, political frictions are at the core of any model attempting to evaluate this reform.

In my paper with Marco Battaglini and Stephen Coate, we develop an environment that accounts for the benefits of disciplining policymakers. In the basic environment, a legislature bargains over fiscal policy. This involves a level of debt, taxes, spending on public goods (such as defense or education), and constituency-driven spending (e.g., targeted transfers to their own constituencies). In the model, we find that, due to political frictions, politicians are more short-sighted than citizens. So politicians incur excessive deficit spending and accumulate too much debt. The intuition is simple: Faced with the possibility of not being in office in the future, in which case they have no control over spending for their own constituencies, the modeled legislators have incentives to spend more than they otherwise might. This additional spending is financed in part by deficits, which are less politically costly than tax increases. In our model, existing electoral rules endow “political agents” with the authority to *spend without taxing* (see the 1997 study by Buchanan). The existence of a political friction, in this case, policymakers’ turnover, results in deficit over-spending. In the model, the introduction of a balanced budget rule, by restricting the set of financial instruments, may serve to reduce these inefficiencies. We consider a balanced budget rule along the lines of the proposed 2011 balanced budget amendment, which precludes a deficit in any fiscal year.

What are the effects of this rule? By forbidding deficits, it reduces the

incentives to over-spend. However, since the economy may be subject to adverse shocks (like recessions, wars, or natural disasters in the real world), a restriction on the amount of debt that governments can issue limits its ability to face these shocks. In particular, the additional spending on public goods (i.e., infrastructure) necessary to counteract the effects of the negative shock (i.e., an earthquake) must be financed with additional taxes. Increasing distortionary taxes puts more pressure on the economy by reducing the supply of labor and hence exacerbating the negative shock. Imposing a BBR thus involves a trade-off: a *disciplinary effect* on policymakers versus a *flexibility cost*, due to the restricted set of financing instruments.

This study has some interesting and unexpected findings associated with the introduction of a balanced budget rule. Although the rule is simply an upper bound on deficits, it induces debt to gradually *fall* over time. Moreover, it settles at a level that

ing, they decide to reduce the stock of debt in good times. This decreases expected interest payments, which will be beneficial if bad times arrive. Finally, the BBR binds future policymakers to a course of action by forbidding them to increase debt. Notice that this channel would not be operative if legislators were allowed to borrow freely under any possible realization of the shock. My co-authors and I report numerical results showing that within our model the average debt to GDP ratio is reduced significantly (even eliminated) once the rule is introduced.

An unexpected side-effect of the rule pointed out in our paper is that the amount of constituent-driven spending *increases* under the balanced budget rule. Once the economy reaches a point where debt is small, such additional spending is relatively cheap — in terms of tax distortions — during a boom. Since the economy grows during a boom and interest payments are relatively low, legislators find it optimal to increase the amount of transfers

We also find that, in our model, a BBR is beneficial in the long run; that is, consumers’ welfare is 0.3 percent higher in an economy that has a BBR compared with an economy that does not have a BBR.

would not be reached in the absence of this rule. The intuition is the following: The BBR raises the expected cost of taxation in the future. Legislators realize that if the economy faces a negative shock, they will not be able to borrow in order to spread the costs of this shock over time (ineffective tax smoothing). In addition, if the stock of debt is large, interest payments will constitute a heavy burden for consumers, who are already suffering under the adverse economic conditions. Given that legislators are forward look-

targeted to their constituency. There is discipline in terms of the level of debt, but not in terms of expenditures.

In our paper, we also analyze the possibility of an override analogous to that proposed in the 2011 balanced budget amendment. We consider the provision that total outlays may exceed total expenditures if three-fifths of the legislators vote affirmatively. We show that this “escape clause” severely undermines the positive effects of the balanced budget rule in disciplining policymakers. The reason is that

legislators agree to finance spending with deficits under adverse economic conditions. This in turn implies that the expected cost of taxation does not increase when conditions are favorable, so the incentives to engage in precautionary saving (or to reduce debt) are eliminated. This is in line with the findings of Bohn and Inman, who show that states with constitutionally grounded rules that need at least two-thirds of the legislature to approve a budget run lower deficits than those states in which a budget can be overturned by a simple majority (statutorily based rules).

We also find that, in our model, a BBR is beneficial in the long run; that is, consumers' welfare is 0.3 percent higher in an economy that has a BBR compared with an economy that does not have a BBR. However, the transition costs associated with lowering the stock of debt when a BBR is imposed on an economy without one can be prohibitively high for the current level of debt in the U.S. In our numerical example, the flexibility costs outweigh the disciplinary gains. These welfare computations have to be taken with caution, however, since our model does not consider the effects of debt on capital accumulation (both private and public). As mentioned above, the reduction of debt may serve to lessen the negative crowding out effects on private-sector savings and investment, which would increase welfare. However, this may also reduce the


government's ability to finance growth-promoting infrastructure, which would reduce welfare.

CONCLUSIONS AND FURTHER CONSIDERATIONS

Evidence from the U.S. states suggests that strong BBRs require ex-post accounting, must be costly to amend, and must be enforced by politically independent agents that can impose significant penalties when deficit violations arise. Following the example of Switzerland and Germany, imposing a balanced budget rule contingent on economic conditions (or other shocks, such as wars and natural disasters) may be more beneficial than allowing for a super-majority override. The former would reduce the loss in flexibility associated with a ban on deficits while at the same time increasing the expected cost of taxation if deficits are used for constituent-driven spending. Additionally, existing rules in Europe generally express deficits as a percentage of GDP. This is reasonable in a growing economy, such as the United States. An upper bound on deficits to output, if appropriately chosen, would result in a level of debt that is not increasing relative to the long-run growth of the economy (see the study by Corsetti and Roubini).

Another important aspect that has received little attention in both the academic and the political debate regards which budgetary items should be subject to the rule. In particular, should

entitlement programs be included? The introduction of Social Security as an "on-budget" item (rather than as an "off-budget" one, as it is currently treated) would have important implications for the behavior of deficits and, more important, the size of debt.

A final point that has been overlooked in the current legislative discussion is the possibility of reaching a point at which the government accumulates assets. If a long enough stream of good shocks arises, it is possible that federal debt can actually become negative. In such a case, the government would be saving rather than borrowing. Under current U.S. law, unanticipated surpluses cannot be used to acquire financial or nonfinancial assets but must be saved in the form of cash. If a balanced budget rule like the one proposed in 2011 was in place, accumulated surpluses might not be able to be used to finance government spending or relieve adverse economic conditions with fiscal policy. The reason is that the rule proposed in 2011 required that expenditures not exceed revenues *even if these expenditures were financed by government savings*. The introduction of a capital account such as the ones operating at the state level (see Bassetto and Sargent, 2006) or the possibility of allowing for outlays to surpass spending when the government has savings (that is, when the level of debt is negative) should perhaps be considered in future proposals. 

REFERENCES

- Aiyagari, S. Rao, Albert Marcet, Thomas Sargent, and Juha Seppälä. "Optimal Taxation Without State-Contingent Debt," *Journal of Political Economy*, 110:6 (2002), pp. 1220-54.
- Aiyagari, S. Rao, and Ellen McGrattan. "The Optimum Quantity of Debt," *Journal of Monetary Economics*, 42:3 (1998), pp. 447-69.
- Aschauer, David. "Is Public Spending Productive?," *Journal of Monetary Economics*, 23 (1989), pp. 177-200
- Azzimonti, Marina, Marco Battaglini, and Stephen Coate. "Analyzing the Case for a Balanced Budget Amendment to the U.S. Constitution," mimeo (2009).
- Ball, Laurence, and N. Gregory Mankiw. "What Do Budget Deficits Do?" Federal Reserve Bank of Kansas City (1995), pp. 95-119.
- Barro, Robert J. "On the Determination of the Public Debt," *Journal of Political Economy*, 87 (1979), pp. 940-71.
- Bassetto, Marco, and Thomas J. Sargent. "Politics and Efficiency of Separating Capital and Ordinary Government Budgets," *Quarterly Journal of Economics*, 121:4, (2006), pp. 1167-1210.
- Bernanke, Ben S., Carol Bertaut, Laurie Pounder DeMarco, and Steven Kamin. "International Capital Flows and the Returns to Safe Assets in the United States, 2003-2007," Board of Governors of the Federal Reserve System International Finance Discussion Papers, 1014 (February 2011).
- Blanchard, Olivier. "Current and Anticipated Deficits, Interest Rates, and Economic Activity," NBER Working Paper 1265 (1984).
- Bohn, Henning, and Robert P. Inman. "Balanced Budget Rules and Public Deficits: Evidence from the U.S. States," *Carnegie-Rochester Conference Series on Public Policy*, 45:1 (1996), pp. 13-76.
- Bowen, William G., Richard G. Davis, and David H. Kopf. "The Public Debt: A Burden on Future Generations?," *American Economic Review*, 50:4 (1960), pp. 701-06.
- Buchanan, James M. *Public Principles of Public Debt: A Defense and Restatement*. Indianapolis: The Liberty Fund, 1999 (first published 1958 by Richard D. Irwin, Inc.).
- Buchanan, James M. "The Balanced Budget Amendment: Clarifying the Arguments," *Public Choice* 90 (1997), pp. 117-38.
- Christiano, Lawrence, Martin Eichenbaum, and Sergio Rebelo. "When Is the Size of the Multiplier Large?," NBER Working Paper 15394 (October 2009).
- Corsetti, Giancarlo, and Nouriel Roubini. "European Versus American Perspectives on Balanced-Budget Rules," *American Economic Review*, 86:2 (1996), pp. 408-13.
- Dotsey, Michael. "Some Unpleasant Supply Side Arithmetic," *Journal of Monetary Economics*, 33 (1994), pp. 507-24.
- Fatas, Antonio, and Ilian Mihov. "The Macroeconomic Effects of Fiscal Rules in the US States," *Journal of Public Economics*, 90 (2006), pp. 101-17.
- Feldstein, Martin. "The Effect of Marginal Tax Rates on Taxable Income: A Panel Study of the 1986 Tax Reform Act," *Journal of Political Economy*, 103:3 (1995), pp. 551-72.
- Feldstein, Martin, ed. *The Effects of Taxation on Capital Accumulation*. Chicago: University of Chicago Press for the National Bureau of Economic Research, 1987.
- Feldstein, Martin, and Otto Eckstein. "The Fundamental Determinants of the Interest Rate," *Review of Economics and Statistics*, 52:4 (1970), pp. 363-75.
- Hatchondo, Juan Carlos, and Leonardo Martinez. "The Politics of Sovereign Defaults," Federal Reserve Bank of Richmond *Economic Quarterly* (Third Quarter 2010), pp. 291-317.
- Hausman, Jerry. "Taxes and the Labor Supply," NBER Working Paper 1102 (March 1983).
- Inman, Robert. "Do Balanced Budget Rules Work? U.S. Experience and Possible Lessons for the EMU," NBER reprint 2173 (1998), pp. 306-32.
- Keynes, John Maynard. *The General Theory of Employment, Interest, and Money*, 1936.
- King, Robert, and Charles Plosser. "Money, Deficits, and Inflation," *Carnegie-Rochester Conference Series on Public Policy*, 22:1 (1985), pp. 147-95.
- Leeper, Eric, and Todd Walker. "Fiscal Limits in Advanced Economies," *Economic Papers*, Economic Society of Australia, 30:1 (2011), pp. 33-47.
- Lucas, Robert, and Nancy Stokey. "Optimal Fiscal and Monetary Policy in an Economy Without Capital," *Journal of Monetary Economics*, 12 (1983), pp. 55-93.
- Pappa, Evi, and Fabio Canova. "The Elusive Costs and the Immaterial Gains of Fiscal Constraints," *Journal of Public Economics*, 90 (2006), pp. 1391-1414.
- Poterba, James. "Balanced Budget Rules and Fiscal Policy: Evidence from the States," *National Tax Journal*, 48:3 (1995), pp. 329-36.
- Poterba, James. "State Responses to Fiscal Crises: The Effects of Budgetary Institutions and Politics," *Journal of Political Economy*, 102 (1994), pp. 799-821.
- Reinhart, Carmen, and Kenneth Rogoff. "The Forgotten History of Domestic Debt," *Economic Journal*, 121:552 (2011), pp. 319-50.
- Reinhart, Carmen, and Kenneth Rogoff. *This Time Is Different: A Panoramic View of Eight Centuries of Financial Crises*. Princeton: Princeton University Press, 2009.
- Sachs, Jeffrey, and Xavier Sala-i-Martin. "Political and Economic Determinants of Budget Deficits in the Industrial Economies," *European Economic Review*, 33:5 (1992), pp. 903-33.
- Saturno, James, and Megan Lynch. "A Balanced Budget Constitutional Amendment: Background and Congressional Options," Congressional Research Service Report (2011), R41907.
- Stockman, David. "Balanced-Budget Rules: Welfare Loss and Optimal Policies," *Review of Economic Dynamics*, 4 (2001), pp. 438-59.

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

BY LEONARD NAKAMURA

T

he 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-



Leonard Nakamura is a vice president and economist in the Philadelphia Fed's Research Department and head of the department's

regional and microeconomics section. This article is available free of charge at www.philadelphiafed.org/research-and-data/publications/.

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.

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.

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

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.

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

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.

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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

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

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.



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CONSTRUCTING A “REGIONAL RESILIENCE INDEX”

In this paper, the author studies long-run population changes across U.S. metropolitan areas. First, the author argues that changes over a long period of time in the geographic distribution of population can be informative about the so-called “resilience” of regions. Using the censuses of population from 1790 to 2010, the author finds that persistent declines, lasting two decades or more, are somewhat rare among metropolitan areas in U.S. history, though more common recently. Incorporating data on historical factors, the author finds that metropolitan areas that have experienced extended periods of weak population growth tend to be smaller in population, less industrially diverse, and less educated. These historical correlations inform the construction of a regional resilience index.

Working Paper 13-1, “Regional Resilience,” Jeffrey Lin, Federal Reserve Bank of Philadelphia

ENHANCING THE DETECTION AND MEASUREMENT OF SYSTEMIC RISK

This paper sets forth a discussion framework for the information requirements of systemic financial regulation. It specifically describes a potentially large macro-micro database for the U.S. based on an extended version of the Flow of Funds. The author argues that such a database would have been of material value to U.S.

regulators in ameliorating the recent financial crisis and could be of aid in understanding the potential vulnerabilities of an innovative financial system in the future. The author also suggests that making these data available to the academic research community, under strict confidentiality restrictions, would enhance the detection and measurement of systemic risk.

Working Paper 13-2, “Durable Financial Regulation: Monitoring Financial Instruments as a Counterpart to Regulating Financial Institutions,” Leonard Nakamura, Federal Reserve Bank of Philadelphia

ADDRESSING THE EFFECT OF THE BLOCKING POWER OF SECOND MORTGAGES

Refinancing a first mortgage puts legal principles in conflict when other, junior, liens also exist. On one hand, the principle that seniority follows time priority leaves the new refinancing mortgage junior to mortgages that were junior to the original, refinanced first mortgage. On the other hand, the principle of equitable subrogation gives the refinancing mortgage the seniority of the claim it paid down. States resolve this tension differently, thus differentiating how much a second mortgage impedes refinancing of the first. The authors exploit this cross-state variation to identify the impact on mortgage refinancing and find that refinancing is significantly more likely in the states following the principle of equitable subrogation when the homeowner also has a second mortgage.

Working Paper 13-3, "Does Junior Inherit? Refinancing and the Blocking Power of Second Mortgages," Philip Bond, University of Minnesota; Ronel Elul, Federal Reserve Bank of Philadelphia; Sharon Garyn-Tal, Max Stern Yezreel Valley College; and David K. Musto, University of Pennsylvania

MAKING THE NORMATIVE CASE FOR DELAYING POLICY REFORM

This paper argues that there is a normative case for delaying policy reform. Policy design in dynamic economies typically faces a trade-off between the policy effects in the short and long term, and possibly across future states of nature. When the economy is in an atypical state or available policies are less flexible than ideal, this trade-off can be steep enough that retaining the status-quo policy in the short term and taking on the reform at a later date are welfare improving. In a simple New Keynesian economy, the author considers monetary policy reform from discretion to the optimal targeting rule. He finds that the policy reform should be postponed if a sharp drop in output drives the nominal interest rate to the zero lower bound but only modest deflation pressures are observed under the status-quo policy.

Working Paper 13-4, "On the Timing of Monetary Policy Reform," Roc Armenter, Federal Reserve Bank of Philadelphia

ANALYZING THE IMPACT OF TRANSACTIONS CREDIT ON INTEREST RATES AND PRICES

Using a segmented market model that includes state-dependent asset market decisions along with access to credit, the authors analyze the impact that transactions credit has on interest rates and prices. They find that the availability of credit substantially changes the dynamics in the model, allowing agents to significantly smooth consumption and reduce the movements in velocity. As a result, prices become quite flexible and liquidity effects are dampened. Thus, adding another medium of exchange whose use is calibrated to U.S. data has important implications for economic behavior in a segmented markets model.

Working Paper 13-5, "Interest Rates and Prices in an Inventory Model of Money with Credit," Michael Dotsey, Federal Reserve Bank of Philadelphia, and Pablo Guerron-Quintana, Federal Reserve Bank of Philadelphia

EXAMINING THE EFFECTS OF MACROPRUDENTIAL POLICY AND MONETARY POLICY ON CREDIT AND INFLATION

This paper examines the different effects of macroprudential policy and monetary policy on credit and inflation using a simple New Keynesian model with credit. In this model, macroprudential policy is effective in stabilizing credit but has a limited effect on inflation. Monetary policy with an interest rate rule stabilizes inflation, but this rule is 'too blunt' an instrument to stabilize credit. The determinacy of the model requires the interest rate's response to inflation to be greater than one for one and independent of macroprudential policy. That is, the 'Taylor principle' applies to monetary policy. This dichotomy between macroprudential policy and monetary policy arises because each policy is designed to differently affect the saving and borrowing decisions of households.

Working Paper 13-6, "Dichotomy Between Macroprudential Policy and Monetary Policy on Credit and Inflation," Hyunduk Suh, Indiana University-Bloomington and Federal Reserve Bank of Philadelphia

EXPLORING AN ALTERNATIVE CLASS OF ALGORITHMS FOR DSGE MODELS

The authors develop a sequential Monte Carlo (SMC) algorithm for estimating Bayesian dynamic stochastic general equilibrium (DSGE) models, wherein a particle approximation to the posterior is built iteratively through tempering the likelihood. Using three examples consisting of an artificial state-space model, the Smets and Wouters (2007) model, and Schmitt-Grohé and Uribe's (2012) news shock model, the authors show that the SMC algorithm is better suited to multi-modal and irregular posterior distributions than the widely used random walk Metropolis-Hastings algorithm. Unlike standard Markov chain Monte Carlo (MCMC) techniques, the SMC algorithm is well suited to parallel computing.

Working Paper 12-27, "Sequential Monte Carlo Sampling for DSGE Models," Edward Herbst, Federal Reserve Board, and Frank Schorfheide, University of Pennsylvania, and Visiting Scholar, Federal Reserve Bank of Philadelphia

HOW SHOULD MACROPRUDENTIAL POLICY AND MONETARY POLICY INTERACT TO ACHIEVE FINANCIAL STABILITY?

This paper examines the interactions of macroprudential policy and monetary policy in a New Keynesian

DSGE model with financial frictions. Macroprudential policy can stabilize credit cycles. However, a macroprudential instrument that aims to stabilize a specific segment of the credit market can cause regulatory arbitrage, that is, a reallocation of credit to a less regulated part of the market. Within this model, welfare-maximizing monetary policy aims to stabilize only inflation and macroprudential policy only stabilizes credit. Two aspects of the model account for this dichotomy. First, credit stabilization is welfare improving because lower volatility is compensated by higher mean equilibrium credit and capital. Second, monetary policy is sub-optimal for credit stabilization. The reason is that it operates on the decisions of borrowers and savers, while macroprudential policy operates only on the decisions of borrowers.

Working Paper 12-28, "Macroprudential Policy: Its Effects and Relationship to Monetary Policy," Hyunduk Suh, Federal Reserve Bank of Philadelphia

EXAMINING THE EFFECTS OF FORGIVING DEFAULTS

Swedish law mandates the removal of information about past credit arrears from the individuals' credit reports after three years. By exploiting a quasi-experimental variation in retention times caused by a change in the credit bureau's timing of arrear removal, the authors are able to examine the causal effect of increased retention time on consumers' short- to medium-run credit scores, loan applications, credit access, and future defaults. They find that a prolonged retention time increases the need for and access to credit relative to shorter retention times. Additionally, prolonged retention times seem to reduce the likelihood to default again two years after removal. The authors also find that in both regimes only a minority of the individuals

(less than 27 percent) receive a new arrear within two years after removal, suggesting that only a minority of the individuals who received an arrear may be inherently high risk. Alternatively, their results may be interpreted as suggesting that removal of credit arrears may induce borrowers to exert greater effort along the lines of Vercammen (1995) and Elul and Gottardi (2007). Either interpretation opens the possibility that credit arrear removal is welfare enhancing.

Working Paper 12-29, "Should Defaults Be Forgotten? Evidence from Legally Mandated Removal," Marieke Bos, Swedish Institute for Financial Research, and Leonard Nakamura, Federal Reserve Bank of Philadelphia

EVALUATING THE IMPACT OF INTERNAL CONSUMPTION HABIT ON THE EMPIRICAL FIT OF NKDSGE MODELS

The authors study the implications of internal consumption habit for New Keynesian dynamic stochastic general equilibrium (NKDSGE) models. Bayesian Monte Carlo methods are employed to evaluate NKDSGE model fit. Simulation experiments show that internal consumption habit often improves the ability of NKDSGE models to match the spectra of output and consumption growth. Nonetheless, the fit of NKDSGE models with internal consumption habit is susceptible to the sources of nominal rigidity, to spectra identified by permanent productivity shocks, to the choice of monetary policy rule, and to the frequencies used for evaluation. These vulnerabilities indicate that the specification of NKDSGE models is fragile.

Working Paper 12-30, "Business Cycle Implications of Internal Consumption Habit for New Keynesian Models," Takashi Kano, Hitotsubashi University, and James M. Nason, Federal Reserve Bank of Philadelphia