

Evaluating Policies to Prevent Another Crisis: An Economist's View

Paul S. Willen

ABSTRACT

I consider four policies created to address the financial crisis: (a) the ability-to-repay requirement in mortgage underwriting, (b) reform of rating agency compensation, (c) risk retention in securitization, and (d) mandatory loan renegotiation. I ask whether economic theory tells us that those policies can improve on the market. I argue that policies a, b, and c are likely to reduce welfare versus the market, and only policy d has the potential to increase it.

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1. INTRODUCTION

Economic analysis does have one important benefit, which is that it can help kill ideas that are completely logically inconsistent or wildly at variance with the data. This insight covers at least 90 percent of proposed economic policies.

—Ben Bernanke, June 2, 2013¹

In the wake of the financial crisis and recession that started in 2008, policymakers instituted legal and institutional changes with the goal of preventing a recurrence. In this paper, I evaluate four of those policies and ask the central question of classical economics: do these government policies improve upon the market?

Let me illustrate the point of this paper using mandatory risk retention, a key provision of the 2010 Dodd-Frank Wall Street Reform and Consumer Protection Act. Mandatory risk retention specifies that firms that securitize mortgages must retain not less than 5 percent of the credit risk for any security they issue backed by mortgages. The idea is that the 5 percent retained risk exposes the original lender to losses when borrowers default, thereby inducing the lender to exert more effort in underwriting loans, which, in turn, reduces losses to investors.

Is welfare higher in an economy with government-mandated risk retention than it would be without it? The answer is unclear. If the benefit of fewer defaults to the investor exceeds the cost of retained risk to the lender, why wouldn't the lender volunteer to retain the risk? Why would government need to force investors and lenders to do something that is already in their interests? The purpose of this paper is to answer those questions. Surprisingly, in the literally thousands of

¹ Ben S. Bernanke, "The Ten Suggestions" (speech at the Baccalaureate Ceremony, Princeton University, Princeton, NJ, June 2, 2013), <http://www.federalreserve.gov/newsevents/speech/bernanke20130602a.htm>.

papers, reports, and op-eds written about the role of securitization in the crisis, no one has really tried to answer them. Policymakers and, surprisingly, most economists have been satisfied with the argument that because risk retention leads to more effort at underwriting loans and such effort is good, risk retention is good policy.

In what follows, in addition to risk retention (Section 4), I discuss the ability-to-repay requirement (Section 2), reform of rating agency compensation (Section 3), and mandatory loan renegotiation (Section 5), each time asking the same question: does this policy improve on the market?

As with any policy analysis in economics, the starting point is the first theorem of classical welfare economics, the “First Welfare Theorem” hereafter, which states that under standard assumptions, market equilibrium is Pareto optimal. That means that if we try to reallocate resources, the only way we can make one person better off is by making someone else worse off. The necessary conditions for the First Welfare Theorem to hold are many, but the following are the ones we care about here:

- All market participants have the same (“symmetric”) information.
- All market participants are rational.
- There are no externalities.

For government policies to work, one of those assumptions must fail.

Two pieces of economic jargon help here. If the First Welfare Theorem does not hold in an economy, then we say that there is a market failure in the economy. The gap between the optimal allocation (one with resources reallocated) and market equilibrium is known as the deadweight loss of the market failure. Policy analysis in classical economics essentially consists of the search for deadweight losses. The existence of a deadweight loss is a necessary condition for effective policy, and the net reduction of deadweight loss is a sufficient condition.

In Sections 2–5, the main focus is on whether failure of the first assumption, symmetric information, is enough to justify the policies. Those sections form the core of the paper because all the policies I discuss involve some form of asymmetric information. For example, the economic issue in risk retention is that investors (or anyone else providing funds to a lender, including depositors or shareholders) cannot observe how much effort the lender puts into underwriting a loan. That asymmetric information does lead to a deadweight loss in

equilibrium, but I show that, under standard assumptions, mandatory risk retention actually makes the deadweight loss worse.

For all of the policies except loan renegotiation, I argue that asymmetric information alone cannot justify government intervention. In all three cases, a more plausible argument for government intervention is that market participants are irrational. In my view, irrationality is at the heart of many of the bad decisions that caused the crisis, but the policies described fail to address the relevant problem: unrealistic beliefs about house price appreciation.

In Section 6, I turn to externalities. Foreclosure externalities could provide justification for any of the four policies because all, in theory, reduce the number of foreclosures. I draw attention to the distinction between physical externalities, which always generate deadweight losses, and pecuniary externalities, which, under standard assumptions, do not.

There exists, for all practical purposes, a theorem in economics that—for any proposed economic policy—there is some cocktail of market imperfections that can justify the policy. Geanakoplos and Polemarchakis (1986), for example, show that with multiple goods and incomplete markets, a government policy always exists that can increase welfare. But precisely because it is so easy to come up with such examples, the null hypothesis in economics has been that government policy cannot improve on the market. To show that a policy will work, one must have robust evidence of a market imperfection and a clear logic for how the proposed policy addresses it. I argue herein that only one of the proposed policies, mandatory loan modifications, plausibly passes that test.

One may read the results in this paper as saying that many of the policies developed to deal with the crisis are welfare reducing. But I think it is more accurate to say that the policies are welfare reducing in an economy composed of rational individuals in which foreclosures generate no physical externalities. As I explain, failure of either of those conditions could make all those policies welfare improving. However, to make policy work, economists cannot simply say that people are irrational or that externalities exist. If one believes, for example, that investors in subprime securities were irrational, then we need to know how they were irrational and how important that irrationality was. So, in a sense, this paper is not a criticism of policy but rather a call for better models and better research.

2. ABILITY TO REPAY

Title XIV, Subtitle B, Section 1411, of the Dodd-Frank Act states the following:

In accordance with regulations prescribed by the Board, no creditor may make a residential mortgage loan unless the creditor makes a reasonable and good faith determination based on verified and documented information that, at the time the loan is consummated, the consumer has a reasonable ability to repay the loan, according to its terms, and all applicable taxes, insurance (including mortgage guarantee insurance), and assessments.

On the face of it, Section 1411 seems like common sense. Would a rational lender make a loan that a borrower doesn't have a "reasonable ability to repay"? And would a rational lender make a determination without "verified and documented information"? Yet I contend that the answer to both questions is yes and that, as a result, the ability-to-repay requirement generates deadweight losses.

Let us start with the idea that a lender should make loans only when the borrower has "a reasonable ability to repay the loan." On the face of it, that requirement sounds reasonable. Why would a lender make a loan if the probability of default is high? Why would a rational borrower want such a loan? The classic subprime story is of a person who has a history of credit problems; a lot of high-interest, unsecured debt; and an equity stake in his or her home. By taking out a mortgage secured by the house, the borrower can get a much lower interest rate and in doing so improve his or her finances. To be sure, the likelihood is high that the borrower will default, but the lender compensates for that by charging a much higher interest rate than if the borrower had a clean credit history.

In the example, the borrower gets a lower interest rate than would be available without home equity collateral, and the lender gains because the benefits of the high interest rate outweigh the costs of higher default risk, so both parties gain from the transaction. In this example, by preventing lenders from making loans because the borrower lacks a "reasonable ability to repay the loan," Section 1411 creates a deadweight loss: the benefits to the borrower of getting the loan exceed the costs to the lender of producing the loan.

Now we turn to the question of verification. Even if lenders want to make risky loans, doesn't it always make sense to verify what the borrower reports? The answer, again, is not necessarily. Suppose we have a lender who is confronted with 10 observably identical borrowers who have applied for \$10 loans. Four of the borrowers will default on their loans, and the lender will recover nothing. To understand the lender's problem, we turn to a great insight attributed to the pioneering 19th-century retailer John Wanamaker, who famously quipped, "Half the money I spend on advertising is wasted; the trouble is, I don't know which half." The lender here might paraphrase Wanamaker, saying, "I have 10 borrowers and 4 will default; the trouble is, I don't know which 4."

Suppose, however, that by verifying the information in the borrower's application, the underwriter can identify two of the defaulters, but suppose that the verification process costs \$2.50 per loan. Should a rational lender do it? One might think the answer would be an emphatic yes. By spending \$2.50, the lender can avoid a much bigger loss of \$10. But in fact, the answer is no. The problem is that the lender has to pay the verification costs on all 10 loans because, of course, the point here is that he can't tell which borrowers will default, so the cost of verification is actually \$25. Since verification prevents only two defaults, it saves the lender only \$20, so the costs of verification outweigh the benefits, and the lender opts against verification.

2.1 A Simple Model of Underwriting

To expand on this example, consider a simple model of underwriting due to Bubb and Kaufman (2009). Suppose we have a set of borrowers. For each borrower, the lender observes a verifiable, public piece of information, x . Think of x as, for example, an index of the number of times the borrower has been delinquent on his or her current mortgage in the past year. For simplicity, assume that x is some number between 0 and 1 and that x equals the probability of default. In other words, if 100 borrowers apply for loans with $x = 0.2$, then the lender knows that 20 of the borrowers will default—but, of course, the problem is that the lender does not know which 20. We can formalize the idea of verification by supposing that if the lender pays an amount c , it can identify some fraction s of the borrowers who will default. If s is 50 percent and x is 20 percent, then the lender will learn the identity of 10 of the 20 defaulters. After verification,

the lender extends loans to the remaining 90 borrowers, knowing that 10 will default, but, again, the lender does not know which 10.

Suppose that the lender earns an interest rate of $R > 1$ if the borrower repays and faces a cost of funds of 1. The lender faces a choice: to verify or not to verify. If the lender chooses not to verify, the payoff is

$$(1) \quad \underbrace{(1-x)(\bar{R}-1)}_{\text{RePAYERS}} + \underbrace{x \times -1}_{\text{Defaulters}} = \bar{R} - 1 - \bar{R}x$$

If the lender chooses to verify, then the payoff is

$$(2) \quad \underbrace{(1-x)(\bar{R}-1)}_{\text{RePAYERS}} + \underbrace{sx \times 0}_{\text{Identified Defaulters}} + \underbrace{(1-s)x \times -1}_{\text{Unidentified Defaulters}} - c = \bar{R} - 1 - c - (\bar{R}-s)x$$

Subtracting equation (1) from equation (2) yields the condition for optimal verification:

$$s \cdot x > c \leftrightarrow x > c/s \equiv x^A$$

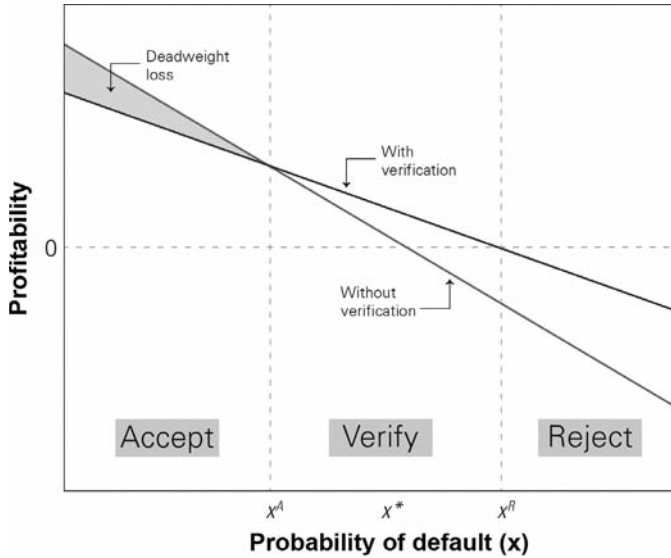
Verification makes sense only if $s \cdot x$, the losses associated with the defaulters identified by the verification, exceeds the costs, implying that if x is sufficiently low ($< x^A$), verification does not make economic sense.

To illustrate the effects of mandatory verification, I plot the payoff to verifying loans and not verifying loans as a function of x , the *ex ante* probability of default. Panel A of Figure 1 shows that we can divide borrowers into three regions. For the borrowers with $x > x^R$, lending is never profitable, even with verification. At the other extreme, the costs of screening exceed the benefits for borrowers with $x < x^A$, so the lender accepts the borrowers without screening. In the middle, the benefits of screening exceed the costs, and the lender screens. Screening clearly generates welfare benefits: for borrowers between x^A and x^R , profits are higher for the lender and, in the absence of screening, borrowers between x^R and x^* would not get loans at all. Suppose Congress now imposes mandatory verification. What happens to welfare? The shaded area on the upper left shows the resulting deadweight loss. No additional borrowers receive credit, and for the lender, the benefits of the additional screening do not justify the costs.

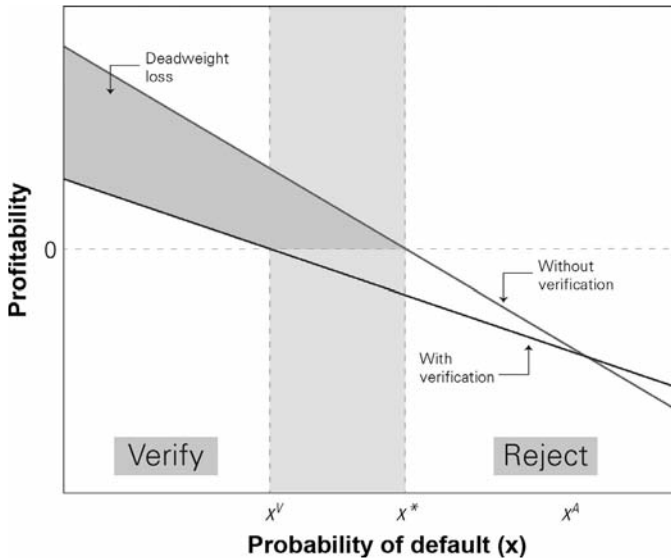
Panel A shows the deadweight loss of requiring verification when the costs of verification exceed the benefits. Panel B shows that sufficiently high verification costs prevent some borrowers from getting credit. See Section 2.1 for details.

Figure 1
A Simple Model of Loan Verification

Panel A: Deadweight loss of verification



Panel B: High verification costs



Panel B of Figure 1 shows the effect of mandatory screening when the cost of verification is even higher. Suppose, for example, that we are considering a sample of self-employed borrowers for whom measuring income is extremely complex. In this example, x^* falls below x^A , so verification dominates only for loans that are unprofitable anyway. The resulting deadweight loss is, of course, much larger, but there is an even worse aspect. Now mandatory verification means that loans between x^V and x^* are no longer profitable for the lender, and borrowers in that region no longer receive credit.

2.2 The Role of Irrationality

For lenders at least, forcing verification reduces welfare. Some critics of the lending industry have accused lenders of “not bothering” to verify income, but—as the model shows—a perfectly rational lender may choose not to verify. Proponents of the ability-to-repay rule will respond that the purpose is not to protect lenders, but to protect borrowers. But to an economist, that argument should strike as odd. Notice that in our simple model of underwriting, it is the borrower who has private information about whether he or she can repay the loan, not the lender. The purpose of the underwriting process is to maximize profits for the lender, not to maximize utility for the borrower.

Ultimately, any justification for the ability-to-repay standard has to rely on a behavioral model and argue that limiting choice increases borrower utility. Laibson (1997) has stressed the idea that when we consider alternatives to classical assumptions on preferences, limiting choice can make an individual better off. Gul and Pesendorfer (2001) consider preferences defined over sets of consumption bundles in which it is possible for a consumer to prefer a subset to the set itself. In either setup, it is possible that a borrower’s utility will be higher if Congress makes it impossible for the borrower to get a loan.

My view is that the deeper problem here is that the true irrationality in the crisis involved expectations of house price appreciation. A mortgage is collateralized debt, and the assumption underlying the contract is that the value of the collateral guarantees the ability to repay because the borrower can sell the house. In 2005, both borrowers and lenders were exceptionally confident that houses would be significantly more valuable over time and very unlikely

to be less valuable. Under those circumstances, the ability-to-repay standard would have had only a minimally deterrent effect. The only way in which the ability to repay from income would be an issue is if the ability to repay by selling was not an option; because the lender believed the latter scenario to be highly unlikely, the benefits of high-interest income from subprime loans would outweigh the cost of the higher risk of a lawsuit in the event that the borrower proved unable to sell the house and lacked the income to repay the loan.

Before I conclude, it is important to stress how odd the ability-to-repay standard is. To see why, consider another important decision: hiring. If we applied a similar rule to hiring, we would require employers to carefully verify everything in a prospective job applicant's file. If the worker were hired and then subsequently fired, the worker would have the right to sue the employer if the worker found out that, for example, the employer had failed to call all the references. No such law has ever been proposed, despite the fact that the consequences of job loss are, in many cases, worse than those of default and foreclosure.

3. RATING AGENCIES

Title IX: Subtitle C of the Dodd-Frank Act specifies "Improvements to the Regulation of Credit Rating Agencies." The authors of the bill write:

In the recent financial crisis, the ratings on structured financial products have proven to be inaccurate. This inaccuracy contributed significantly to the mismanagement of risks by financial institutions and investors, which in turn adversely impacted the health of the economy in the United States and around the world. Such inaccuracy necessitates increased accountability on the part of credit rating agencies.

As a result, they propose that in

certain activities, particularly in advising arrangers of structured financial products on potential ratings of such products, credit rating agencies face conflicts of interest that need to be carefully monitored and that therefore should be addressed explicitly in legislation in order to give clearer authority to the Securities and Exchange Commission.

Among other things, the law directs the Securities and Exchange Commission to study the following aspects of the institutional structure of the rating agency model:

- (1) the credit rating process for structured finance products and the conflicts of interest associated with the issuer-pay and the subscriber-pay models; (2) the feasibility of establishing a system in which a public or private utility or a self-regulatory organization assigns nationally recognized statistical rating organizations to determine the credit ratings of structured finance products.

What is the basic economics here? Rating agencies analyze securities and evaluate the likelihood of credit losses and then relate that information to investors, who can, as a result, make rational decisions about whether to invest in the securities. According to the crisis consensus, the problem was that rating agencies had a conflict of interest because they were paid by the issuers of the securities they were supposed to evaluate. The result was the agencies gave optimistic ratings, which led investors to overinvest in securities and subsequently lose money.

On the face of it, that result appears to be a classic example of incentives at work, but what does economic theory say? Consider a simple model of rating agencies. Suppose there is a lemons problem in the securities market. Issuers have private information about whether a security is a peach, which is worth V_G to investors and $V_G - \delta$ to the issuer, or a lemon, which is worth $V_B < V_G$ to investors and $V_B - \delta$ to the issuer. The probability that a security is a peach is π , and we assume that the expected value of a security is $\pi V_G + (1 - \pi)V_B < (1 - \delta)V_G$. Investors know their own valuation, the valuation of the issuer, and the probability of a peach, but they do not know whether a particular security is a peach or a lemon. Akerlof (1970) showed that in such a model, the only securities traded in equilibrium are lemons. The intuition is that if the investor knows that if he pays the expected value of the security $\pi V_G + (1 - \pi)V_B$, the issuer will sell only the bad security, meaning that the investor will lose money, so the only possible equilibrium is with price V_B . Equilibrium is Pareto inefficient because the investor values the peach more than the issuer does, but trade cannot take place.

Suppose we introduce a rating agency. The issuer reveals its private information to the rating agency, which in turn can credibly announce

whether a particular security is a peach or a lemon. Now trade can occur in both securities at prices V_G and V_B , respectively. The new equilibrium is Pareto improving, as the price for the lemons stays the same, but trade now occurs for peaches, making the issuer better off because he receives V_G for something he valued at only $V_G - \delta$.

What can go wrong? The critique of rating agencies on which Dodd-Frank is based depends on the fact that the pay of the rating agency depends on the rating. Suppose we change the previous model a little and say that the rating agency is paid a share of the valuation of the security, $\gamma(V_i - V_B)$. Now the rating agency has an incentive to always report that the security is a peach because it will get paid $\gamma(V_G - V_B)$, but if it reports that the security is a lemon, it will get nothing. Now if investors pay V_G on average they will get securities worth $\pi V_G + (1 - \pi)V_B < V_G$. According to this narrative, misaligned incentives of rating agencies can explain why investors lost money.

But that logic is flawed: the situation described is not an equilibrium. The investors in the model do not know whether a security is a peach or a lemon, but they know the incentives of the issuer and the rating agency. If the rating agency makes more money by saying that a security is a peach, then the agency will always say a security is a peach, and therefore the rating will have no meaning. As a result, the investor will treat the rating as "cheap talk," and the original Akerlof equilibrium will reemerge. Who loses? Everyone. Since all traded securities are lemons, the rating agency gets paid nothing, and both the issuer and investor lose the gains from trading peaches.

3.1 The Role of Irrationality

Of course, one could argue that investors did not understand the conflicts of interest for the agencies. But given that the firms that lost the largest sums of money on structured products were issuers of the securities, that is a hard argument to make.² In addition, even if one tried to argue that investors were ignorant of the corruption of the rating agencies in 2005, it is hard to see how they could remain ignorant now; yet all three rating agencies are still doing business and still rating mortgage-backed securities.

² Bolton, Freixas, and Shapiro (2012) construct a model with "naive" investors who do not understand the incentives of the rating agency.

3.2 Alternative Information Issues in Ratings

That said, one cannot dismiss the broader idea that bad ratings have real effects, but to do so, one needs to understand exactly what ratings were used for. Specifically, investment funds often use ratings to limit a manager's investment choices. For example, pension funds might say that the manager of the fund can invest only in AAA-rated securities.

I propose that using rating agencies to limit investment manager choice results in a different asymmetric information problem. Suppose that the returns to a pension fund depend on the unobservable effort of the manager. So following the discussion in Section 3, the manager's compensation depends on returns. However, suppose that the fund manager is risk neutral and that the investors are risk averse. By investing in riskier assets, the manager can raise the expected return and his expected pay, but at a cost of increasing risk to the investors. One solution to that problem would be to limit the fund manager to observably low-risk securities, which is exactly what funds typically do.

The implication of the fund's asymmetric information problem is that the investment manager now has an incentive to get the rating agency to give high ratings to risky products. In other words, both the issuer and the investment manager have an incentive to get high ratings for lemons. If that were the case, then the "investor pays" model would be no more likely to lead to more accurate ratings than the much-maligned "issuer pays" model.

In the end, though, the point here is that for the rating agencies to have value to issuers, they must have value to investors; otherwise investors would not pay more for a rated security than they would for an unrated security. And to have value to investors, rating agencies must be credible. In other words, the rating agencies have a strong market incentive to solve the credibility problem, and it is not clear why government needs to tell them to do it. No government agency needs to regulate *Consumer Reports* to ensure that it is objective: if it were perceived to be biased, no one would pay for the magazine.

4. RISK RETENTION

Title IX: Subtitle D of the Dodd-Frank Act, titled "Improvements to the Asset-Backed Securitization Process," specifies that firms that securitize mortgages are required to retain not less than 5 percent of

the credit risk for any security they issue that is backed by mortgages. Framers of the law included an exemption for "qualified residential mortgages," which are loans deemed to be of low risk of credit loss. The law also prohibits securitizers from hedging or transferring the credit risk that it is required to retain with respect to the assets.

Risk retention has been broadly popular across the board, earning praise from journalists, academics, and policymakers. One of the reasons so many mortgages defaulted, the argument goes, is that the lenders who made the loans were selling the loans in securities and had no reason to invest effort in underwriting the loans because they did not share in any losses when the loan defaulted. In popular parlance, lenders had no "skin in the game." If lenders knew they would lose money if loans defaulted, they would have been much more careful. With more careful underwriting, investors would not have lost money on mortgage-backed securities, and we would not have had a crisis. Keys et al. (2013), for example, write that it would be "beneficial to enforce some mandatory retention of a fraction of lower tranche by originators/underwriters to better align their interests with those of investors."

How does that view fit into our discussion of the First Welfare Theorem? Proponents of risk retention argue that securitization has an asymmetric information problem. Although one can imagine how mortgage underwriting could lead to both moral hazard and adverse selection problems, researchers and policymakers have focused on the moral hazard problem, which results from the fact that investors cannot observe how much effort the securitizer puts into screening the mortgages. As previously mentioned, the presence of asymmetric information typically leads to inefficiency, and thus in principle government policy might lead to a welfare improvement. But, as I will show now, the Dodd-Frank requirement not only fails to eliminate the deadweight loss caused by asymmetric information, but also actually inflates it.

It is important to stress here that securitization does not create the moral hazard problem but is instead a method of dealing with it. The underlying problem in financial intermediation is that savers want to lend to borrowers but need someone to help them make sure they get their money back. The moral hazard problem emanates from the fact that the savers cannot observe the effort put in by the intermediary.

Over the years, market participants have come up with many different mechanisms to deal with the moral hazard problem. Securitization is one contract—or incentive scheme as we call it below—in which the intermediary takes on very little of the risk of default. An alternative contractual mechanism is portfolio lending, in which the owners of the bank (who may not be the ones making the lending decision) take on all the risk. The problem of choosing the optimal contract consists of deciding which incentive scheme maximizes the joint surplus of the intermediary and the savers. In other words, which incentive scheme deals best with the underlying problem that the savers cannot observe the effort of the intermediary?

To understand the problem of incentives in mortgage underwriting, we consider a pool of 10 loans. If the lender puts no effort into underwriting the loans, three borrowers will default but, as always, the lender does not know which three. By investing effort, the lender can identify the problem borrowers. The column labeled “Total Effort” in Panel A of Table 1 shows that by spending \$4 in effort, the lender can identify one of the problem borrowers and thus reduce defaults to two. The column labeled “Marginal Effort” shows that the cost of reducing defaults is increasing: the marginal effort required to reduce defaults from two to one costs twice as much as it does to reduce defaults from three to two. The columns labeled “Recovery” show the benefits of default prevention: for each default prevented, the total recovery of principal increases by \$10.

Now suppose that we have an investor who wants to invest in mortgages, and so he offers to buy mortgages from a lender. The lender is willing to underwrite mortgages but has an outside option that will yield a profit of \$69. In the language of contract theory, we call the investor “the principal” and the lender “the agent.” How can the principal ensure that the agent expends the proper amount of effort? Panel B shows three possible incentive schemes that the principal can use. In each scheme, the principal promises the agent a combination of a fixed payment and an incentive payment, which is a fraction of the amount recovered. For example, Incentive Scheme 1 gives the agent a base payment of \$33, and then the agent keeps 50 percent of any money recovered. For example, if the agent expends effort of \$4, the agent will receive $33 + 0.5 \times 80 = \$73$, which yields a profit to the agent of \$69, which is the \$73 payment less the \$4 expended in effort.

Table 1
A Simple Model of Moral Hazard in Mortgage Underwriting
 (see Section 4 for details)

Panel A. Costs and benefits of effort

	Agent		Principal	
	Total	Marginal	Total	Marginal
Defaults	Effort	Recovery	Effort	Recovery
3	0	0	70	0
2	4	4	80	10
1	12	8	90	10
0	24	12	100	10

Panel B. Choosing the optimal incentive scheme without uncertainty

	Incentive Scheme 1 Incentive: 50% Base Pay: 33				Incentive Scheme 2 Incentive: 90% Base Pay: 0				Incentive Scheme 3 Incentive: 130% Base Pay: -37			
	Agent		Agent		Agent		Agent		Agent		Agent	
Total	Marginal	Principal's	Total	Marginal	Principal's	Total	Marginal	Principal's	Total	Marginal	Principal's	
Effort	Income	Profit	Income	Utility	Profit	Income	Utility	Profit	Income	Utility	Profit	
0	68	2	63	63	7	54	54	7	54	54	16	
4	73	7	72	9	8	67	68	8	67	13	13	
12	78	12	81	9	9	80	69	9	80	13	10	
24	83	17	90	9	10	93	66	10	93	69	7	

(continued)

Table 1
(continued)

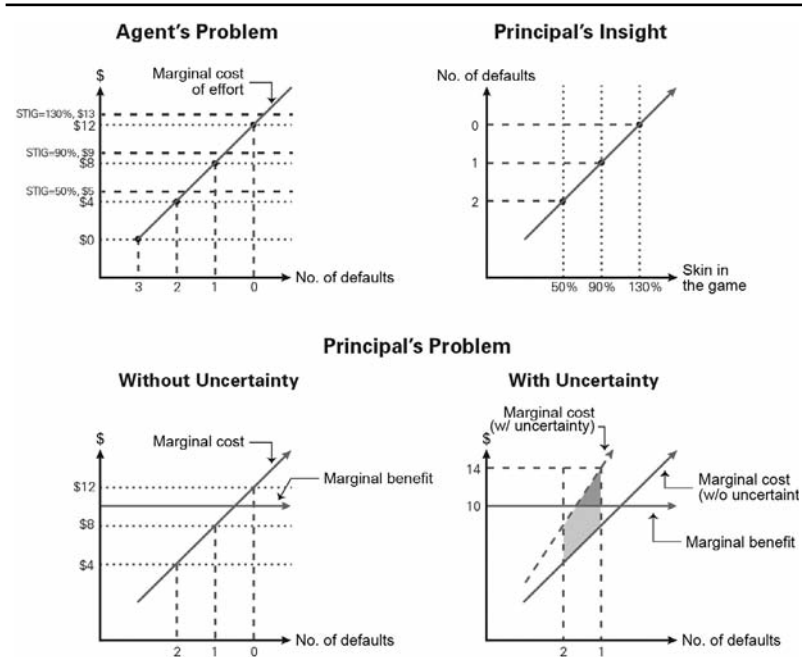
Panel C. Choosing the optimal incentive scheme with uncertainty

Total Effort	Expected Defaults	Incentive Scheme 1 Incentive: 50% Base Pay: 37						Incentive Scheme 2 Incentive: 90% Base Pay: 8					
		Agent			Agent			Agent			Agent		
		Bad	Good	Total Income	Marginal Income	Cost of Risk	Utility	Principal's Profit	Bad	Good	Total Income	Marginal Income	Cost of Risk
0	3	67		4	4	68	68	62	82	8	8	63	-1
4	2	72	5	4	4	69	69	70	90	8	8	68	0
12	1	77	5	4	4	66	66	79	99	8	8	69	1

The design of the optimal contract proceeds in two steps: First, the agent chooses a level of effort conditional on the contract. For Incentive Scheme 1, marginal analysis shows that the optimal level of effort for the agent is \$4: the marginal income to the agent from reducing a default is $0.5 \times 10 = \$5$, which exceeds the marginal cost of reducing defaults from three to two, but not from two to one. The top left graph in Figure 2 illustrates the agent's optimal decision graphically.

Top left panel shows the agent's decision to exert effort. Top right panel shows how the principal inverts the adjacent panel to infer effort from the incentive scheme. Bottom left panel shows the principal's optimal choice of effort without uncertainty, and the bottom right panel shows the optimal choice of effort with uncertainty. See Section 4 for details.

Figure 2
Graphical Depiction of a Simple Principal-Agent Problem
Based on Holmstrom and Milgrom (1987)



In the second stage of the solution, the principal chooses an incentive scheme, taking the agent's optimal response as given. In other words, the principal scans Panel A of Table 1. Then, corresponding to each incentive scheme, the principal can read off levels of effort, defaults, and payments to the agent and, as a result, profits. Analysis of Panel A illustrates a central point of contract theory: despite being unable to observe effort directly, the principal can deduce the effort level from his understanding of the agent's optimal decision problem. The top right panel of Figure 2 makes the point that the principal can, in a sense, invert the agent's decision problem and, in doing so, choose the level of unobservable effort by choosing the incentive scheme.

Which is the optimal scheme? It is displayed in Panel B of Table 1. For example, for Incentive Scheme 3, the agent will put in maximal effort leading to zero defaults and a profit of \$7 to the principal. Incentive Scheme 1 will generate much less effort, but the corresponding payment to the agent is smaller, so the profit stays the same at \$7. Incentive Scheme 2 yields maximal profits with more effort than Scheme 1 but lower payments than Scheme 3.

What are the welfare implications? Incentive Scheme 2 is privately optimal, but is it socially optimal? Yes. The lower left panel of Figure 2 illustrates the principal's choice graphically. The principal's choice of one default maximizes the total social surplus and is thus socially optimal. Adam Smith's "invisible hand" at work again!

If the private outcome is socially optimal, then why did I say in the introduction that the First Welfare Theorem fails in the presence of asymmetric information? The reason is that there is no meaningful asymmetric information problem here. The principal cannot observe effort, but he can observe output, which is perfectly correlated with effort. To see the failure of the First Welfare Theorem, we need to introduce asymmetric information, and we do that by supposing that there is some random variation in the number of defaults. If the agent expends \$4 in effort, the expected number of defaults equals two. But suppose, actually, with 50 percent probability, there will be one default and a 50 percent probability that there will be three.

Risky payoffs to the agent change the profit-maximizing contract. The optimal contract from Panel B now delivers the agent a lottery paying \$72 and \$90 with equal probabilities. For a risk-averse agent, the lottery is worth less than a certain payment of \$81, meaning that

the agent's utility now falls short of \$69 and—recall from earlier—we assumed that the agent had an outside option paying \$69, so now the agent rejects the contract and refuses to work.

Assume, specifically, that the agent has negative exponential utility with an absolute risk aversion coefficient of 0.69, which implies that Incentive Scheme 2 yields a utility of \$61, \$8 less than it did with certainty. Similar analysis of Incentive Scheme 1 shows that the addition of uncertainty also lowers the utility of the contract to the agent. However, because risk retention is lower, the sensitivity of the payout is smaller (Incentive Scheme 1 pays out \$68 and \$78 with equal probabilities, as opposed to \$73 with certainty), and so risk reduces utility from \$69 to \$65, that is, by half as much as for Incentive Scheme 2.

By raising the base payments, the principal can induce the agent to come back to work, and Panel C of Table 1 shows the uncertainty-adjusted incentive schemes. Panel C shows that uncertainty has inverted the ranking of the two incentive schemes: Incentive Scheme 1 is now profit maximizing. What changed? The key point here is that the addition of risk disproportionately affects Incentive Scheme 2 because of the higher level of risk retention.

The bottom right panel of Figure 2 illustrates the effects of adding uncertainty. The dashed line shows the marginal cost of different levels of effort and defaults. Without uncertainty, the principal simply had to compensate the agent for his effort. But now—to elicit a higher level of effort—the principal must increase risk retention, which, in turn, increases risk for which the principal must now compensate the agent. In other words, there are two components to the marginal cost of effort: the direct cost of compensating the agent for his time and the indirect cost of eliciting effort.

What about welfare? The failure of the First Welfare Theorem occurs here because of the indirect cost of eliciting effort. An all-knowing, all-seeing social planner would not need to use risk retention to get the agent to work and would choose the higher level of effort because the marginal benefit of reduced defaults exceeds the marginal cost of additional effort by the agent. Compared with that benchmark, a deadweight loss is represented by the shaded area under the marginal benefit line.

But is an all-knowing, all-seeing social planner the right benchmark? For such situations, economists have defined an alternate

welfare concept, called “constrained Pareto optimality,” that limits the planner to the same information set as the one the principal has, meaning that the planner has to choose from the same incentive schemes as the principal. In designing the Dodd-Frank risk retention requirement, Congress implicitly acknowledged the idea of constrained optimality by imposing an incentive scheme and not a level of effort.

Does the risk retention requirement increase welfare? Suppose, in the model, Congress decided that it wanted first-best levels of effort and, as a result, imposed Incentive Scheme 2 on the principal. The bottom right panel of Figure 2 shows that such a rule would create a deadweight loss. Thus, the policy would eliminate the deadweight loss of reduced effort—the shaded area under the marginal benefit curve—but the cost of eliminating that deadweight loss would be the area between the two marginal cost curves, which, by construction, exceeds the deadweight loss from reduced effort; the overall deadweight loss is the shaded triangle above the marginal benefit line.

Before we continue, it is important to address three questions:

1. *By reducing defaults, wouldn't a requirement of risk retention have attenuated the crisis?* Yes and no. In theory, mandatory risk retention should have had no effect on the investors' massive losses, which caused the financial crisis. That statement may sound surprising, as we have shown that higher risk retention reduces defaults, but the problem here is that investors lose money not when more borrowers default, but when more borrowers default *than expected*. With more risk retention, investors would have expected more effort and fewer defaults and so, in the model, the losses would have been exactly the same.

At the same time, in the model, requiring risk retention does lead to fewer defaults. In a sense, one can think about retention as a tax on defaults: it causes a deadweight loss, but it does reduce defaults. In Section 5, we return to this question.

2. *Isn't there empirical evidence showing that securitization caused lenders to expend less effort and thus contribute to the crisis?* Many researchers cite a paper by Keys et al. (2010) as evidence that securitization led to lower levels of effort in underwriting, which, in turn, caused the crisis. Keys et al. purport to show that when lenders knew that there was a higher likelihood that they would sell the loan in a security, they did a worse job screening, thereby

leading to higher default rates.³ The problem with interpreting Keys et al. as evidence in favor of the Dodd-Frank risk retention requirement is that their findings are completely consistent with the model described above. They show that more risk retention leads to more effort. Furthermore, in the model, more risk retention leads to more effort, as shown in Figure 2, but risk retention still reduces welfare. In other words, all Keys et al. do is confirm that the top left panel of Figure 2 is an accurate description of the world.

If we are to illustrate the point, suppose policymakers were considering an interest rate subsidy for manufacturers as a way of increasing manufacturing investment. What Keys et al. do is essentially equivalent to showing that lower interest rates lead to more investment, but it would obviously be wrong to conclude that manufacturing investment was suboptimal or that an interest subsidy would be welfare improving.

3. Doesn't the model imply that some risk retention is optimal? In the model, the optimal incentive scheme involves 50 percent risk retention, far in excess of what Dodd-Frank requires. Indeed, in the Holmstrom-Milgrom model (1987), the optimal scheme *always* involves some risk retention, so one might conclude that whether 5 percent is right or not, it is still better than the 0 percent that prevailed in many securitization deals in 2005. Doesn't that mean that policy should at least force lenders to retain *some* risk always, if not exactly 5 percent? No. The purpose of the model is to illustrate how the market determines the optimal level of risk sharing. The fact that firms in the real world did not exactly conform to the model means there is something wrong with the model, not that there is an opportunity for government to tell firms what to do.

As an illustration of the point, consider portfolio choice theory. All standard models of portfolio choice imply that the optimal allocation to stocks is greater than zero. But the data show that many households hold no equities. One might argue that, on the basis of the model, the government should enforce a minimum 5 percent allocation to stocks. But, instead, economists have tried to come up with economic explanations for why so few households hold stock.

³ Bubb and Kaufman (2009) argue that Keys et al. (2010) misunderstood the institutional evidence and that the patterns they observed reflect underwriting rules having nothing to do with securitization. Nonetheless, for pedagogic purposes, we will assume that the interpretation by Keys et al. is correct.

4.1 Moral Hazard and Government Policy

The fact that the risk retention requirement enhances incentives but that a government policy to increase risk retention reduces welfare exposes a tension in economic thought. On the one hand, standard economic theory stresses the role of incentives. Adam Smith, the father of the “invisible hand,” wrote:

It is the interest of every man to live as much at his ease as he can; and if his emoluments are to be precisely the same, whether he does, or does not perform some very laborious duty, it is certainly his interest . . . either to neglect it altogether, or, . . . to perform it in [a] careless and slovenly a manner. (Smith [1776] 1904, p. 760)

On the other hand, Milton Friedman, Smith’s modern disciple, makes a similar argument, laying out a simple theory:

When you spend, you may spend your own money or someone else’s; and you may spend for the benefit of yourself or someone else. Combining these two pairs of alternatives gives four possibilities summarized in the following simple table: (Friedman and Friedman 1980, p. 116)

Whose Money	On Whom Spent	
	You	Someone Else
Yours	I	II
Someone Else’s	III	IV

Friedman then focuses on Category IV:

Category IV refers to your spending someone else’s money on still another person. You are paying for someone else’s lunch out of an expense account. You have little incentive either to economize or to try to get your guest the lunch he will value most highly. (p. 117)

The tension here is that both Smith and Friedman were dedicated opponents of government intervention in markets and, I am quite certain, would have opposed the Dodd-Frank risk retention provision. But how could they oppose a policy that moves economic activity from Category IV of the table above to Category I? The key point of the

principal-agent model is that the principal knows that more risk retention leads to more effort but chooses less risk retention. In Friedman's example, the employer knows that workers in Category I work harder than do workers in Category IV; in a market economy, the employer is free to choose Category I if he wants to do so. The fact that he chooses Category IV despite the availability of Category I means that, for some reason, he believes that the benefits of Category IV versus Category I outweigh the costs.

Another way to see that point is to understand how the Dodd-Frank requirement affects the different market participants. Proponents view it as a limit on the behavior of the agent: the law, as written, circumscribes the behavior of the agent. But in practice, the law actually restricts the choice set of the principal: the law blocks an investor who wants to take on all the credit risk in a transaction from his desired choice. The implicit presumption of the framers of Dodd-Frank was that no reasonable person would want to invest in a security in which the issuer held no risk retention. But we turn to the central principle established by Smith and described by Friedman as follows: "Adam Smith's key insight was that both parties to an exchange can benefit and that, so long as cooperation is strictly voluntary, no exchange will take place unless both parties do benefit" (Friedman and Friedman 1980, p. 1).

4.2 More General Models

In the example in Table 1, government policy cannot increase welfare, but the result is substantially more general than that. The example is, as mentioned already, a special case of Holmstrom and Milgrom (1987), and the result extends to that model. But, in fact, Prescott and Townsend (1984) show that in any moral hazard model with a single consumption good, equilibrium is constrained to be efficient so the risk retention requirement always reduces welfare. In adverse selection models, Bisin and Gottardi (2006), however, show that equilibrium is typically constrained to be inefficient. In other words, government could increase welfare by restricting the space of available contracts. However, the general problem in adverse selection models is that there is too little risk sharing, not too much.

Consider the leading example, health insurance. Rothschild and Stiglitz (1976) consider a world where risk-averse individuals have private information about how healthy they are and show that the First Welfare Theorem fails because more healthy individuals fail to

insure fully—in other words, they retain some of their health risk. The solution, according to Rothschild and Stiglitz, and as implemented in the 2010 Patient Protection and Affordable Care Act, is to *force* individuals to buy insurance—to *ban* risk retention. In other words, if economists really believed that adverse selection was a problem in mortgage underwriting, the solution would not be to force lenders to retain bad loans, it would be to force them to securitize good loans!

In models with multiple goods, the situation becomes more complex. Changes in policy have general equilibrium effects on relative prices, and pretty much anything can happen. Greenwald and Stiglitz (1986), in a celebrated paper, show that, generically, governments can change the contract space in such a way as to increase welfare. The issue with asymmetric information is that agent behavior is circumscribed by a set of incentive compatibility constraints. As Greenwald and Stiglitz show, changes in relative prices can relax those constraints and thus lead to a welfare improvement.

If we are to illustrate why the existence of additional constraints allows government policy to improve welfare, consider some real-world examples. Suppose that lenders constrain households to borrow up to a specific multiple of income when they are buying homes. For households with an upward-sloping income profile, Gerardi, Rosen, and Willen (2010) show that such a constraint prevents smoothing of housing consumption over the life cycle. A government policy to drive down house prices relaxes the borrower's constraint and allows him to buy a bigger house and to better smooth consumption over the life cycle. An alternative example is that existing homeowners who want to move face a down payment constraint, as in Stein (1995). A government policy to increase house prices would relax the down payment constraint and allow better matching of households with homes.

In the Dodd-Frank Act, Congress points explicitly to the possibility that risk retention has broad effects. In Section 946, Congress asks for a "Study on the Macroeconomic Effects of Risk Retention Requirements." Specifically, Congress proposes "an analysis of the effects of risk retention on real estate asset price bubbles, including a retrospective estimate of what fraction of real estate losses may have been averted had such requirements been in force in recent years."

The link between risk retention and asset price bubbles is, at best, purely speculative. Economists have few good models of how bubbles form and no models that link low levels of risk retention to

bubbles. Indeed, the macroeconomic effects, almost by definition, are somewhat limited. To understand why, remember that the upper right panel of Figure 2 shows that principals can infer how much effort agents are putting in, meaning that, in the models at least, if investors invest in mortgage-backed securities with low levels of risk retention, they do so knowing that many borrowers will default. Therefore, they will pay a correspondingly low price.

Ultimately, pointing to the macroeconomic benefits of risk retention is also somewhat disingenuous. The main appeal of risk retention is its simplicity, which is displayed in the top left panel of Figure 2. More risk retention leads to more effort; that conclusion, at least, is settled in economics. As we have explained here, that finding alone, unfortunately, does not justify mandatory risk retention as a policy.

4.3 Irrationality

One potential justification for risk retention is that investors did not understand that there was a relationship between risk retention and effort. To see why investor misunderstanding could lead to an opportunity for government policy, imagine that, for example, the market outcome was Incentive Scheme 1 in Panel C of Table 1. But suppose investors believed that lenders misunderstood the incentives and believed that lenders were putting in \$12 of effort, whereas the lender's optimal response to Incentive Scheme 1 was to exert only \$4 of effort. Investors would then be shocked when twice as many defaults occurred as they expected. Such a result is broadly consistent with what happened in the crisis. If government policy forced lenders to use Incentive Scheme 2, then policy would bring investor beliefs into line with reality and their expectations of default into line with outcomes, potentially avoiding the financial crisis.

As a theory of the crisis, however, the idea that investors did not understand the incentives of lenders is problematic. As Foote, Gerardi, and Willen (2012) and Richardson, Ronen, and Subrahmanyam (2010) show, most of the firms with the greatest exposure to subprime risk were underwriters and securitizers of subprime mortgages. It seems implausible that Bear Stearns' executives would not have understood the link between effort and risk retention.

More broadly, investors based their beliefs about the performance of securitized mortgages on the historical performance of securitized mortgages. If no risk retention means no effort, then loans made

with no risk retention will perform badly and investors buying loans with no risk retention will pay accordingly. So it is hard to see how investors could have formed incorrect beliefs about the relationship between effort and retention.

5. RENEGOTIATION

During the crisis, many commentators lamented the unwillingness of lenders to renegotiate or “modify” mortgages. The logic was as follows: Suppose the borrower owes amount M^* , the house is worth $P < M^*$, and the lender will recover $(1 - \lambda)P$ from a foreclosure. If the lender sets the loan balance to $M' = (1 - \lambda)P$, the lender will be no worse off, and since $M' < P$, the borrower now has positive equity, can sell the property if needed, and has an incentive to keep making payments. Critics of the lending industry wondered why there were any foreclosures at all.

Throughout the crisis, there have been vigorous calls for executive action and legislation to force lenders to modify mortgages. For example, in a recent opinion piece, Martha Coakley and Eric Schneiderman (2013), attorneys general of Massachusetts and New York, respectively, wrote:

Mortgage modification, including significant principal reduction for underwater mortgages, can actually increase the lifetime value of a mortgage by reducing the likelihood of default. It is far more profitable for any financial institution to hold a portfolio of performing \$200,000 mortgages that keep families in their homes than a portfolio of nonperforming \$250,000 mortgages headed toward default.

The most popular explanation for why lenders modified so few mortgages was institutional frictions particularly related to securitization. Since the entity making the decision about renegotiation—the servicer of the loan—did not actually own the loan, it did not stand to gain from modification and so generally opted against it. Subsequently, critics blamed the shortage of renegotiation on the intransigence of Edward DeMarco, the acting director of the Federal Housing Finance Agency, who had blocked principal reduction as a tool for the institutions he regulated, Fannie Mae and Freddie Mac.

One result is that there have been major policy changes with respect to delinquent loans. In the short run, the administration

implemented in 2009 the Home Affordable Modification Program, which provided subsidies to servicers with the goal of overcoming institutional frictions. But in addition to the emergency measures, policymakers have also made permanent changes to the relationship between borrower and lender. As part of the 2012 National Mortgage Settlement (NMS) with the state attorneys general, servicers agreed to a set of standards that gave borrowers substantial rights in the loan modification process. Although, in theory, no one has challenged the idea that the lender should maximize profits when conducting loss mitigation on delinquent loans, the NMS and other legal actions like the Multi-Agency Consent Decree and the California Homeowners Bill of Rights have established substantial rights for the borrower in the loss mitigation process.

However, as we will now discuss, it is not clear that the institutional friction theory of why modifications are rare is the correct one. As Adelino, Gerardi, and Willen (2013) show, the frictions could, at most, explain only a small part of the unwillingness of lenders to renegotiate loans. Figure 3, which is from that paper, shows that portfolio lenders who faced neither the frictions of private label securitization nor the strictures of Federal Housing Finance Agency regulations were not more likely to renegotiate mortgages. In short, securitization cannot explain why lenders failed to modify most mortgages.

Why do lenders renegotiate so few mortgages? The economics of asymmetric information here provides a plausible explanation. To see why, return to the example at the beginning of this section. Now suppose that for each borrower, there is some amount V_i that he is willing to repay. Suppose that a continuum of borrowers is uniformly distributed along the interval $[0, a/b]$. Suppose that the lender, instead of modifying the loan to $M' = (1 - \lambda)P$, sets the balance at $M > M'$ and forecloses on any borrower unwilling to repay M . Now,

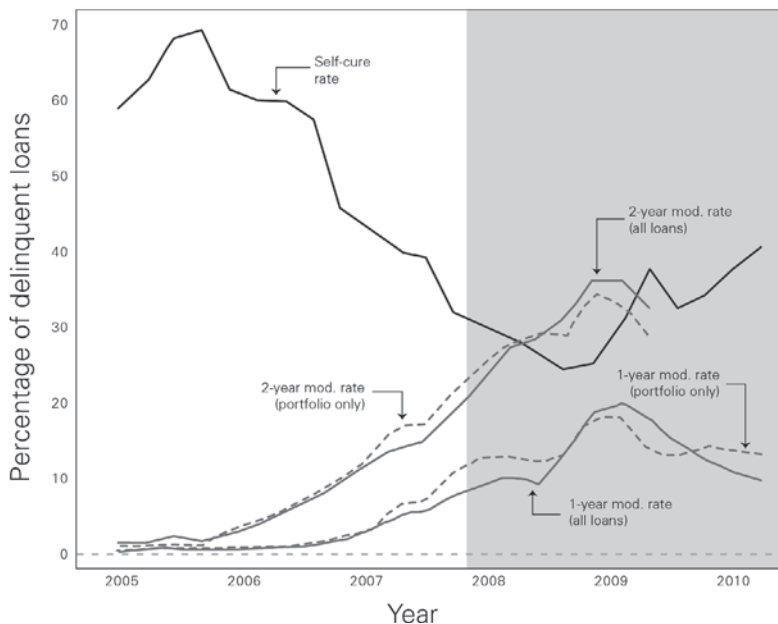
$$Q = \frac{a - M}{a} \cdot \left(\frac{a}{b}\right) = \frac{a}{b} - \left(\frac{1}{b}\right)M$$

borrowers are willing to pay the modified balance, but overall the lender collects $M > (1 - \lambda)P$ from the Q borrowers who are willing to pay M and still collects $(1 - \lambda)P$ from the borrowers on whom it forecloses, and so the lender is better off. It is easy to see that to choose the optimal number of modifications Q , the lender solves the problem:

$$(3) \quad \max_Q M \cdot Q - (1 - \lambda)P \cdot Q = \max_Q (a - bQ) \cdot Q - (1 - \lambda)P \cdot Q$$

Figure 3
Loan Modifications, 2005–2011

Modifications are measured over the period (one year or two years) following the month that a loan became 60 days delinquent. See Adelino, Gerardi, and Willen (2013) for a full discussion of the methodology.



Source: Adelino, Gerardi, and Willen (2013).

Note: “Portfolio” refers to loans held on banks’ balance sheets. “All loans” refers to loans securitized by government-sponsored enterprises and loans securitized by private firms.

Equation (3) should look familiar as it is the optimization problem of a monopolist facing a linear demand curve. Optimal Q solves the first-order condition

$$a - 2bQ = (1 - \lambda)P$$

where the left-hand side is the “marginal revenue” of an additional modification. Figure 4 illustrates the solution. The top line labeled “No. of Borrowers Who Can Repay” is Q as defined above, and we

can think of it as the demand for modifications. The “cost” of doing a modification is the revenue from the alternative, $(1 - \lambda)P$. The no-foreclosures solution, where the lender reduces principal to $(1 - \lambda)P$ for everyone, is the competitive solution. However, for the lender, the monopoly solution of setting the price equal to M^* obviously dominates the competitive solution.

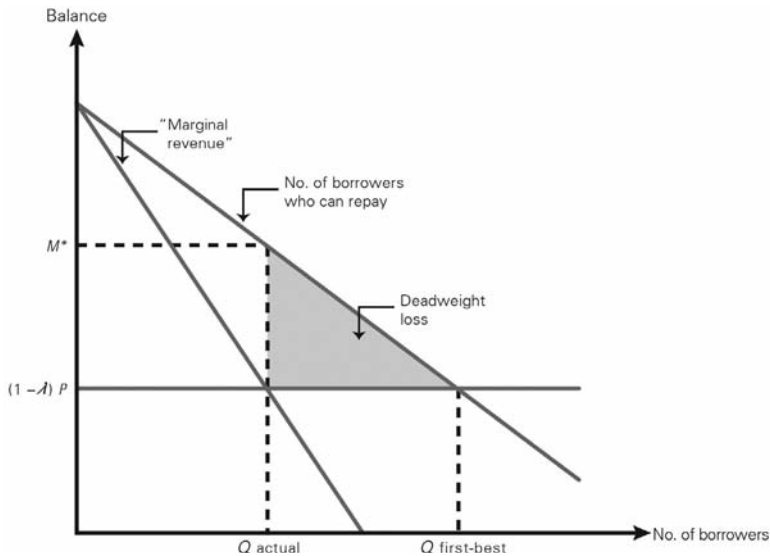
Thinking about the modification problem as a monopoly pricing problem reconciles different views. On the one hand, critics of the industry were right that lender policy was leading to a large deadweight loss. In Figure 4, many borrowers were willing to pay more than the lender recovered from foreclosures. On the other hand, the view of the critics that lenders could increase profits by modifying more loans was wrong. The argument is precisely the same as saying

Figure 4

Loan Renegotiation

If borrowers have unobservably different willingness to repay their mortgages, then the lender's decision to modify is equivalent to a monopoly pricing problem.

See Section 5 for details.



that a hotel with empty rooms represents a deadweight loss but that, at the same time, cutting room rates to fill the rooms is not profit maximizing for the hotel.

What is the optimal policy here? In 2009, drawing on the logic that institutional frictions were the main reason lenders weren't modifying loans, the administration's Home Affordable Modification Program intervened by providing financial incentives to intermediaries to modify loans. The earlier analysis illustrates why relatively small financial incentives could not overcome the basic economics of loan renegotiation.

To prevent foreclosures, a government in Figure 4 has two options: First, it can force lenders to implement the competitive solution by requiring that lenders modify all loans down to $(1 - \lambda)P$. Although that option would inflict a large financial penalty on lenders, the total surplus would be substantially increased. Second, the government could force lenders to implement the competitive solution and use a tax to compensate them for lost profits. What should be clear, though, is that preventing foreclosures without inflicting losses on lenders or covering their losses is impossible.

Going forward, one could argue that a government policy that forced modifications would increase consumer surplus. The zero economic profit condition means that somewhere earlier in the process, lenders paid for the right to extract surplus from delinquent borrowers, and so the elimination of the deadweight loss will cost lenders nothing. Of course, in a sense, that surplus extraction was embedded in the price borrowers paid for the loans when they got them. So although the overall economic gain will be positive, some borrowers may complain that they would prefer to pay a lower rate up front and suffer the consequences later.

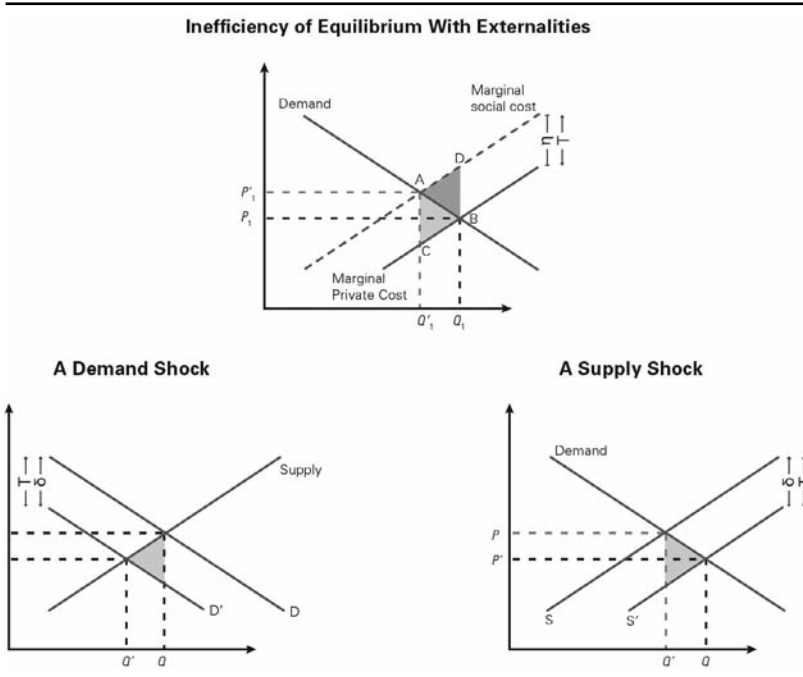
6. EXTERNALITIES

As mentioned in the Introduction, the presence of externalities in an economy invalidates the First Welfare Theorem. Consider a simple supply-and-demand model from Econ 101 with a downward-sloping demand curve and an upward-sloping supply curve. The top panel of Figure 5 illustrates the problem with externalities. Firms make decisions on the basis of the curve labeled "Marginal private cost," but production of the commodity inflicts an additional cost η on neighbors, which means that the "Marginal social cost" is higher.

Figure 5

The Effect of a Tax on the Sale of Property, Without and With Physical Externalities

If foreclosures cause physical externalities, then a tax can increase welfare (top panel). If foreclosures cause a pecuniary externality (e.g., an increase in the supply of properties on the market), then an offsetting tax is welfare reducing (bottom right panel). See Section 6 for details.



To understand why equilibrium is inefficient, imagine that we introduce a tax $\tau = \eta$ on producers. The tax reduces welfare by the triangle ABC , the usual deadweight loss resulting from the fact that consumer surplus and producer surplus fall by more than the tax revenue generated. But because production has fallen from Q to Q' , the neighborhood costs fall by the quadrilateral $ADBC$. Subtracting the deadweight loss from the reduction in neighborhood costs yields the net benefit of the tax, the triangle ABD . Intuitively, the triangle

is a loss to society that results from the fact that the costs of the foreclosure to neighbors exceed the consumer and producer surpluses generated by the production. The first Q' of output still generates externalities, but from the standpoint of society as a whole, the tax revenue exactly offsets the costs. The fact that the government can increase welfare with a tax illustrates that the First Welfare Theorem cannot hold.

What are the externalities in the mortgage market, and how could government policies offset them to improve welfare? To answer that question, we need to distinguish between two types of externalities. The first type, depicted in the top panel of Figure 5, is known as technological or physical externalities, and they occur when something an individual or a firm does directly enters into the utility or production function of another individual or firm, respectively, in the economy. Pollution is the classic example, but for our purposes the more natural example is foreclosures. Thus, many have argued, foreclosures led to neglect of properties, which, in turn, inflicts damage on neighboring properties.

The second type of externality, referred to by Viner (1932) and elucidated by Scitovsky (1954) as pecuniary externality, is more subtle and works through market mechanisms. An example of a pecuniary externality occurs when I list my house for sale, thereby making it somewhat more difficult for someone selling a close substitute. Obviously, I don't take that into account when I list the property, just as I don't take into account the effect on my neighbors if I play loud music late at night or do compression tests on my motorcycle on a peaceful Saturday afternoon. Doesn't that provide another opportunity for government intervention? As we now explain, in our standard undergraduate models, the First Welfare Theorem still holds in the presence of pecuniary externalities: government cannot make everyone better off. In richer models, as we discuss next, pecuniary externalities do allow for welfare-improving government policies.

To see why government cannot help, consider first a demand shock, as depicted in the lower left panel of Figure 5. The left panel shows what happens if prices fall because of a demand shock δ . Suppose the government could introduce a subsidy $\tau = \delta$ that would restore the previous equilibrium prices and quantities. The figure illustrates that such a policy would reduce welfare, thereby generating a dead-weight loss, shaded in the figure, which results from the fact that the subsidy leads transactions to occur between sellers who value the

properties less than the buyers do. Now, turning to the right panel of Figure 5, suppose a lender forecloses on a property and lists it for sale, shifting the supply curve by amount δ down and to the right and lowering prices and increasing the level of sales in the market. Suppose the government intervenes and introduces a tax $\tau = \delta$ on property sales, which exactly offsets the shift in the supply curve and restores prices to the previous level. Isn't that a good thing? No. The shaded triangle shows that there is deadweight loss to the economy: there are potential buyers who value properties more than potential sellers do, but because of the tax, those trades don't take place.

7. CONCLUSIONS

In the end, I believe that externalities have to be at the heart of any justification of the slate of policies discussed in this paper. Let me focus on risk retention because, in a sense, I view it as the most egregious error. As I have shown, risk retention does not solve the asymmetric information problem or "improve the securitization process." Instead, it simply makes lenders more cautious and thus reduces the number of defaults, but at the cost of a deadweight loss to the investors and lenders. If one believes that foreclosure externalities are significant, then one might view risk retention as a sort of Pigouvian tax⁴ in which the social benefits of eliminating externalities make up for the deadweight loss.

But in practice, I am skeptical that risk retention would even achieve the goal of reduced defaults. As Foote, Gerardi, and Willen (2012) argue, the financial crisis resulted from the fact that most of the key financial intermediaries had too much exposure to residential real estate—in other words, they had *too much* skin in the game.

If externalities are the justification for risk retention, then one might well ponder a more direct approach: default taxes. In other words, risk retention is a roundabout way of preventing default that would have been ineffective anyway. A default tax targets the externality precisely and has the added benefit of generating revenue for the government at precisely the time when it is needed.

Academics and journalists are fond of saying that the crisis occurred because of "misaligned incentives." What they mean by

⁴ A Pigouvian tax is a tax on negative externalities, which are effects that are harmful to another person or group.

that verbiage is never exactly clear. In economics, misaligned incentives lead to a breakdown in trade: a rating agency with misaligned incentives is not worth anything to issuers or to the owners of the rating agency. I think what people have in mind is that the incentives of market participants are not aligned with the goals of society; in other words, that the invisible hand has failed. Default externalities are a perfect example. Because they do not incorporate the costs of foreclosures on neighbors, market prices do not give lenders proper incentives to avoid defaults, and the number of defaults in equilibrium is suboptimally high. Yes, incentives are misaligned, but no, the incentive misalignment has nothing to do with the structure of private financial contracts. Distorting financial contracts, as key provisions of Dodd-Frank do, can help only by accident.

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Comment

Neng Wang

The recent financial crisis has had a profound effect on the macroeconomy. Various policy interventions in response to the crisis have been proposed and implemented. Paul Willen challenges the soundness of some of those policies by using modern economic theory (e.g., classical welfare analysis and modern agency theory). Specifically, he provides a critical assessment of the following four proposed regulations and policies:

- the ability-to-repay requirement in mortgage underwriting
- reform of rating agency compensation
- risk retention in securitization
- mandatory loan renegotiation

Willen's main argument against those policies is quite straightforward: Standard economic theory leaves little room, if any, for government intervention. Rational economic agents living in the real world and facing complicated frictions (e.g., informational asymmetry and various forms of moral hazards) already behave in their own interests by optimally choosing their actions and designing constrained efficient contracts. It is thus very hard to improve the equilibrium outcome via government interventions. Importantly, it is insufficient to justify government intervention simply because the observed economic outcomes (e.g., the costly foreclosure process) appear highly undesirable. One needs to provide an argument on how government intervention can create additional net value beyond what the private market and contractual agreements can deliver.

Willen nicely frames the debate on the validity of those policies by centering the discussions on the economics-based reasoning (Economics 101 in action). Although providing a natural benchmark for us to think critically about those policies, he does not rule out the

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possibility that the policies may be justifiable in a richer economic setting with more important real-world frictions. For instance, he writes, "I believe that externalities have to be at the heart of any justification of the [crisis consensus] slate of policies."

Understandably for expositional purposes, the standard models that he uses to illustrate his key argument summarized earlier are stylized and may not incorporate some important real-world frictions. For example, externalities, bubbles, institutional constraints, general equilibrium considerations, and some forms of bounded rationality, irrationality, or both (at least for some agents in the economy) may provide some justifications for some forms of government intervention.

I will now briefly comment on Willen's critique of the policies. As an example, consider the ability-to-repay requirement for mortgage underwriting. The significant deterioration of mortgage underwriting standards during the precrisis period is often viewed as a cause of the recent financial crisis. With the objective of tightening the underwriting standard, the 2010 Dodd-Frank Act requires that "no creditor may make a residential mortgage loan unless the creditor makes a reasonable and good faith determination based on verified and documented information that, at the time the loan is consummated, the consumer has a reasonable ability to repay the loan, according to its terms, and all applicable taxes, insurance (including mortgage guarantee insurance), and assessments."

An economist may ask: "If imposing the ability-to-repay requirement is a good idea, why don't private parties choose to do so in their own interests? If verifying and documenting information create net surplus, why don't the borrower and lender get together and find a way to implement that? What additional value will this ability-to-repay regulation create, if any?" In competitive markets, standard economic theory will predict that contracts between the borrower and lender will be optimally chosen so that the lender's value and the borrower's value will be on the Pareto frontier, and hence the government (or any other third party) cannot improve the contractual agreement between the private parties. Indeed, imposing certain requirements, such as ability to repay or a minimal level of the lender's verification effort, effectively introduces an additional constraint and distorts the optimal contracting agreement between the lender and borrower, reducing the total surplus.

That is a classic and powerful argument used in various economic applications. Unless the government has information that private

parties lack (which seems unrealistic), or can resolve market failures (e.g., externality) that private agents have no incentives to address, or can achieve a more efficient allocation at a lower cost than private parties do (subject to the incentive-compatibility conditions from the private sector), there is little room for government intervention, regardless of how seemingly desirable the policy may appear.

On a related point, the government should not simply limit “exotic” mortgages (e.g., adjustable-rate mortgages with a teaser rate and a likely follow-up rate increase) just because the complicated mortgages are often perceived to be too risky for subprime borrowers and perhaps have been used by sophisticated lenders to take advantage of naive borrowers. Instead, using a state-of-the-art dynamic contracting framework, Piskorski and Tchistyi (2010) show that “exotic” mortgages (with complicated features, including adjustable rates, progressively increasing payments, and prepayment penalties) can benefit less creditworthy households in contrast to the popular view.

Having said that, one has to acknowledge that standard economic theory does make some strong assumptions that inevitably have strong policy implications (e.g., on mortgage lending practices). We need to think about the robustness of those policy implications once we allow for deviations from the standard assumptions. First, borrowers are assumed to be rational in standard economic models. There is much evidence at the micro level indicating that borrowers may be irrational, especially when facing very complicated financial products. An adjustable-rate mortgage with a teaser rate and various implicit or explicit state contingencies embedded in the contract are simply very difficult for many households to understand. Even economic theorists have only recently figured out the economic settings under which adjustable-rate mortgages are optimal contracts.

Additionally, some borrowers may have time-inconsistent preferences and have difficulties with making valuable commitments (Laibson 1997; Gul and Pesendorfer 2001). For borrowers with those behavioral biases, imposing some constraints (e.g., ability to repay) might help borrowers make better financial decisions (e.g., to mitigate time-inconsistency problems). Willen also notes the possibility of government policy in such a world, but he thinks that behavioral assumptions are unlikely to justify the ability to repay or other policies. The correct view is unclear to me at this moment. We need more economic models (e.g., contracting) where agents are subject

to bounded rationality and behavioral biases to further assess the implications of important behavioral biases on government policies.

Also, the general equilibrium implications of micro frictions (e.g., the one between borrower and lender) on the macroeconomy can be very different from those in the standard micro-agency models (not cast in general equilibrium). Why is that so? As an example, systemic risks (particularly important for the crisis-related policy debates) at least partly created by the increasingly sophisticated financial intermediation sector are not factored into any models, including optimal contracting models. Therefore, there may be additional social costs imposed by private parties on the macroeconomy, as private parties do not fully bear the costs on society—a form of externality, as Willen puts it. With the possibility of systemic risks, private contractual agreements in theory can be potentially enhanced via government intervention. Additionally, if private agents in the economy have the expectations that the government will bail them out in really bad times (e.g., the crisis period), the optimal contracting arrangement between private agents at the micro level will not be desirable at the aggregate level, as the government effectively is an agent (it has to make payments in crisis!) but is not involved in the contracting stage between private agents.

Another potentially important contributor to the recent crisis is the housing bubble. Does standard economic theory yield sensible policy implications in a world that may have housing bubbles or mispricing? How does the housing bubble influence the implications of policy interventions? Willen mentions the potential relevance of unrealistic house price appreciation on policy (e.g., the ability-to-repay requirement). What are the incentives for borrowers and lenders in a world with unrealistic house price appreciation? The incentive issues between borrower and lender become much more complicated with bubbles. How should the government behave in a setting with endogenous bubbles? Interestingly, in a bilateral contracting setting, Piskorski and Tchistyi (2011) show that high expectations of house price growth can help explain some controversial features of the recent subprime lending episode, such as loans with low initial rates but set to increase over time, but they show only the results in a partial equilibrium setting with exogenous price appreciation. The implications of policy interventions in general equilibrium with endogenous bubbles remain unexplored.

Willen has written a provocative paper that puts economic theory at the center of important policy debates. By using standard microeconomic

theory with rational agents and no externality, he shows that the room for effective government intervention to improve welfare is rather limited. Intuitively, economic agents have the incentives on their own to work out the optimal contractual agreements among themselves, and the government has no particular advantage to improve the private resource allocation and contract design. Willen's article serves as an excellent starting point for further constructive and deeper crisis-related policy debates. However, because some important frictions are left out of stylized partial-equilibrium models, we do not yet have conclusive answers on important crisis-related policy debates. We need richer general-equilibrium models with important frictions to evaluate those policies.

One frequently quoted argument in support of the government intervention in the recent crisis is the fear that, otherwise, the economy could have suffered much more (a counterfactual that we will never observe in reality). To evaluate various crisis-motivated policies, we need richer tractable, dynamic, and intuitive models that allow us to incorporate systemic risk and externality, bubbles, bounded rationality, and various important micro frictions (e.g., incentive issues, informational frictions, and institutional constraints) in order to better assess the consequences of various policies.

Policy debates eventually boil down to details. (I guess no one knows where the 5 percent risk retention in Dodd-Frank comes from.) What are the quantitative implications and economic significances of those policies? We can only try to answer those questions in quantitative tractable equilibrium models with important frictions embedded, as discussed earlier.

Recently, we have seen a fast-growing list of PhD job-market candidates doing promising financial crisis-related research that lies at the intersection between macroeconomics and finance. The best predictor for future exciting research is the junior economists' job market. I am optimistic that we will learn much about financial crisis and crisis-related policies in the next decade.

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Comment

Parag Pathak

Paul Willen's wide-ranging and provocative paper offers a lot to consider. To summarize, he examines four policy responses to the recent housing market bubble and financial crisis, and he makes the following claim: simple economic models do not necessarily imply a role for government policy. "Simple" is an important word here, for reasons that I'll explain below.

Three of the four policy responses Willen examines are especially noteworthy because they're intended to harness private information that banks and other financial firms supposedly had, or should have had, going into the financial crisis that might have averted the crisis. These three policy responses are as follows:

- requirements for risk retention and securitization ("skin in the game")
- policies related to the "issuer pays" credit rating system
- policies concerning borrower "ability to repay"

Willen argues that, contrary to those policies, regulators are subject to the same kinds of information problems as market participants, and so we should be somewhat skeptical of whether any of those policies actually lead to Pareto improvements.

I really appreciate Willen's emphasis on first principles. It is my opinion that regulatory reforms are too often rushed in the wake of a crisis, ignoring simple yet important insights from the field of economics. There's a fair amount of discussion in his paper about first principles of economics—back to the insights of Milton Friedman and Adam Smith. That is where I want to begin my comments: I want to situate my remarks on my take of how basic welfare economics has evolved.

Willen begins his paper by discussing the First Welfare Theorem: the idea that competitive markets lead to Pareto-optimal outcomes so long as there are no market failures. For government intervention

to produce a Pareto improvement, some sort of market failure must exist—a failure like asymmetric information, externalities, or some sort of missing markets problem. Three of the four policy responses Willen considers are efforts to address a supposed asymmetric information problem. To his eye, the contracting party that supposedly is the beneficiary of the information asymmetry is the party that suffered the most harm from the suspect transaction in the run-up to the crisis, so it makes little sense to say that policy intended to right those asymmetries would produce a better outcome. To my eye, however, the details in those transactions are incredibly important, and it is essential to precisely model the contractual frictions he has in mind. It is not sufficient to appeal to general theorems in general equilibrium with adverse selection and moral hazard as Willen does, because those papers illustrate how rich commodity spaces are needed to restore efficiency, and they may not be realistic.

Basic welfare economics has also advanced to incorporate political economy considerations. Willen argues that this feature further undermines the rationale for interventions. The second way welfare economics has evolved is that it now considers the challenge posed by behavioral economics. Behavioral economists argue that people make mistakes, they may be misinformed, and they may have wrong beliefs. Those realizations, by themselves, do not provide sufficient rationale for intervention. It is not enough for proponents of policy intervention to recognize *ex post* that mistakes were made; Pareto-improving intervention requires that recognition *ex ante*. The burden is on the proponents to identify precisely what mistakes are looming. I am sympathetic to Willen on that matter, and the policy implications of that perspective can be as radical as he suggests. However, he should acknowledge the possibility that some interventions may make the market more operable or make it easier for market forces to play out their role.

Let's now consider more carefully some of the interventions that he discusses. Consider first the "skin in the game"—requiring banks to retain some ownership over the mortgage-related financial instruments they sell off. Specifically, a provision in the Dodd-Frank legislation says that securitized mortgage lenders are required to retain at least 5 percent of the credit risk for any security they issue that is backed by a mortgage. If there is securitization without skin in the game, Willen postulates that rational market participants will demand compensation for the supposed lack of mortgage

lenders' monitoring. He clearly describes the apparent tension between the idea that if mortgage lenders retain some of the risk, then they'll improve their monitoring of mortgages, and the possibility that the benefit of fewer defaults will be offset by higher mortgage costs, reducing public welfare.

He examines what happens when people have biased beliefs, overestimating underwriting efforts and underestimating defaults. He shows that it is possible for policies that force mortgage lenders to retain some risk to enhance public welfare by debiasing investors. That realization draws on work that Willen has undertaken in other papers, where he examines how firms that were the underwriters of securitizers of subprime mortgages would then leave themselves heavily exposed to those risky mortgages. That is, how could those firms have underestimated that risk so dramatically? I think that is a very challenging question, and it might undermine taking an Econ 101 view on the crisis.

Willen has been a leader among academics in trying to tease out whether those behavioral biases were actually taking place. In a paper with Kristopher Gerardi et al. (2008), he argues that many mortgage market participants understood that if house prices fell, then many borrowers would default. The paper includes Lehman Brothers' estimates in 2005 of defaults and losses under various scenarios, including a "financial meltdown" scenario. Lehman understood the risk modeling, but it apparently got the actual trajectory of house prices incorrect. That observation would support the idea that people systematically had the wrong impressions about future house prices. Another table in the paper illustrates how J. P. Morgan analysts continuously reappraised the likelihood of different types of house price changes and their effects. In 2006 and 2007, we see signs that the analysts' belief-updating in response to real-world news was slow, but that it improved in the fall of 2007 as price declines accelerated, as well as in December 2007 when there was some stabilization. The delayed reactions of even those sophisticated participants beg the question of what we can assume about market participants.

Now let's turn to policies involving financial rating firms. One premise underlying the Dodd-Frank legislation is that the inaccuracies of the financial ratings of unstructured financial products in the run-up to the financial crisis was due, at least in part, to a conflict of interest for the rating firms. Under the system that was then in

place, firms that created the financial products paid the rating firms for analyzing and grading the products. That practice supposedly created the conflict: the rating firms may not have wanted to deliver low grades to their customers. Dodd-Frank considers replacing that payment system with one that basically treats ratings as a public utility. Willen, however, points out a problem with the conflict-of-interest theory: the biggest losses in the crisis were experienced by the financial firms that issued the securities. That is, if a conflict of interest existed, then the financial firms paid money to be misled—a theory that does not make much sense. So again, the onus is on policy proponents to demonstrate that investors did not understand the conflict of interest.

On the subject of ratings, I believe that Coval, Jurek, and Stafford (2009) present compelling evidence that investors misperceived risks with ratings. Those authors argue that a fundamental principle of asset pricing is that assets that deliver returns in bad economic times—or, more formally, in states where the endowment is low—should be priced higher than other assets because the former deliver dollars when those dollars are most valuable. They draw a distinction between the structured finance products that were used to finance the housing boom—credit default obligations (CDOs) and the like—and catastrophe bonds. Catastrophe bonds pay off when a catastrophe occurs, and so they should have a relatively high price, whereas the housing products should have a lower price. However, the latter financial products were priced relatively high during the housing boom because they were priced based on their credit ratings alone. Coval, Jurek, and Stafford show empirically that if you look at the pricing of a lot of structured products, even though they should demand different risk premiums than, say, AAA-rated corporate debt, they did not actually command different risk premiums. The authors note that covariances are what is really important in asset pricing—something that was not well understood in the practitioner literature on the pricing of CDOs.

The issue here is that rating agencies professed CDOs and the like to be safe even though they were not, from an asset-pricing perspective. As Willen has noted, maybe the problem here is that investors rely too heavily on credit ratings. In particular, some market participants were restricted to having ownership of only highly *rated* securities, so the risks (according to Coval, Jurek, and Stafford) were

not properly understood and not properly priced by the markets. You can interpret that situation as systematic evidence that people did not understand and price the rating firm conflict of interest. Willen responds by saying that, sure, people did not anticipate those risks back in 2005 and 2006, but they won't make the same mistake going forward. That is a fair point, but it relies on not repeating the same mistakes, which seems like a strong assumption.

Let's now consider the ability-to-repay requirements. Did borrowers understand the mortgages that they took out? As Willen explains, the conventional wisdom is that they did not. That answer takes us beyond the world of the simple economic model, which assumes rational agents with perfect information and perfect foresight. As Willen explains, if the borrower has private information, a rational lender should simply verify income up to the point where it is in the lender's interest.

Woodward and Hall (2012) make the interesting argument that mortgage brokers would benefit greatly if they would "shop around" more vigorously for borrowers just as would-be borrowers can shop for mortgage lenders. That "shopping around" process would help expose would-be borrowers' private information. The authors go on to argue that a simplified environment where a broker receives all compensation from a lender rather than points and other fees would likely lead to better terms for the borrower as well as aid the lender. That argument brings us back to behavioral economics and the notion that borrowers may have self-control issues.

Woodward and Hall adopt an explicit behavioral point of view: "We are inclined to believe that simple admonitions, such as 'mortgage brokers are salesmen and the only way to get a good deal is to shop and bargain' and 'you are more likely to get a good deal if you shop for no-cost loans' are more likely to yield improvements than, for example, trying to teach borrowers enough financial economics to understand the tradeoff between cash and the interest rate" (p. 3271). I have a hard time squaring that idea, which I think is probably right, with the simple Economics 101 logic that Willen heavily relies on, because the inherent idea is that people do not actually process enough information and shop around enough. Woodward and Hall are basically saying that it does not even make sense to teach prospective borrowers basic financial economics because taking out a mortgage is a complex problem. Speaking more generally, I believe that notion

underlies many of the proposed policies advocated in response to the financial crisis.

Let's now turn to the final policy measure Willen examines in the paper, loan modification, which does not fit under the "asymmetric information" category. Foreclosures in large numbers appear to create a sort of negative externality on empty neighborhoods, with resulting harms in public safety, quality of life, housing market pricing, and public finance (see, e.g., Campbell, Giglio, and Pathak 2009). That externality provides justification for policy intervention, and one proposed intervention is policies to encourage loan modifications that would allow mortgage holders to stay in their homes but make more manageable payments.

The conventional wisdom is that there haven't been enough loan modifications in the wake of the financial crisis because of "institutional frictions" that Willen describes in his paper. He argues, in effect, that lenders have imperfect information about borrowers' willingness to pay, and that the lenders would be willing to modify if they had better information because the returns following a large number of modifications would be preferable to the returns following a large wave of foreclosures. To overcome the frictions, we could use some small financial incentives, which is the thinking behind the federal Home Affordable Modification Program. I think Willen is relatively spot-on in saying that, in effect, we want to change the profit maximization calculus of banks, and small financial incentives may not be enough.

In that setting, another possible policy response is to inflict losses on foreclosing lenders, reflecting the loss to public welfare from foreclosure externalities. So how do the foreclosure externalities compare with the costs—both private and public—now experienced by lenders? That question then leads to a second question: once policies are in place to encourage modification, will nondistressed borrowers then act strategically to force remodeling, which could harm public welfare in the long run? There is now an emerging literature on that issue and the potential manipulation of eligibility criteria for mortgage modification. Guiso, Sapienza, and Zingales (2013) argue that borrowers generally will not act strategically because of bounded rationality or moral considerations. Mayer et al. (2011), on the other hand, looked at modifications made in the wake of Countrywide Financial's settlement with state attorneys general and

found strong evidence of strategic behavior: the delinquency rate of Countrywide's loans increased after the mortgage modification program was announced. My own view is that if we are going to follow Econ 101, then the potential for strategic behavior must be part of the discussion.

To conclude, I think it is hard to disagree with Willen's basic premise that simple economic models do not rationalize intervention, but the issue I raise is whether simple economic models are relevant for describing the financial crisis. I think there is a larger role for behavioral considerations. Willen is not opposed to that view, and we both agree that the arguments need to be articulated clearly. There is always the long-standing challenge of understanding whether market forces will lead people to learn and overcome their behavioral biases. I think the most important feature of Willen's paper and his other work is that it points to our need to better understand what went wrong and whether that was knowable *ex ante*.

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