

# research review



Issue No. 16, July 2011 - December 2011

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# research review

Issue No. 16, July 2011 – December 2011

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# Public Policy Discussion Papers

p-11-4

## An Economic Analysis of the 2010 Proposed Settlement between the Department of Justice and Credit Card Networks

by Scott Schuh, Oz Shy, Joanna Stavins, and Robert Triest

complete text: <http://www.bostonfed.org/economic/ppdp/2011/ppdp1104.htm>

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### Motivation for the Research

In 2010 the Department of Justice (DOJ) filed a lawsuit for alleged antitrust violations against the credit card networks American Express, MasterCard, and Visa. This suit and the proposed settlement announced by the DOJ were prompted by the fact that payment card networks in the United States exhibit a market imperfection—imperfect information about merchant fees. The Proposed Settlement between the DOJ and Visa and MasterCard (MC) attempts to remedy this market imperfection and suggests other changes to improve the functioning of the market.

Under the Proposed Settlement merchants for the first time would be explicitly allowed to disclose to consumers their fees and costs associated with accepting different payment instruments. With this new freedom, merchants could provide enhanced discounts and other incentives to encourage consumers to use lower-cost payment methods. The Proposed Settlement represents a significant step toward removing the explicit and implicit current restrictions placed on merchants by credit card networks. However, merchants may not be able to take full advantage of this Settlement

### Availability of Card Fee Information by Entity

Fee Type	Banks		Other Parties	
	Acquirers and Networks	Issuers	Merchants	Consumers
Interchange fee categories <sup>a</sup>	Y	Y	Y	Y
Interchange fee on specific card during the transaction	Y <sup>b</sup>	Y	N	N
Average merchant fee	Y	N	Y	N
Merchant fee on a specific card during the transaction	Y <sup>b</sup>	N	N <sup>c</sup>	N

Source: Authors' research

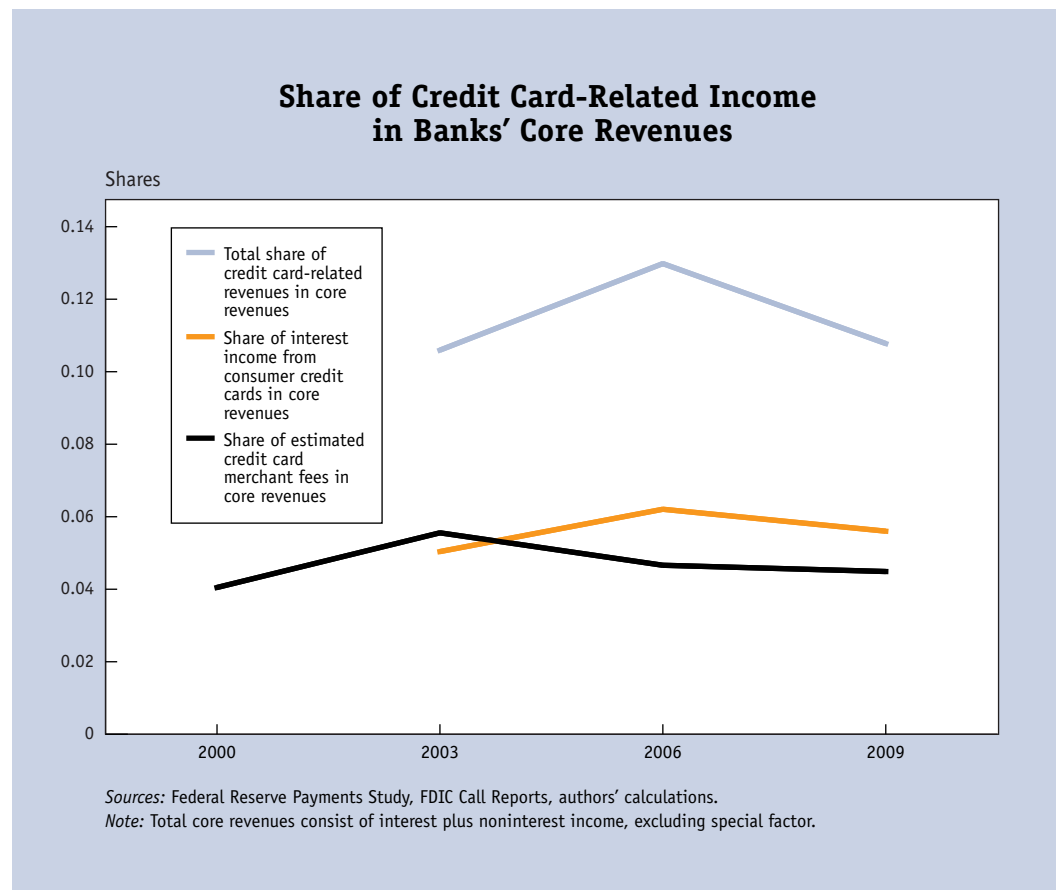
Note: Y/N means information available/not available to the entity.

<sup>a</sup> Visa and MasterCard publish their interchange fee categories on their websites, although it is not clear how many consumers are aware of that.

<sup>b</sup> Based on conversations with bankers and card networks, we assume that acquirers have information about specific merchant and interchange fees in real time during transactions.

<sup>c</sup> Unless fees are flat across all card types.

because they lack transparent information about the merchant fees associated with each type of payment card. This problem arises because merchant fees vary significantly by whether the card is a reward versus nonreward card and by the card issuer (a specific bank, for example) as well as by the network (Visa, for example), among other things. There are too many types of card for the merchant to be able to figure out the merchant fee in real time at the point of sale. Therefore, the Proposed Settlement could be more effective if merchants had this information, and if they were allowed to surcharge customers who are using more costly payment instruments, in addition to being allowed to provide discounts for using more cost-effective payment methods.



## Research Approach

The paper summarizes the DOJ intervention, analyzes the probable economic effects of the Proposed Settlement, discusses consumers' and merchants' information needs, including how merchant fees might be disclosed, and draws conclusions regarding the extent to which the Proposed Settlement is likely to achieve its stated main goal: to allow merchants to influence consumer payment choice.

## Key Findings

- Overall, there is a strong case for mandating that the credit card networks disclose to both merchants and consumers the fees associated with different payment options. Policies designed to reveal and enhance full information about merchant fees to both merchants and consumers are likely to enhance competition in payment card markets in at least two ways. First, full information and transparency of fees is likely to encourage reductions in interchange fees and incentivize merchants to steer consumers toward lower-fee cards. Second, by reducing merchants' payment

costs and offering inducements consumers to balance the costs and benefits of alternative payment methods, disclosure of full information about fees is likely to encourage merchants to compete on the basis of offering lower retail prices to their customers.

- In word and spirit, the Proposed Settlement represents a significant step toward promoting price-based competition in the credit card market. However, merchants are unlikely to be able to take full advantage of the Proposed Settlement's new freedoms because they currently lack comprehensible and complete information on the full and exact merchant discount fees for their customers' credit cards.
- If merchants had the necessary information in real time (at or before the time of the transaction) to facilitate the mapping of cards and fees, under the Proposed Settlement they could attempt to steer customers toward lower-cost payment methods. However, merchants would still be restricted in the mechanisms they could use to this end because the Proposed Settlement did not challenge the Visa and MasterCard rule that prohibits merchants from imposing surcharges that reflect the costs they incur in processing payments.
- The refusal of American Express to join the Proposed Settlement may have effects on the participants in and functioning of the credit card market. Merchants that accept American Express in addition to Visa and MasterCard may have to continue to adhere to American Express rules, which could limit their ability to take advantage of the most important provisions of the Proposed Settlement.

### **Implications**

Although the Proposed Settlement is a significant step forward in correcting market failures generated by the existing payment card system, merchants may not be able to exercise price differentiation due to an inherent lack of detailed knowledge of the level of merchant fees that the current Proposed Settlement fails to remedy completely.

p-11-5

## **Classroom Peer Effects and Student Achievement**

*by Mary A. Burke and Tim R. Sass*

complete text: <http://www.bostonfed.org/economic/ppdp/2011/ppdp1105.htm>

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### **Motivation for the Research**

The potential for peers to affect an individual student's academic achievement is central to many important policy issues in elementary and secondary education, including the impacts of school choice programs, ability tracking within schools, "mainstreaming" of special education students, and racial and economic desegregation. Vouchers, charter schools, and other school choice programs may benefit students who stay in traditional public schools by engendering competition that leads to improvements in school quality, but may also harm those same students by diminishing the quality of their classmates (Epple and Romano 1998; Caucutt 2002). Grouping students in classrooms by ability might likewise have a significant impact on student achievement, depending on the magnitude and shape of peer influences (Epple, Newlon, and Romano 2002). The effect of desegregation policies on achievement will depend not just on the average spillover effects from peer ability, but also on whether students of varying backgrounds and ability levels experience peer effects of different magnitudes and/or exert different influences on their peers.

Although there is an extensive body of work that estimates peer effects of various stripes in academic settings, the findings vary widely across these studies, and consistent policy implications are hard to extract. As is well known, steep challenges are involved in identifying peer effects, due to issues such

as endogenous peer selection, simultaneity of outcomes, and the presence of correlated inputs within peer groups. Yet in recent years significant progress has been made as researchers have made clever use of available data. In particular, a handful of recent papers appear to show broad agreement that disruptive peer behavior has negative effects on individual achievement (Figlio 2007; Carrell and Hoekstra 2010; Aizer 2008; and Neidell and Waldfogel 2010). Consensus is still lacking, however, on achievement spillovers from peer ability. Because many recurrent policy issues (charter schools, economic and racial desegregation, tracking/de-tracking) entail redistributing students on the basis of ability measures or characteristics that correlate with ability, the value of reliable measures of ability spillovers remains high.

Using a unique panel dataset encompassing all Florida public school students in grades 3–10 during the academic years from 1999/2000 to 2004/2005, the authors have an unprecedented resource with which to test for peer effects in the educational context. Unlike any previous study, the paper simultaneously controls for the fixed inputs of students, teachers, and schools in measuring peer effects on academic achievement at the classroom level. These controls sharply limit the scope for bias from endogenous selection of peers and teachers and permit a sharper estimate of the influence of classroom peer ability (as opposed to grade-level-at-school peer ability) than has been possible in previous research. While fixed effects cannot control for classroom assignment policies that depend on unobserved, time-varying factors—Rothstein’s (2010) “dynamic tracking” problem—the authors employ sample restrictions that limit the risks posed by such policies and find the results to be robust to such restrictions

### **Research Approach**

This is the first study using U.S. data to compare peer effects across three levels of schooling—elementary, middle, and high school—for both math achievement and reading achievement. In addition, the data enable the authors to estimate models involving nonlinear, heterogeneous peer effects that depend on both individual ability and peer ability, in keeping with recent evidence that simpler specifications fail to capture important dimensions of peer effects.

In addition to exploiting a rich dataset, the authors employ a new estimation technique, adapted from Arcidiacono, Foster, Goodpaster, and Kinsler (2010)—hereafter AFGK—in which peer effects operate through a measure of peer ability that captures observed as well as unobserved components. This method mitigates the potential measurement error associated with standard ability measures such as lagged test scores and demographic characteristics, and greatly facilitates the estimation of models involving multiple levels of fixed effects.

The authors begin by specifying a linear-in-means model based on the cumulative cognitive achievement production function developed by Boardman and Murnane (1979) and Todd and Wolpin (2003). The model assumes that the achievement function is linear, with separable inputs. The effects of inputs do not vary with the student’s age, but they may depend on the amount of time that has elapsed since the inputs were initially applied. The authors relax the age-independence assumption somewhat by estimating separate models for elementary, middle, and high school observations.

In the authors’ linear-in-means model, peer effects operate through average peer ability. It seems reasonable to expect that students might benefit more from exposure to high-aptitude peers than to low-aptitude peers (that is, effects are monotonic in peer ability), for example, if high-aptitude peers ask penetrating questions and provide key insights during classroom discussions more frequently than do lower-aptitude students. However, it is not obvious that such benefits would be linear in peer ability, nor that such benefits would accrue uniformly to all types of students. Indeed, a growing list of papers finds evidence of nonlinearities in peer effects. Such findings constitute an important development, because education policy can hope to generate aggregate achievement gains only if peer effects are nonlinear and therefore nonzero sum in their impact on student achievement.



Accordingly, the authors also estimate two nonlinear models of peer effects. In the first, the influence of the mean peer fixed effect is allowed to depend on a quintile ranking of the student's initial achievement level (based on an initial test score) relative to Florida's entire student population. In the second, peer effects again depend on the student's initial test-score rank, but the measure of peer quality is no longer the mean peer fixed effect. Instead, in the authors' model, similar to the model of Carrell, Sacerdote, and West (2011), students are influenced by the respective shares of peers in the bottom quintile and top quintile of the global distribution of student fixed effects, and in turn these effects depend on the student's initial test-score ranking. The share of peers in the middle of the distribution is omitted due to collinearity.

### **Key Findings**

- Peer effects are small, but statistically significant, in the linear-in-means models, although these effects obscure more complex interactions. In the nonlinear models, peer effects are larger on average than in the linear models, and the effects are statistically and economically significant.
- The impact of peer ability depends on the student's own ability and on the relationship between a student's own ability and that of his/her peers—for example, having very high-aptitude peers appears worse for low-achieving students than having peers of average ability. Such nonlinearities imply that there are opportunities for redistribution of students across classrooms and/or schools that may result in aggregate achievement gains.
- Peer effects tend to be stronger at the classroom level than at the grade level—in most cases the results indicate no significant peer effects at the grade-within-school level. This result accords with recent findings by Carrell, Fullerton, and West (2009) that peer effects estimates can differ greatly depending on the accuracy with which the econometrician identifies the set of relevant peers. In most specifications, estimated peer effects are smaller when teacher fixed effects are included in the model than when they are omitted, reinforcing the importance of controlling for unobserved teacher inputs when estimating classroom peer effects.

### **Implications**

While estimating models with multiple levels of fixed effects is both data-intensive and computationally demanding, the authors' data resources and choice of methods greatly facilitate the estimation of such models. The ability to identify peer effects using nonexperimental data represents an important contribution because truly random classroom assignments are quite rare in practice, especially in the United States. Further, the nature of peer influences may differ depending on whether peers are chosen deliberately or at random (Foster 2006; Weinberg 2007; Duflo, Dupas, and Kremer forthcoming). In addition, AFGK show that a moderate degree of sorting based on student ability enables more accurate estimates of peer effects than obtain under purely random assignment, as sorting generates greater variation in peer group ability.

This paper adds to a growing list of studies that use matched panel data to estimate peer effects in academic achievement. As in earlier studies, the panel data facilitate the identification of peer effects on academic achievement by enabling control for endogenous variation in peer groups. Unlike many earlier studies, this study is able to place students within classroom groups with specific teachers, and observe the teacher's interactions with more than one group of students. Accordingly, this is the first study to control simultaneously for unobserved heterogeneity in both student ability and teacher effectiveness, among other unobserved effects, the first to estimate classroom-level peer effects at the elementary, middle, and high school levels for the same school system, and to compare these classroom-level effects to grade-level effects. While not the first researchers to do so, the authors add further value by adopting an innovative computational technique that aims both to facilitate the estimation of fixed effects and to minimize measurement error in peer ability. The authors estimate nonlinear peer effects models that allow for nonzero sum policy implications.

These preferences over peer ability do not point to a single, optimal policy prescription, since the diverse peer rankings cannot be simultaneously satisfied for all types of students. However, they do suggest that classroom assignment policies involving some degree of tracking by ability—such as splitting students into two tracks—should be preferred to policies in which all classrooms contain a broad mix of students. The preferences of high-ability students would call for segregating these students in a separate track. However, the desirability of such a policy—which could increase inequality of outcomes—depends on whether achievement gains (or losses) are weighted equally regardless of the student’s initial achievement level, and on whether achievement disparities should matter in addition to average achievement. If the goal is to raise achievement among the lowest scorers, the focus should be placed on matching such students with others of modestly higher ability rather than with the top students. While the findings suggest that the distribution of student ability may influence teaching strategies in ways that benefit some students but not others, more research is needed to reveal the nature of such strategies and how teacher resources might be best exploited in light of classroom assignment policies.

p-11-6

## **Securitization and Moral Hazard: Evidence from Credit Score Cutoff Rules**

*by Ryan Bubb and Alex Kaufman*

complete text: <http://www.bostonfed.org/economic/ppdp/2011/ppdp1106.htm>

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### **Motivation for the Research**

Conventional wisdom contends that securitization contributed to the sharp rise in mortgage defaults that precipitated the recent financial crisis. The logic of the moral hazard problem posed by securitization is straightforward: lenders originating loans that they then sell to dispersed investors may bear less of the cost when these loans default than lenders who hold the loans on their books—hence securitizers may have less incentive to screen borrowers. The widespread belief that this moral hazard problem played an important role in fomenting the financial crisis has influenced regulatory reform, with the 2010 Dodd-Frank Act adopting a requirement that securitizers and/or originators retain a 5 percent interest in mortgages they securitize to better align their incentives and reduce broader financial market risk.

However, there are reasons to think that securitization may not have had a large moral hazard effect on lender screening practices. Mortgage securitization was developed over decades, and as early as 1993 the overall securitization rate was nearly as high as in the period leading up to the recent financial crisis. Lenders and securitizers both had strong incentives to devise ways to avoid the moral hazard problem posed by securitization, and a range of practices were indeed developed to mitigate it (Gorton 2009). These include contractual provisions such as representations and warranties by lenders and clauses that require lenders to buy back loans that default soon after sale, monitoring strategies like the extensive underwriting guidelines and audits used by some purchasers of large loans, and software systems that automate parts of the mortgage underwriting process. Hence, the extent to which securitization actually reduced lenders’ scrutiny of borrowers remains an empirical question.

One promising strategy for answering the question of whether securitization played a major role in the sharp rise in mortgage defaults is to use variation in the behavior of lenders at credit score cutoff points. Lenders use credit scores as a summary measure of default risk, with higher credit scores indicating lower default risk. Despite the smoothness of the distribution of credit scores in the overall U.S. population, histograms of mortgage borrower credit scores are step-wise functions

with a series of discontinuities. It appears that borrowers with scores just above certain thresholds are treated differently than those scoring just below, even though potential borrowers on either side of the threshold are essentially very similar. These histograms suggest that using a regression discontinuity design to learn about the effects of the change in behavior of market participants at these thresholds will help answer to what extent securitization actually played a role in the recent mortgage-induced financial crisis.

### Research Approach

In this paper, the authors distinguish between two explanations for credit score cutoff rules that pose different implications for what these cutoff rules reveal about the relationship between securitization and lenders' screening practices. The authors refer to the explanation that is currently most accepted in the literature as the *securitization rule-of-thumb theory*. First offered by Keys, Mukherjee, Seru, and Vig (2010) (hereafter, KMSV), this explanation posits that secondary-market mortgage purchasers employ a rule of thumb whereby they are exogenously more willing to purchase loans made to borrowers with FICO scores just above 620 than to borrowers with scores just below 620. KMSV exploit this rule of thumb in a regression discontinuity design to investigate the effect securitization had on lenders' incentives to screen loan applicants. Examining a dataset comprised only of securitized loans, the authors interpret discontinuities in loan performance at a 620 score as estimates of securitization's causal effect on the lender screening process.

However, the validity of this research design depends on two crucial assumptions. First, there must be a discontinuous increase in the probability of securitization at a 620 FICO score. In the terminology of instrumental variables (IV), there must be a valid first stage—the instrument (the 620 cutoff) must have an effect on the treatment of interest (the probability of securitization). KMSV's primary dataset from LoanPerformance contains only securitized loans, and KMSV does not show whether the fraction of loans securitized jumps at 620. Second, lenders' discontinuous change in screening at the 620 cutoff must be entirely driven by the change in probability of securitization at 620. If lenders' behavior changes discontinuously for other reasons, then one cannot attribute the jump in defaults at 620 to securitization. In IV terms, this would be a violation of the exclusion restriction—meaning that the cutoff is affecting the outcome through a channel other than ease of securitization.

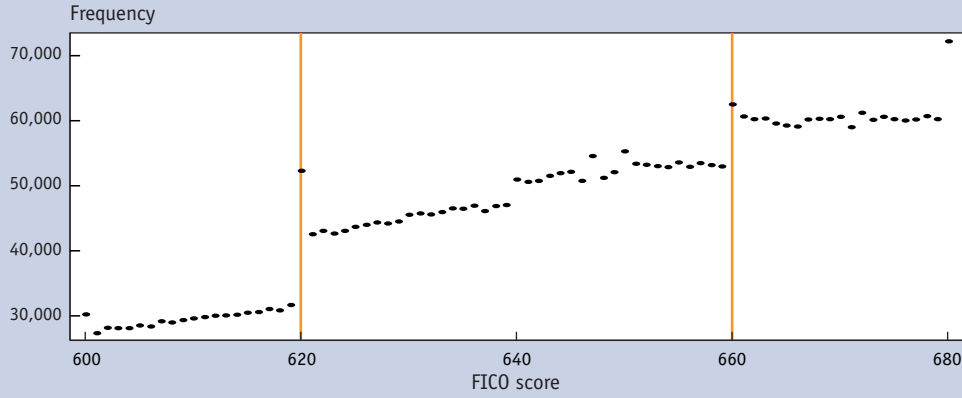
The authors consider an alternative theory for the origin of credit score cutoff rules that implies a violation of this exclusion restriction. They refer to this alternative theory as the *origination rule-of-thumb theory*. Specifically, they argue that lenders adopted credit score cutoff rules directly in response to underwriting guidelines issued by Fannie Mae and Freddie Mac (the government sponsored enterprises (GSEs) that insure the vast majority of U.S. mortgages). The origination rule-of-thumb theory is based on institutional evidence that shows that in the 1990s, with the goal of improving underwriting, the GSEs required originators to adopt credit score cutoff rules to determine how carefully to screen mortgage applicants. Moreover, these credit score cutoff rules spread widely through originators' use of underwriting software that incorporates the cutoffs. The authors offer a simple model based on discreteness in the cost of information collection for why the GSEs directed originators to adopt such credit score cutoff rules. Furthermore, the discontinuity in lender screening at the credit score cutoff points creates discontinuities in the amount of private information originators have about loans. Information asymmetry can inhibit trade, and hence origination rules of thumb can result in discontinuities in the securitization rate.

### Key Findings

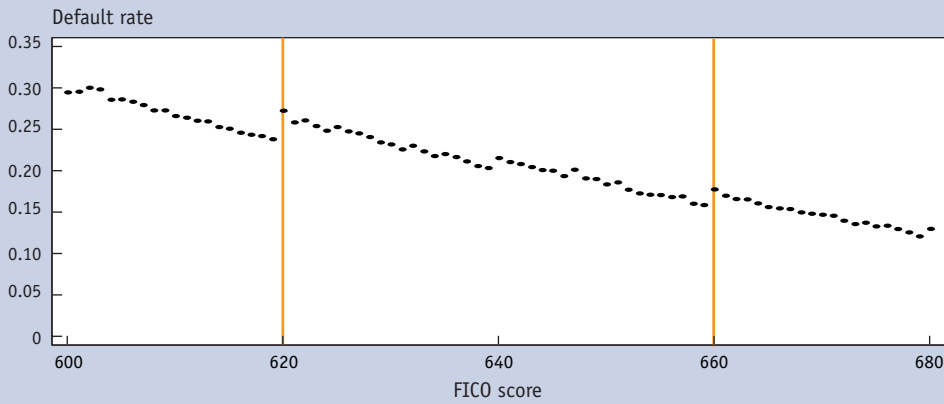
- Importantly, the origination rule-of-thumb theory and the institutional evidence on which it is based imply a violation of the exclusion restriction of KMSV's research design. The independent change in lenders' screening intensity at the cutoff scores confounds the effect of any change in the ease of securitization, thus invalidating a regression discontinuity design based on these cutoffs.

# Sample Frame of First-Lien, Non-buydown, Owner-Occupied, Single-Family, Conforming Mortgage Loans Originated Between January 2003 and December 2007

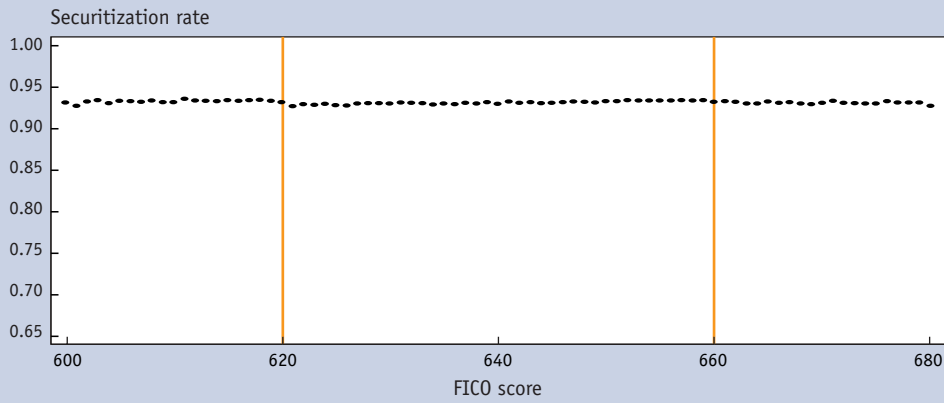
Panel A. Frequency



Panel B. Default



Panel C. Securitization



Data Source: Lender Processing Services Applied Analytics, Inc.

The jumps in default at credit score thresholds thus do not provide evidence that securitization led to lax screening.

- Loan-level data show large jumps in the number and default rate of loans at credit score cutoffs in the absence of corresponding first-stage discontinuities in the securitization rate. In instrumental variable terms, the first stage shows that the instrument has no effect on the treatment. Despite this, it has a large reduced-form effect on the outcome, confirming the exclusion restriction violation implied by the institutional evidence.
- Data from Lender Processing Services that include both securitized and portfolio loans reveal jumps in both the number of loans and the default rate at the FICO scores of 620 and 660, confirming the presence of lender screening cutoffs at those scores. However, there are no corresponding jumps in the securitization rate. These results are inconsistent with the securitization rule-of-thumb theory but are consistent with the origination rule-of-thumb theory.
- The authors' findings provide evidence that to some extent securitizers were able to mitigate the incentive problems posed by securitization. When Fannie Mae and Freddie Mac, the two largest mortgage purchasers, determined that using credit score cutoff rules to determine how carefully to scrutinize loan applications could improve mortgage underwriting, they included these rules in their underwriting guidelines. The ubiquity of the 620 and 660 FICO credit score cutoff rules in the mortgage markets is a testament to the ability of Fannie and Freddie to enforce their underwriting guidelines through software programs, contractual provisions, and monitoring. Interpreted in light of the authors' findings and analysis, the discontinuities in default at certain credit score thresholds do not provide evidence for the hypothesis that securitization led to lax screening. Rather, the discontinuities provide support for the opposing hypothesis: large securitizers like Fannie and Freddie were to some extent able to regulate lenders' screening behavior.

### **Implications**

In this paper the authors argue that lenders adopted credit score cutoff rules directly in response to underwriting guidelines issued by Fannie Mae and Freddie Mac in the 1990s. Institutional evidence shows that the GSEs required lenders to adopt credit score cutoff rules and that these rules spread through their incorporation into underwriting software. Moreover, the authors develop a simple equilibrium model that rationalizes the use of such cutoff rules in origination. Evidence from a loan-level dataset reveals screening cutoffs at 620 and 660 in the absence of a discontinuous increase in securitization. The data show that these lender screening cutoffs remained in place after the private-label mortgage securitization market had shut down in 2008–2009 in the wake of the financial crisis.

This pattern of evidence is consistent with the origination rule-of-thumb theory but not with the securitization rule-of-thumb theory. Unfortunately this implies that credit score cutoff rules do not provide a useful laboratory for estimating the effect of securitization on lender screening. Lenders change their screening behavior at the credit score cutoffs for reasons other than a change in the probability of securitization. Therefore, the change in default rates at these credit score cutoff points is not evidence that securitization led to lax screening by lenders.

The cutoff rule evidence does tell us, however, that Fannie Mae and Freddie Mac were to a significant extent successful in implementing their desired underwriting guidelines throughout the mortgage industry. After concluding that credit score cutoff rules in screening would improve mortgage underwriting, Fannie and Freddie used contractual provisions, monitoring, and software systems to ensure that originators adopted these rules. This evidence, of course, does not settle the important question of the extent to which securitization led to lax underwriting in the run-up to the subprime mortgage crisis, the answer to which remains an open and urgent research question.

# Quantifying the Role of Federal and State Taxes in Mitigating Income Inequality

by Daniel H. Cooper, Byron F. Lutz, and Michael G. Palumbo

complete text: <http://www.bostonfed.org/economic/ppdp/2011/ppdp1107.htm>  
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## Motivation for the Research

Income inequality has been increasing in the United States since at least 1980 and possibly as far back as 1970 (Gottschalk and Smeeding 2000; Karoly 1993). An important component of this increase has been a rise in the wage differentials associated with education, occupation, and experience. Over the same period, wage dispersion within these broad groups has also increased (Katz and Autor 1999; Autor, Katz, and Kearney 2008). The increase in wage inequality has, in turn, produced increases in broader measures of income inequality and in consumption inequality (Cutler and Katz 1992; Karoly and Burtless 1995). The tax policies enacted by the federal and state governments are a potential compensating factor in the rise in wage and income inequality, particularly as these policies relate to progressivity or the rate at which taxes tend to rise with income. This paper quantifies the role of taxes in mitigating income inequality in the United States.

The paper is closely related to two distinct and large literatures—the wage inequality literature and the empirical tax incidence literature. This paper makes several contributions to these literatures. First, the authors' results are driven primarily by the connection between taxes and wage inequality. Almost all previous tax incidence studies have focused on broader definitions of income inequality. However, the labor market is the primary source of income for most individuals and families, and there are a number of conceptual and methodological advantages to focusing on labor income inequality. Second, the authors provide an unusually rich analysis of the influence of individual state tax codes over a long period of time. Past studies have tended to focus on a very short time period (such as immediately before and after the Tax Reform Act of 1986) and/or consider the collective impact of state tax codes instead of analyzing them individually. The authors also capture the three largest state taxes—the personal income tax, the general sales tax, and the gasoline tax—with an analysis of the sales and gas taxes based on expenditure data. Many previous studies have focused on just one of these state taxes—not all three—and only very limited attention has been given to state gas taxes and sales tax exemptions. Third, although the paper focuses primarily on state taxes, the federal tax analysis provides a useful baseline for comparing the magnitude and dispersion of the state results. In addition, the federal estimates run through 2008 and are therefore useful as an update to earlier estimates, which have become dated (see Kasten, Sammartino, and Todder 1994; Gramlich, Kasten, and Sammartino 1993).

## Research Approach

The analysis has two components and considers separately the influence of the federal and state tax systems. Because the influence of state taxes on inequality has received less attention than the influence of the federal tax code, the authors emphasize the role of state policies. The first approach is cross-sectional in nature and compares before- and after-tax inequality across all 50 states, ranked by the extent to which their tax codes compress the after-tax distribution of income relative to the before-tax distribution. The second approach assesses the evolution over time of tax-induced income compression in mitigating labor income inequality.

The authors of this paper use two complementary measures of inequality—the Gini coefficient and the 90/10 income differential (the difference between incomes at the 90th percentile of the income distribution and the 10th percentile, measured in natural logs). Ranging from a value of 0

(which would represent a perfectly equal distribution in which every person's income was exactly the same) to a value of 1 (which would represent a perfectly unequal distribution in which one person earned all of the income in the society), the Gini coefficient tends to be heavily influenced by the middle of the income distribution and generally underweights differences in income in the tails of the distribution. The 90/10 income split does a better job of capturing differences in the tails of the income distribution and can be viewed as capturing overall inequality. The authors also present a few 90/50 and 50/10 income percentile splits to capture inequality in the upper and lower halves of the income distribution.

The main data for this paper are annual income observations from 1984 through 2008 from the March *Current Population Survey* (CPS). The CPS has collected annual income data for U.S. households since 1948 and includes detailed data on households in all 50 states and the District of Columbia, but little information on households' income tax liability and other tax payments. Households' federal and state income tax burdens are estimated using the NBER's TAXSIM module, which takes a variety of inputs and estimates each tax unit's federal and state tax liabilities.

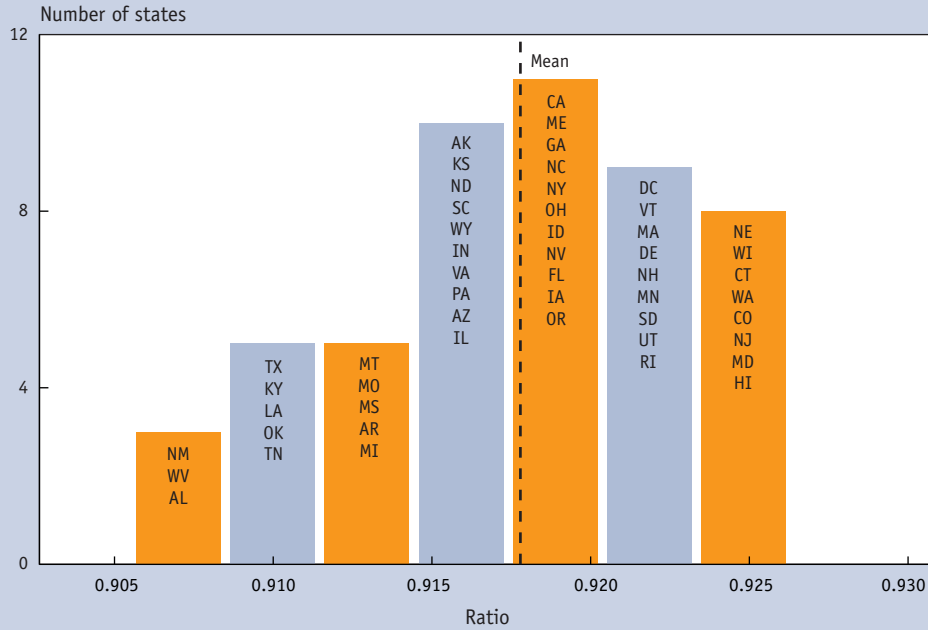
The unit of analysis is the federal tax unit—typically a household—and the analysis is restricted to tax units headed by full-time, full-year (FTFY) workers aged 16 to 64 years. Despite the paper's focus on wage inequality, the authors use total income as the income metric, as it forms the base for the federal income tax calculation. That said, by focusing on FTFY workers and using either the Gini coefficient or the 90/10 income differential as the measure of inequality, the authors ensure that the conclusions about income inequality are driven by wage inequality. That is, the FTFY age restriction of 16–64 year olds excludes the vast majority of households that receive government transfer income. Specifically, Medicare benefits are mostly eliminated from income calculations, as are most transfers of Supplementary Security Income (SSI), unemployment insurance, most Social Security payments, and so on. Furthermore, the measures used are little influenced by capital income because such income is mostly located at the very upper end of the income distribution—very high incomes do not contribute to the calculation of the 90/10 income differential and have very little influence on the Gini coefficient, which is most responsive to the middle of the distribution. On average, wages and salaries account for 84 percent of total income in the sample.

### **Key Findings**

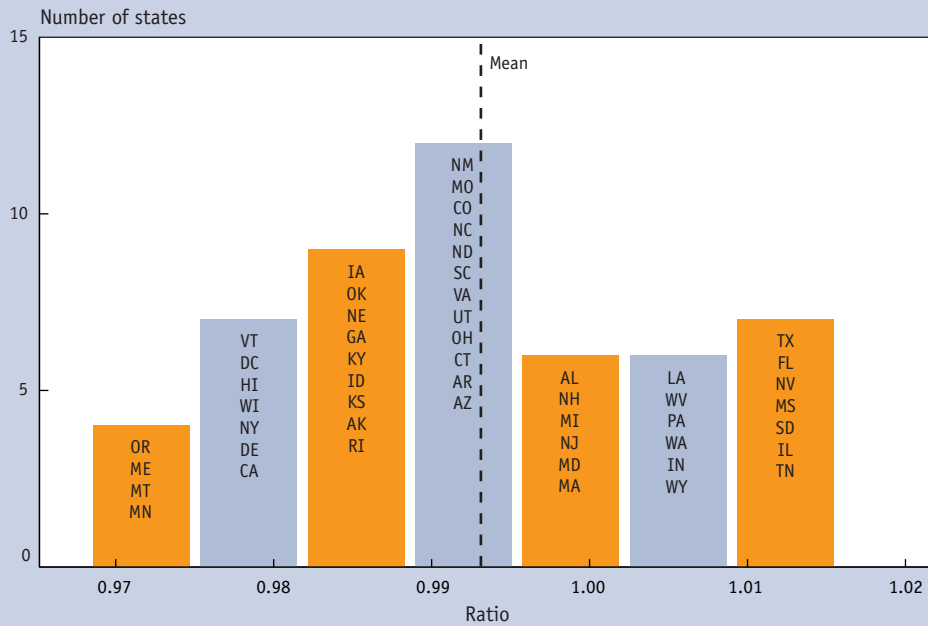
- The results indicate that the U.S. tax code substantially reduces income inequality in all states, with most of the compression of the income distribution attributable to federal taxes. On average, the compression achieved by state taxes is equal to only around 12 percent of the compression achieved by the federal tax code. Although average state compression is relatively small, the authors find some economically meaningful differences across the states. In a few states, such as Minnesota, Oregon, and Wisconsin, state tax compression amounts to about one-third or more of the compression brought about by federal taxes. On the other hand, the tax systems in eight states—including Florida, Illinois, and Texas—actually widen the income distribution.
- The state-levied gasoline tax plays a surprisingly large role in the amount of income compression across the states. On average, the gas tax is estimated to offset roughly 20 percent of the income compression achieved by state income and (general) sales taxes. The analysis also shows that some states' exemptions for food and clothing from state sales taxes also play a quantitatively important role in narrowing the after-tax income distributions of these states.
- Income compression due to federal and state taxes has been remarkably stable over the past 25 years. The rapid increase in before-tax labor income inequality widely documented by other researchers has thus been transmitted nearly one-for-one into after-tax labor income.

## Federal and State Compression

**Panel A. Ratios of Net and Gross Income Gini Coefficients (Federal Compression)**



**Panel B. Ratios of Net and Gross Income Gini Coefficients (State Compression)**



Source: Authors' calculations using CPS data.



## Implications

Given that the authors' cross-sectional analysis suggests the overall tax structure in the United States is progressive, the neutrality of the combination of federal and state taxes with respect to the increase in wage inequality is perhaps surprising. Under a progressive tax system in which the function relating income to taxes is stable, an increase in before-tax inequality would be expected to increase compression as measured by the 90/10 metric. Thus, the contrast found between the cross-sectional and time-series results on the impact of taxes on income equality—and, hence, in the effective, overall progressivity of the tax system—suggests that the parameters of the tax system may have shifted over time with the effect of reducing its overall progressivity to some degree.

Future versions of this research will test the robustness of the conclusions to alternative incidence assumptions and will incorporate corporate taxes and perhaps property taxes. The authors also rely on annual incidence estimates, which can differ significantly from lifetime tax incidence calculations (Fullerton and Rogers 1993; Metcalf 1994; Saez 1991). Certain individuals, such as students and retirees, may have low annual income, but high permanent (or lifetime) income. Thus, static, point-in-time incidence calculations can differ greatly from dynamic incidence calculations based on a person's lifetime resources. The authors note, however, that the annual versus lifetime limitation is inherent in much, though not all, of the wage inequality literature. This literature generally lumps together permanent and transitory income inequality, and thus fails to distinguish between "lifetime" and "annual" wage inequality.

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## Economic Literacy and Inflation Expectations: Evidence from a Laboratory Experiment

by Mary A. Burke and Michael Manz

complete text: <http://www.bostonfed.org/economic/ppdp/2011/ppdp1108.htm>

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### Motivation for the Research

While standard macroeconomic models assume that consumers' inflation expectations are rational and homogeneous, such expectations have been found to exhibit an upward bias on average and to vary significantly with demographic characteristics. Such behavior may hold implications for the successful conduct of monetary policy and the soundness of personal financial decisions, not to mention the predictive power of macroeconomic theory. Yet the dearth of empirical evidence on the formation of inflation expectations contributes to a lack of consensus in monetary policy debates, as exemplified by recent disagreements over the impact that the Federal Reserve's quantitative easing may have on inflation expectations. In light of these implications, monetary policymakers have expressed growing interest in studying the process by which inflation expectations are formed at the individual level. Bernanke (2007), in particular, acknowledges the potential disconnect between real-world inflation expectations and those implied by a rational expectations framework, and calls for research into the open question of "what factors affect the level of inflation expectations and the degree to which they are anchored?"

In this paper, the authors present new experimental evidence on heterogeneity in the formation of inflation expectations and use economic literacy and demographics to explain this variation. The experiment's design allows them to investigate two different channels through which expectations formation may vary across individuals: 1) the information chosen by subjects to assist them in predicting inflation and 2) subjects' use of given information. Both channels are likely to be relevant in the real world where subjects must first choose, consciously or not, what information to reference and then how to process that information, when forming inflation expectations.

## Research Approach

The authors' experimental approach holds advantages over survey methods of eliciting inflation expectations in that, in the experiment: 1) the subjects are rewarded based on the accuracy of their forecasts and so face incentives to think carefully, 2) the subjects form inflation expectations under a diverse set of macroeconomic scenarios, and 3) the subjects' behavior reveals features of the expectations formation process that cannot be readily ascertained via survey methods. While this process is necessarily circumscribed by the experimental design, the authors claim that the design reveals important aspects of subjects' beliefs about what drives inflation and therefore something about how they might predict inflation in a real-world context.

In the authors' experiment, subjects complete a set of inflation-forecasting exercises in a simulated economic environment. Payoffs are based on the absolute difference between a subject's forecast and the forecast derived from a macroeconomic model calibrated against historical U.S. data. In the first set of exercises, in order to inform their forecasts, subjects select from a menu of information sources of varying degrees of economic relevance. These are termed "endogenous information" exercises. In a second series of "exogenous information" exercises, the same subjects receive preselected, uniform information sets. This novel design enables the authors to investigate the individual contributions of both information selection and information processing to heterogeneity in the formation of inflation expectations.

The authors' experimental design differs in several key respects from those used in previous experiments that elicited how inflation expectations are formed. First, rather than always showing subjects specific data such as past inflation, in some exercises the authors offer subjects a choice of data. Second, in order to prevent the subjects from learning about the model during the course of the exercises, subjects are never informed of the "correct" inflation forecast in a particular exercise. Third, future inflation outcomes are determined by the model and are not influenced by individual subjects' own expectations. This last design feature is consistent with the notion that in the real world people are likely to act as if their individual expectations do not affect the path of future inflation.

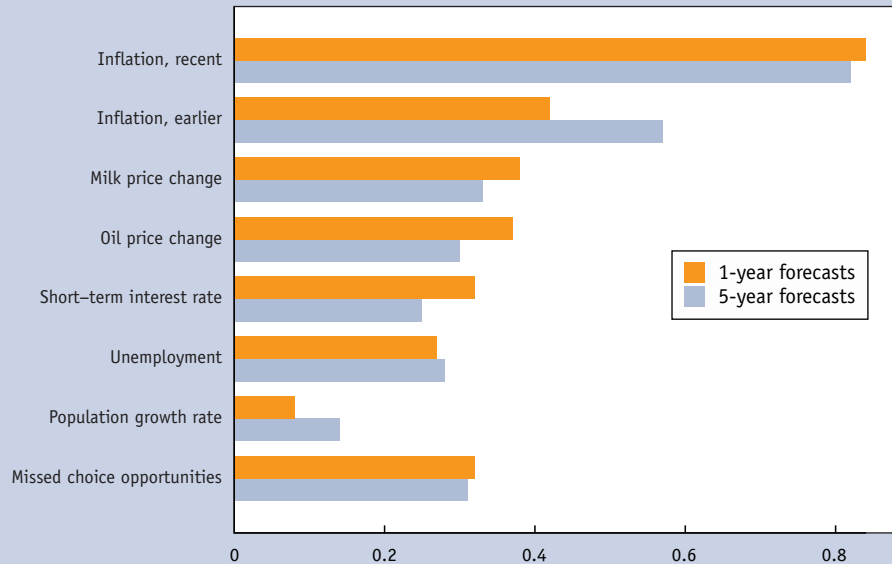
The experiment consisted of six components: 1) a brief set of questions related to past and future U.S. inflation, 2) a series of eight (incentivized) inflation-forecasting exercises pertaining to a simulated economy that offers a menu of information sources to choose from, 3) a set of free-response questions about how subjects selected information in the preceding exercises, 4) a series of nine (incentivized) inflation-forecasting exercises for a simulated economy in which subjects received information chosen by the authors, 5) a set of 16 (incentivized) multiple-choice questions designed to measure economic and financial literacy, and 6) a demographic questionnaire. All the subjects completed each experimental component and received detailed instructions prior to each phase of the experiment. Before the forecasting exercises began, the subjects worked with a practice interface and took an ungraded quiz that indicated whether they understood the instructions. Answers to the quiz were revealed immediately, just before subjects began the forecasting exercises, to ensure that they understood the instructions.

## Key Findings

- In the simulated-economy forecasting exercises, more economically literate subjects chose more relevant information (in the endogenous information exercises), and made better use of given information (in the exogenous information exercises). Therefore, they made more accurate forecasts in general.
- Economic literacy had a greater impact on subjects' performance (measured by mean absolute errors within-subject) in the endogenous-information exercises than in the exogenous-information set. This finding reflects the fact that endogenous exercises required both selection of appropriate information and the ability to make use of information once selected, thereby affording two channels through which literacy contributed to forecasting success.

## Ranking of Information Sources

Average Choice Rates, Sum=3



Source: Authors' research.

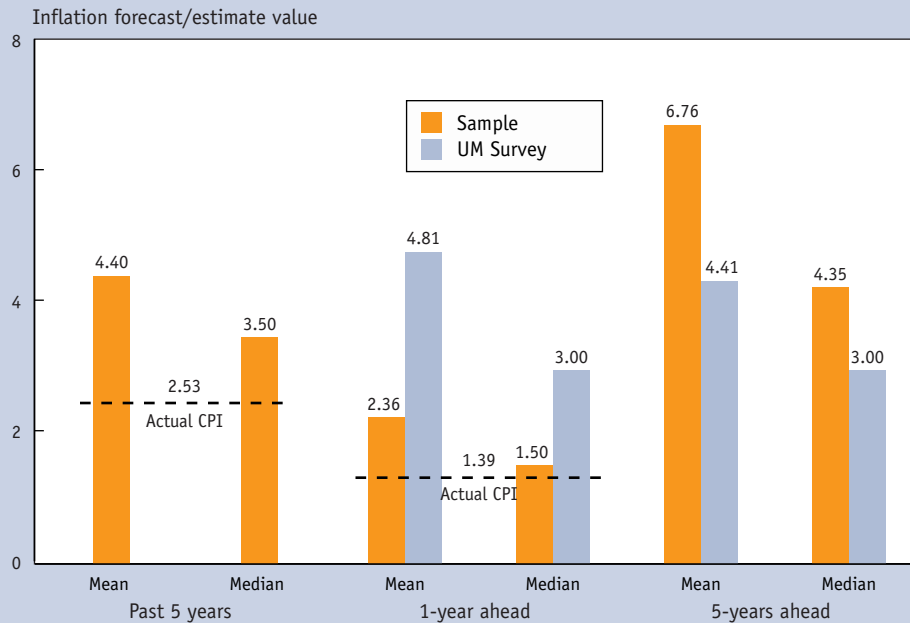
- The effects of economic literacy on forecasting performance are highly significant and are robust to an extensive list of demographic and socioeconomic controls, including general educational attainment—both own and mother's—as well as household income, age, gender, and race. Therefore, one can be fairly certain that the associations between economic literacy and inflation expectations do not arise spuriously, and that economic literacy does have some influence on the forecasts made. In addition, performance in the forecasting exercises cannot be reduced to mere numeracy. Both financial and monetary literacy contributed independently to success at forecasting inflation.
- Economic literacy is also associated with the subjects' forming more accurate perceptions and making more accurate predictions of actual U.S. inflation, findings that corroborate those observed for forecasts in the simulated economy.
- Compared with previous studies of survey data on inflation expectations, the authors find that fewer demographic factors are associated with variation in inflation expectations—and economic literacy accounts for much of the apparent demographic variation in expectations. For example, while women give higher estimates of past U.S. inflation than men do, this discrepancy can be accounted for by gender differences in economic literacy. African-Americans have higher mean errors in forecasting inflation in the simulated environment (but not when estimating past U.S. inflation), indicating stronger positive inflation bias, and higher absolute errors as well, but the effects become insignificant after controlling for economic literacy.

### Implications

The authors' findings imply that variation in inflation-forecasting behavior observed in previous experiments—which in general have provided all of their subjects with the same information sets rather than offering a choice of information—while significant, is likely to be substantially diminished relative to real-world variation in such behavior. Macroeconomic models also generally fail

## Inflation Perceptions and Forecasts: Experiment Sample versus University of Michigan Survey

Polling Date: December 2009



Source: University of Michigan and authors' calculations.

to allow for heterogeneity in the nature of the data employed in making economic forecasts. Those models that do admit heterogeneity in expectation formation, such as Mankiw and Reis (2002), Carroll (2003), and Malmendier and Nagel (2009) among others, tend to posit that agents hold similar conceptual models of inflation and yet may update their data at different frequencies or apply different learning rules in updating their parameter estimates.

Demographic and socioeconomic factors influence behavior in some dimensions, although the effects are less than expected based on the results of previous surveys, and many of the effects are not robust. The authors' findings suggest that the demographic variation in inflation expectations observed in various survey data may be partly attributable to differences in economic literacy across groups.

Taken together, the results suggest that improved economic education, including possibly the education provided by central bank communications, can promote greater uniformity and accuracy in inflation expectations. In particular, a comparison of subjects' performance on the exogenous and endogenous exercises suggests that consumers' inflation forecasts might be improved simply by teaching them to focus on recent aggregate inflation data rather than on specific prices, such as the costs of food and energy that enter into "headline inflation." For such education to be effective, however, subjects would first need to understand the concept of aggregate inflation and how to access information on the consumer price index or similar measures, which often exclude items like food and energy that are subject to price volatility, and neither prerequisite should be taken for granted for the average consumer.

## **Do Borrower Rights Improve Borrower Outcomes? Evidence from the Foreclosure Process**

*by Kristopher Gerardi, Lauren Lambie-Hanson, and Paul S. Willen*

complete text: <http://www.bostonfed.org/economic/ppdp/2011/ppdp1109.htm>

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### **Motivation for the Research**

The U.S. housing crisis is still playing out in terms of foreclosure sales, which states enact through one of two ways: power-of-sale or judicial review. The majority of states conduct foreclosures using the power-of-sale method, which means that when a mortgage is issued, the borrower grants the lender the right to hold a foreclosure auction in the event that the loan goes into default. Under judicial review, used by 18 states located mainly in the Northeast, a court supervises the foreclosure proceeding. The policy intent of judicial review is to afford the borrower some extra measure of protection by ensuring that the foreclosure process is overseen by an impartial third party. In the wake of the foreclosure crisis, some have advocated for the complete elimination of power-of-sale foreclosure, and several states have considered bills mandating judicial foreclosure—both of these policy prescriptions are predicated on the idea that borrowers in default will benefit from greater protections than are available under power-of-sale statutes and that preventing foreclosures is advantageous at the local, state, and national level. Given the immense number of foreclosures being conducted or pending in this country, there is significant public interest in knowing which foreclosure process yields better results, but previous studies have used small samples that do not truly represent the national mortgage market and have offered inconclusive evidence as to whether and how foreclosure outcomes differ in power-of-sale versus judicial states.

### **Research Approach**

The authors study the effectiveness of enhanced borrower protections afforded by judicial review and a policy known as “right-to-cure,” which essentially halts the foreclosure process for a certain amount of time after a borrower defaults on a mortgage. They improve on previous studies by using nationally representative data from the recent crisis and from the pre-crisis period and by employing a wide variety of specifications to check their results. The primary dataset comes from Lender Processing Services (LPS) and consists of loan-level data for about 60 percent of the first-lien residential mortgages in the United States, including those managed by nine of the top 10 loan servicers. The LPS dataset contains mortgages originated between 2005 and 2007, which the authors follow through April 2011, and is representative of the entire U.S. mortgage market. It tracks the monthly repayment status of loans that fall into any of the following categories: held by banks, securitized by the government-sponsored enterprises, securitized by private institutions, and originated by federal agencies such as the Federal Housing Authority and the Department of Veterans Affairs. The LPS data show whether a borrower is current or behind on payments, whether this delinquency is for 30 days, 60 days, or 90 days or more, whether the lender has initiated a foreclosure proceeding, the end date of the foreclosure process, and the repossession date. The authors use an algorithm developed in previous work to identify any loan modifications. Using the LPS data, the authors construct a sample of mortgages originated between 2005 and 2007 that at 90-days past due entered serious delinquency (three consecutive missed monthly payments) before March 1, 2009. These mortgages are observed for at least 18 months after becoming seriously delinquent and followed through August 2010; this end date avoids compromising the sample due to the national “robo-signing” problem that came to light in the fall of 2010, resulting in a slowdown or suspension of foreclosures in judicial states.

A second loan-level dataset from CoreLogic tracks privately securitized mortgages, including sub-prime, alt-a, and jumbo prime loans. While similar to the LPS dataset, the CoreLogic dataset is not

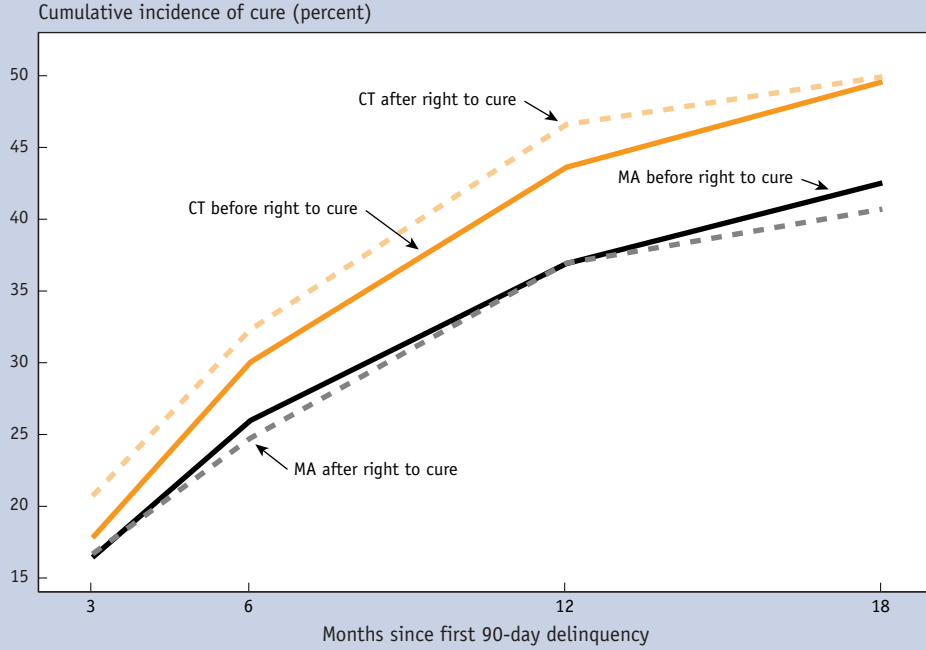
representative of the entire U.S. mortgage market; it has a longer time series going back to the 1990s and identifies when a loan is modified, paid off in full, or discharged via a short sale. The authors construct a sample from the CoreLogic data that overlaps the LPS sample, and use the CoreLogic sample to check the representativeness of the LPS sample results and the accuracy of modifications identified in the LPS sample. Another sample from the CoreLogic dataset uses mortgages originated between 2000 and 2002 and observes them through 2005, thus tracking a time period before the current housing crisis. This earlier sample lets the authors follow borrowers for a longer period of time and see whether in a more normally functioning housing market the judicial foreclosure process produced more significant borrower cure rates.

The authors gauge four potential outcomes in judicial versus power-of-sale states for a borrower who is seriously delinquent on a mortgage: 1) cure, meaning the borrower catches up on the payments or repays the loan in full; 2) modification, meaning that the lender changes the original contractual terms so the borrower can repay more easily; 3) foreclosure, meaning that the lender repossesses the house; and 4) persistent delinquency, a situation in which a seriously delinquent borrower does not cure the problem and the lender has not completed the foreclosure. These various outcomes are gauged at three-month, six-month, 12-month, and 18-month intervals after the initial 90-day delinquency began. The cumulative incidence of loan outcomes is computed, and the differences between the judicial and power-of-sale states are analyzed by estimating logit regressions over the specified time horizons. The authors also analyze borrower outcomes by looking at the monthly hazard of foreclosure and cure, as this method controls for the right-censoring that occurs in the cumulative-incidence functions and provides additional insights. They model the hazards using a multinomial logit model that enables them to control for observable differences in mortgage and borrower characteristics and perform a competing-risks analysis by following borrowers each month after they enter serious delinquency. Using the competing-risks model, they construct the predicted cumulative-incidence function over a 72-month horizon for a prototypical borrower who is 90-days delinquent. This identifies the differences in the cumulative hazards between the judicial and power-of-sale states for the baseline 2005–2010 LPS sample and for the 2000–2005 CoreLogic sample.

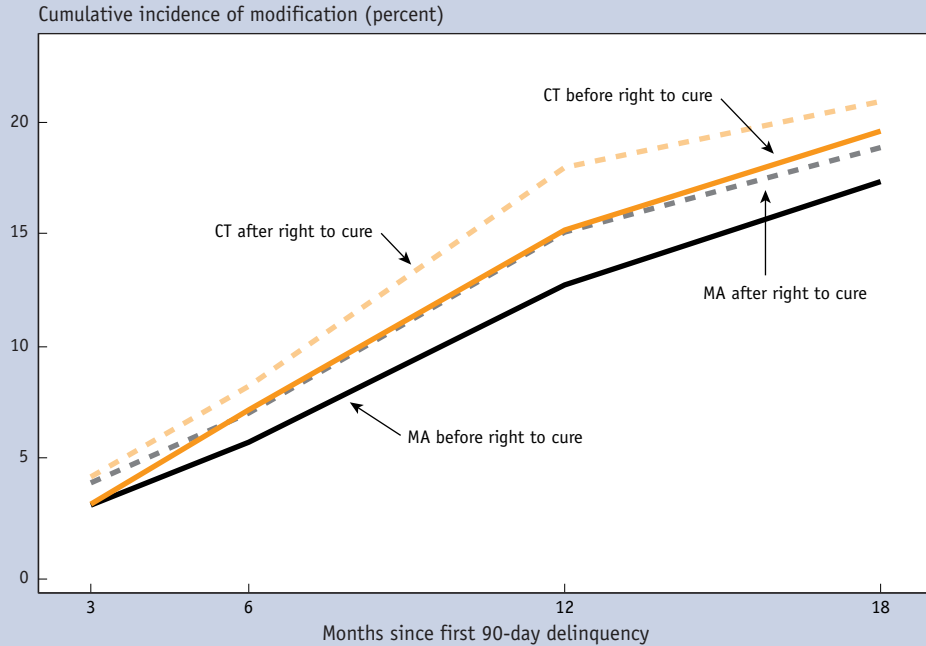
To avoid a potential omitted variables problem generated by the regional concentration of judicial review states, the authors focus on a “right-to-cure” statute instituted in Massachusetts, a power-of-sale state. The right-to-cure policy prevented lenders from starting foreclosure proceedings for 90 days after a borrower entered serious default. The authors compare the Massachusetts foreclosure outcomes before and after the policy took effect on May 1, 2008 with outcomes in neighboring states (some power-of-sale and some judicial) that did not adopt such a borrower protection law. They use LPS data on individual first-lien mortgages originated between 2005 and 2007 in Connecticut, Massachusetts, New Hampshire, and Rhode Island; in most respects the borrowers in these four states are comparable in terms of observed characteristics. The sample is restricted to one-to-four-family homes and condominiums, since these are the properties covered by the Massachusetts right-to-cure statute. By looking at the same state before and after the policy intervention, they control for state effects, and by comparing outcomes with neighboring states they control for time trends in borrower outcomes. The delinquent borrowers are divided into two cohorts, those who entered serious delinquency in January, February, or March 2008 and therefore were unlikely to benefit from the right-to-cure protection, and those whose mortgages became 90-days delinquent in April, May, or June 2008 and hence were likely covered under the right-to-cure statute. Using a difference-in-differences specification, the authors estimate the probability that borrowers cure their delinquency or successfully negotiate with lenders to modify their mortgage. The first difference reflects the change in Massachusetts cure rates before and after the statute took effect, and the second difference identifies the change in cure rates during the same period in the neighboring states. As in the comparison of judicial and power-of-sale states, the results are tested using a wide variety of alternative model specifications and sample definitions.

## Fitted Probabilities of Cure and Modification

Panel A. Cures



Panel B. Modifications



Source: Lender Processing Services (LPS) and authors' calculations.

Note: Cure and modification probabilities are based on right-to-cure results for an average fixed-rate mortgage borrower in Massachusetts or Connecticut at 3, 6, 12, and 18 months after becoming 90-days delinquent.

## Key Findings

- There is little difference in the fraction of borrowers who cure their delinquencies in power-of-sale states compared with judicial states. One year after entering serious default, 26.0 percent of borrowers in judicial states cured their default, compared with 25.6 percent in power-of-sale states. When controlling for differences in observable loan and borrower characteristics after 12 months and after 18 months, the cure rate is 3 percentage points higher in power-of-sale states.
- Modification rates are not affected by the legal regime: after six months, 8.8 percent of borrowers in judicial states received modifications compared with 10.3 percent in power-of-sale states. Eighteen months after serious delinquency, modification rates in power-of-sale states were 2 percent higher than in judicial states.
- While judicial review successfully reduces the likelihood of foreclosure, the difference is accomplished not by an increase in cures but rather by an increase in the number of persistently delinquent borrowers, most of whom are unlikely to cure and eventually do go through foreclosure. The monthly hazards show that the foreclosure half-life, meaning the number of months needed to complete 50 percent of foreclosures calculated from the time of the first 90-day delinquency, exceeds 36 months in 15 of the 18 judicial states, but does so in only seven out of 33 power-of-sale states.
- Both judicial foreclosure and the right-to-cure law dramatically extend the foreclosure timeline. In judicial states, a year after a borrower becomes seriously delinquent, lenders had auctioned off only 14 percent of properties, compared with 35 percent in power-of-sale states. The implementation of the right-to-cure law in Massachusetts essentially halted foreclosure filings and led to a consistent 90-day delay in filings for all subsequent foreclosures.
- After the Massachusetts right-to-cure period was introduced, the probability that borrowers would cure their delinquencies remained the same, around 16.0 percent. There was no economically meaningful change in modification rates in Massachusetts following the Commonwealth's implementation of the right-to-cure law.

## Implications

The notional value attributed to the judicial foreclosure process is that greater borrower protections will enable an increase in better outcomes—curing the default by becoming current on the mortgage, renegotiating more favorable terms with the lender, or selling the property. Yet the authors' rigorous empirical test of this issue shows that there is no net difference in the legal regimes, as judicial states just endure longer foreclosure processes, not a lower incidence of foreclosures. Judicial review has the unintended consequence of slowing the efficient resolution of foreclosures. In some cases properties undergoing the foreclosure process are more prone to enduring the negative externalities, such as vandalism and crime, associated with failed homeownership.



# Account-to-Account Electronic Money Transfers: Recent Developments in the United States

by Oz Shy

complete text: <http://www.bostonfed.org/economic/ppdp/2011/ppdp1110.htm>  
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## Motivation for the Research

Account-to-account (A2A) electronic money transfer is a low-cost platform that does not require any face-to-face interaction in order to transfer money between bank accounts held by different holders. In general, electronic transfers involve commercial transactions (paying bills to small businesses outside the point of sale) and noncommercial transactions, such as money transfers within a circle of family and friends. This paper studies money transfers between bank accounts held mainly by individuals. Compared with other advanced and developing countries, account holders in the United States are being introduced to A2A electronic funds transfers at a very late stage in the development of this technology.

This paper aims to do three things: 1) to explain the emerging decentralized pattern of providers by which A2A money transfers are slowly becoming available in the United States, led by fund transmitters such as PayPal and Amazon Payments; 2) to construct an analytical framework for evaluating this emerging market structure; and 3) to identify why electronic funds transfers among households and small businesses are still relatively rare in the United States compared with practices in other countries.

The ability to conduct A2A money transfers has emerged differently in the United States than in Europe and has resulted in a different market structure. In the United States, the market structure is decentralized, consisting of various groups and isolated money transmitters that operate on different networks. Unlike consumers in other countries, most consumers in the United States first gained access to low-cost A2A money transfers outside of the banking industry. In addition, perhaps because of the heavy use of paper checks in the United States, the U.S. Postal Service has not been involved in providing payment services as was the case in some European countries, where post offices ran the Postal Giro networks that were connected to commercial banks. In the United States, nonbank money transmitters, such as PayPal and Amazon Payments, provide registered users with an online interface to transfer money among registered users. Senders can fund their transfer from their external bank accounts without any fee, or by a debit or credit card (for a fee). Receivers can then transfer their balance to their bank account or spend it using a debit card. Only in the past two years have several commercial banks in the United States begun to integrate A2A money transfer services with online banking.

During the past 90 years, the Federal Reserve System was (and still is) involved in check clearing, while the federal government has continued its involvement via the Check 21 Act of 2003. These efforts may have contributed to the slow adoption of electronic A2A transfers. The recent introduction of new A2A technologies reveals that the United States is heading for multiple A2A transfer networks formed by groups of commercial banks and isolated money transmitters. It is hard to tell whether these separate “silos” are the result of the large number of banks in the United States, a lack of coordinated effort, or both. Regardless, most bank account holders in the country still lack low-cost access to online transfer services whereby they can transmit funds to any other account within the nation.

## Research Approach

The paper begins by defining some relevant terms. Money transfers are generally classified by the type of entities involved and the direction of transfer. The most common types of electronic money transfers, classified by these criteria, are: 1) person-to-person (P2P), 2) person-to-business (P2B), 3) business-to-person (B2P), and 4) business-to-business (B2B). Adding local and federal government, transfers are also made from 5) person-to-government (P2G), 6) government-to-person (G2P), and 7) government-to-business (G2B). B2P transfers are rare here except for employment-related direct deposits; electronic P2P transfers hardly exist in the United States; and currently P2P transfers in this country are either cash based or are accomplished by writing personal paper checks.

A2A money transfers differ from online bill payment (OLBP). In an A2A transfer, the payee provides the payer with the payee's bank account information. This paper defines an A2A money transfer as any transfer performed via online or mobile banking in which the sender logs into his bank account and keys in the transfer recipient's bank routing and account number. In OLBP, such as monthly payments made to utilities and insurance companies, the payer does not know the payee's account information; instead, payment is made using the Internet via the website of a bank, company, or other institution that issued the bill. In addition to applying to P2P transfers, the term A2A applies more to payments made by households to a small business (for example, making a payment to a dentist) rather than to a large company. Some interfaces bypass the need for the sender to key in the recipient's bank account information, by sending an e-mail message asking the recipient to key in this information.

For the purposes of this paper, *direct* transfers are defined as electronic money transfers between two bank accounts with no need to prefund the sending account with funds from another bank's account or to redeposit the transferred funds from the receiving account into another bank's account. For the past few years many commercial banks did provide one form of direct A2A transfers via FedWire. The problem was (and still is) that from the household's perspective, commercial banks set prohibitively high fees for these transactions: as an example, the fee to send and, separately, the fee to receive a transfer has ranged from \$10 to \$30 per transfer. Indirect transfers are defined here as transfers made by prefunding an account held at a nonbank third party, or transfers that involve having to redeposit money into a bank account. Transfers via nonbank money transmitters (such as PayPal and Amazon Payments) require the sender to prefund a nonbank account either via a bank account with the use of an automated clearing house (ACH) or with a debit or credit card.

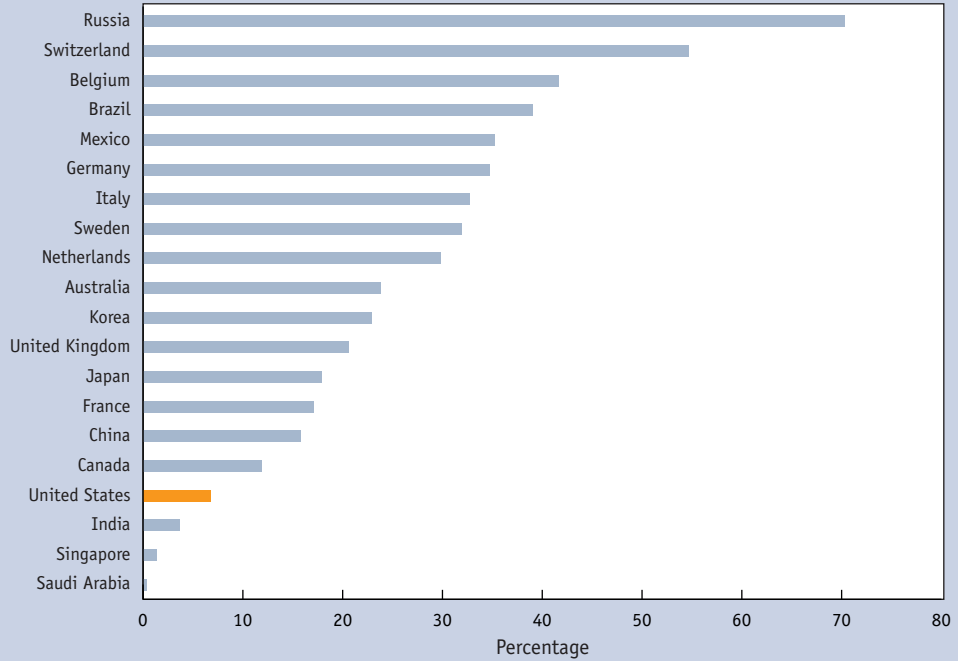
Having defined the relevant terms, the author goes on to analyze whether the slow introduction of A2A in the United States reflects a market failure (in the sense of a largely missing market). Next, the author provides data and international comparisons of the use of A2A electronic funds transfers. He then reports and analyzes recent developments in A2A money transfers in the United States. At the heart of the paper is a section in which the author constructs analytical frameworks to explain the coexistence of multiple payment networks and evaluates the possibility of adoption failures. He concludes by briefly discussing policy options, including the policy of nonintervention, that might further the use of A2A money transfers in the United States.

## Key Findings

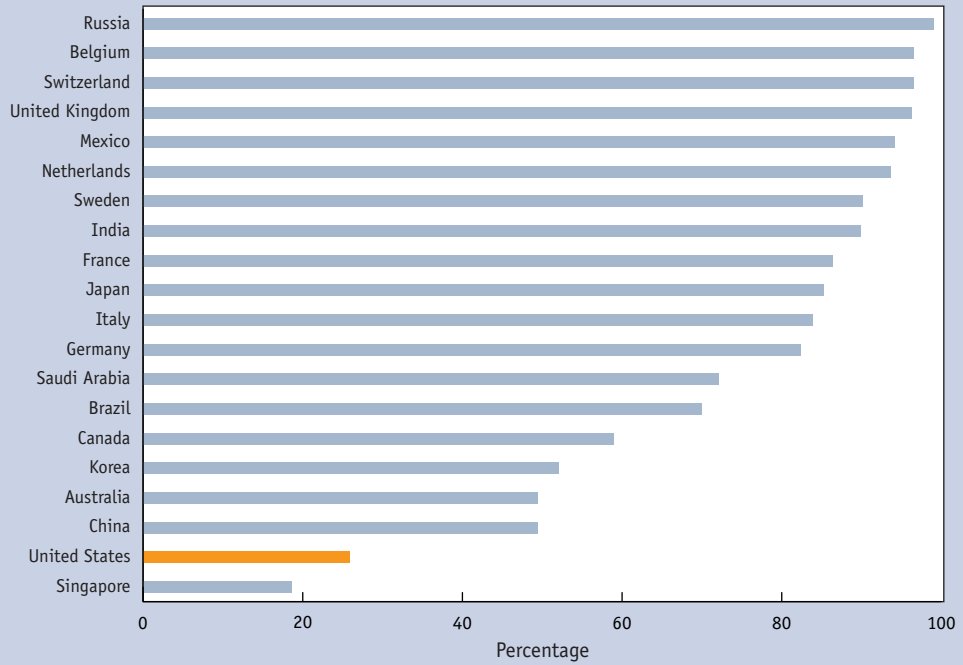
- In percentage terms of the dollar value of total credit transfer transactions, the United States has the fourth-lowest percentage of A2A transactions (less than 6.8 percent in 2009) among 20 advanced and developing countries, according to figures compiled by the Bank of International Settlements.
- During the last two years, a few commercial banks in the United States began introducing new interfaces that enable account holders who use online banking to electronically transfer money from their own bank account to bank accounts held by other individuals. Bank of America (the

## Credit Transfers in 20 Countries

Panel A. Percentage of Number of A2A Transactions



Panel B. Percentage of Dollar Value of A2A Transactions



Source: Bank of International Settlements.

largest in terms of total U.S. deposits) announced this service in August 2009 and ING Direct followed. Bank of America, JPMorgan Chase, and Wells Fargo have announced that they have formed a new P2P payments joint venture called clearXchange. About 200 banks, including Bank of the West, Citibank, and PNC, use Popmoney technology transfers among accounts within this group of banks. Thus, some banks in the United States allow their customers to transfer funds to any account in any bank within the United States, whereas others form joint ventures in which transfers are restricted to accounts held within the network of the contracting banks.

- The paper constructs an analytical model in which each payer's utility increases with the expected number of payments that can be made on the payer's payment network. The analysis shows that an equilibrium with multiple incompatible payment networks exists unless the cost of signing up for an additional payment network is sufficiently low.
- An adoption failure (and therefore, a market failure) occurs at intermediate values of a payer's cost of registering with a second payment network. In this case, the market outcome is such that each payer is registered with only one payment network, whereas registering half of the payers with a second network (100 percent connectivity in the case of two networks) enhances user surplus. The adoption failure occurs because of network externalities: although society as a whole would benefit by having 100 percent connectivity, if the cost of registering with a second network is higher than the benefit gained by the individual, the payer will not register with the second network.
- In cases where there is asymmetry with respect to the utility gain from sending money and receiving money via A2A transfers, the degree of asymmetry determines users' incentives to register with a second payment network.
- In a case with two bank networks plus a money transmission payment network, such as PayPal or Amazon Payments, the costs of registering with an additional network (beyond registering with two bank networks) determine a range in which there are two possible additional equilibria. One reflects an adoption failure: ideally all bank account holders would benefit if they all registered with the money transmitter, but they choose not to do so because they expect nobody else to do so. In the other equilibrium all bank account holders do register with the nonbank payment network, so this adoption failure is avoided.
- Three policy options may be worth considering to remedy the possible market failure associated with the relative dearth of A2A money transfers in the United States: no intervention (allowing the market to develop on its own), intervention (allowing a third party, private or public, to create incentives for commercial banks to provide their account holders with low-fee access to the automated clearing house (ACH) and Fedwire), and creation of a completely new network.

## Implications

The market structure of A2A money transfers in the United States is decentralized and now consists of various groups of banks and isolated money transmitters, each operating a different network. Theoretical models suggest that social welfare is lower in such a dispersed structure than in a more centralized one, since an individual payer's cost to register with an additional network exceeds his or her individual benefit (although the social benefit of that individual's registering is greater than the cost). Time will tell whether this decentralized market structure in the United States will lead to very slow adoption of A2A transfers by households and further slow the transition from cash and checks to electronic payments.

# Working Papers

w-11-6

## House Price Growth When Kids are Teenagers: A Path to Higher Intergenerational Achievement?

by Daniel H. Cooper and María José Lunego-Prado

complete text: <http://www.bostonfed.org/economic/wp/wp2011/wp1106.htm>

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### Motivation for the Research

As a public policy goal the United States has long encouraged homeownership to achieve more stable communities and to encourage households to save and improve their living standards. Since the 1986 Tax Reform Act made interest on home equity loans of up to \$100,000 tax deductible and credit markets have become more liberal over the last 20 years, U.S. households have increasingly been able to finance expenses by borrowing against their home equity. An important research topic has developed around how housing wealth affects consumer behavior, especially given the recent U.S. house price boom and bust.

This paper's motivating idea is that because housing equity rises with house price appreciation, homeowners may borrow against the equity in their homes to fund their children's college education, which in the United States is traditionally a large financial burden. Consequently, rising house prices may improve the higher educational opportunities available to children whose families have experienced a gain in housing equity, with these better opportunities potentially translating into higher lifetime earnings for these children as adults. Rising house prices should be particularly important for children whose parents are potentially liquidity constrained and lack available funds for financing their kids' education. In contrast, rising house prices should have little, if any, impact on the children of renters.

### Research Approach

The authors join two existing strands of research—the educational achievement literature and the intergenerational mobility literature—to explore the impact of changing house prices during kids' teenage years on their earnings as adults. The educational achievement literature has established that a wage premium exists for highly educated individuals holding at least a four-year undergraduate degree. The intergenerational mobility literature estimates the relationship between parents' income and the income their children earn as adults, conditional on age and other factors. The authors' empirical approach seeks to elicit whether house price gains during the children's teenage years impact their adult income beyond the standard intergenerational earnings transmission channel.

Data from the Panel Study of Income Dynamics (PSID) are used to study intergenerational linkages in the United States. The PSID follows a representative sample of U.S. households and their offspring, starting in 1968. The PSID contains identifiers to link children with their parents along with data on individuals' birth years, so the authors can compile relevant house price and other data around the time that the children were 17 years old. House price appreciation data come from the Federal Housing Finance Agency (FHFA) and are assigned to child/parent pairs based on the metropolitan statistical area (MSA) where they live when the child is 17 years old. The authors' final sample contains 913 "child" respondents whose 17th birthday took place between 1979 and 1999. The sample encompasses 126 different MSAs that experienced a broad range of house price growth during this 20-year period. The maximum house price appreciation was 39 percent over this period, while the maximum price decline was 28 percent. Among the heads of household in the sample,

78 percent are male, 44 percent are black, 16 percent of parents have a four-year college degree or higher, and on average the household heads have completed over 13 years of schooling.

The benchmark regressions compute an intergenerational family income elasticity. In order to alleviate any downward bias from measurement error, parental income is averaged over a five-year period centered around the year the child was 17 years old. Children with potentially liquidity-constrained parents are identified based on their parents' nonhousing wealth information contained in the PSID wealth supplement closest to the year before the child turns 17. A family is considered liquidity constrained if its wealth holdings are at or below the median of the variable in question. The liquidity-constraint dummy interacts with the real house price growth variable in the MSA where the child resided at age 17, in order to examine the differential effect on children's future earnings of house price growth for potentially constrained versus unconstrained families. Two-year house price growth prior to the child's turning 17 is used for the benchmark analysis, but the authors also test for house price growth measured at different frequencies. Children's earnings as adults are calculated based on income data from 2005 and 2007. To evaluate the direct effect that house price growth has on post-secondary educational attainment, the authors classify the children of homeowners into three broad educational categories: high school graduate or less, some college, and college degree or higher.

### **Key Findings**

- House price appreciation during their teenage years has an effect on children's future earnings, conditional on parental income and other demographic factors. A 1 percentage point increase in house prices when children are 17 results in roughly 0.8 percent higher average annual income for the children of homeowners and in 1.2 percent lower income for children whose parents rent their family's housing. This effect translates into roughly \$364 additional yearly income for the children of homeowners, and \$354 in lost annual income for the children of renters, based on the median earnings of the two groups.
- Within the group of homeowners, the impact of fluctuating house prices on children's future earnings is significant. Other things being equal, a 17-year-old whose parents experienced house price growth of around 6 percent (the 75th percentile of house price appreciation) is expected to have about 6.6 percent higher annual income than the child of a homeowner who experienced -2.5 percent house price growth (the 25<sup>th</sup> percentile of house price appreciation).
- Assuming that financial constraints can pose obstacles for funding the costs of higher education, it is expected that for homeowners with limited nonhousing financial resources, house price growth during their children's teenage years might have an economically meaningful impact on their future income. Financially constrained homeowners who experienced house price growth of 1 percentage point had children who realized 1.2 to 1.6 percent higher annual income as adults. In addition, these children are more likely to get an undergraduate degree and also tend to have lower noncollateralized debt (student loans, credit cards, or non-securitized loans) as adults compared with their peers from households that did not experience house price growth around the time of college matriculation.
- Children are about 12.7 percent more likely to have completed some college if their 17th birthday occurred during a period of house price appreciation. Although children from low-wealth households are about 22.4 percent less likely to have a college degree than children from high-wealth households, they are about 27.5 percent more likely to obtain a college degree when house prices are appreciating. In other words, the children of low-wealth parents are about as likely as the children of high-wealth parents to graduate from college when house values appreciate.

### **Implications**

To the best of their knowledge, the authors are unaware of other researchers looking at the impact that house price growth during the teenage years may have on future adult earnings. The authors

contribute to the literature by examining an additional channel by which changing house prices can impact household decisionmaking. They also offer an additional perspective on the intergenerational income relationship between parents and their children. The results offer some potential topics for further work—for example, what is the potential impact of the recent housing downturn and the ensuing Great Recession on children's college choices and future earnings?

w-11-7

## **Customer Recognition and Competition**

*by Oz Shy and Rune Stenbacka*

complete text: <http://www.bostonfed.org/economic/wp/wp2011/wp1107.htm>

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### **Motivation for the Research**

During the past 15 years the literature on behavior-based or history-based price discrimination has developed a spectrum of models to analyze different types of price discrimination based on particular types of customer recognition. Fudenberg and Tirole (2000) is a seminal contribution to a general analysis of behavior-based pricing within the framework of a two-period Hotelling duopoly model. In the Fudenberg and Tirole model the firm can distinguish its own inherited customers from those of the rival firm and design a discriminatory pricing scheme that exploits the fact that a customer's past decisions reveal information about this customer's brand-specific preferences. This type of behavior-based pricing model could largely be characterized as identity recognition according to terminology introduced by the paper's authors. Chen (1997), Villas-Boas (1999), Shaffer and Zhang (2000), Taylor (2003), Chen (2008), Gehrig, Shy, and Stenbacka (2011), Gabrielson (2004), Chen and Zhang (2009), Esteves (2010), and Gehrig and Stenbacka (2004, 2007) are examples of studies analyzing important theoretical aspects as well as significant implications and applications of behavior-based pricing. Fudenberg and Villas-Boas (2007) and Esteves (2009) present updated surveys of the literature on behavior-based price discrimination.

This paper introduces three different types of customer recognition—identity recognition, asymmetric preference recognition, and symmetric preference recognition—and focuses on the following questions: How does a firm's profit depend on the type of customer recognition it employs? What is the relationship between profits associated with uniform pricing (no customer recognition) and profits generated from discriminatory pricing schemes based on the different types of customer recognition? Do firms have an incentive to engage in information exchange regarding the recognized preferences of their customers in order to achieve symmetric preference recognition? Compared with uniform pricing, what are the consumer welfare effects of discriminatory pricing schemes based on different types of customer recognition? Do consumers benefit or lose from firms' exchanging information if the firms are able to recognize the preferences of consumers with whom they have an established customer relationship?

### **Research Approach**

The authors construct a benchmark analytical model of identity recognition, in which each firm can distinguish between its own customers and its rival's customers, and use this model to analyze preference recognition asymmetry, whereby firms learn the preferences of their own customers but not the preferences of their rival's customers. The authors then analyze the effects of symmetric preference recognition stemming from information exchange between firms regarding the characteristics of individual customers and compare the effects of the different types of consumer recognition on profits, consumer surplus, and total welfare. Finally, the authors compare the market performance associated with different types of customer recognition with the performance associated with uniform pricing.

## Key Findings

- Firms always benefit from recognizing the preferences of their customers, whether or not they share this information. Further, symmetric preference recognition resulting from information exchange among firms reduces the gains from preference recognition. This means that each firm has a unilateral incentive to acquire information regarding the individual preferences of its customers. Such customer-specific knowledge about individual preferences makes it possible for the firm to differentiate its price among its own customers. This price discrimination promotes the firm's profits compared with pricing based on identity recognition alone. A comparison of the equilibrium poaching prices shows that the competitive threat of being poached by the rival firm remains invariant across the configurations with asymmetric preference recognition and identity recognition. This finding also demonstrates that firms have no incentive to share information regarding customer-specific preferences. The reason for this is that information exchange enables firms to refine their targeted poaching price offers. Such targeted poaching offers intensify competition to the detriment of industry profits.
- Compared with identity recognition, consumers are worse off when firms can price discriminate based on asymmetric preference recognition. Transitioning to symmetric preference recognition (information exchange regarding consumer preferences) hurts consumers even more. This result can be explained by examining the effects of customer recognition on the price variation faced by different consumers, and hence on consumer surplus. More precisely, price discrimination based on recognition of consumer preferences introduces type-contingent price differences for loyal customers compared with pricing based on identity recognition alone. Thus, price discrimination based on asymmetric, preference-based recognition makes it possible for the firms to extract more surplus from consumers. Switching costs restrict the power of the rival firm to compete for this surplus extraction. This finding implies that consumers would benefit from a policy that would ban firms from exchanging information about their customers' individual preferences. In the authors' model, information exchange, in addition to inducing more aggressive prices targeted to consumers with a low preference for a certain brand, also generates less aggressive prices targeted to consumers with a high preference for the brand. At a fundamental level, information exchange reduces consumer surplus because it increases price variation across consumer types, thereby promoting the ability to extract consumer surplus.
- Compared with identity recognition, pricing based on asymmetric preference recognition reduces total welfare. Symmetric preference recognition (information exchange between firms) further increases this social loss. This finding implies that the loss to consumers from price discrimination based on asymmetric preference recognition exceeds the associated profit gains to firms. The total social loss from pricing based on asymmetric preference recognition decreases with the switching cost parameter, whereas it increases as a function of the loss from a mismatch. The magnitude of the loss from transitioning to symmetric preference recognition (information exchange) depends on exactly the same factors.
- The results of comparing the effects of the various types of customer recognition with a benchmark measure in which firms cannot engage in any price discrimination are as follows:
  1. Based on the types of customer recognition analyzed in this study, uniform pricing generates higher profits than any of the discriminatory pricing schemes.
  2. The consumer surplus under all types of price discrimination based on customer recognition is higher than the consumer surplus under uniform pricing.
  3. Total welfare is higher under uniform pricing than under any of the discriminatory pricing schemes based on customer recognition.



This three-part finding implies that competition is more intense when firms compete strategically using discriminatory pricing based on customer recognition than when they compete with uniform pricing. This conclusion holds true for all the different types of customer recognition analyzed in this paper. Discriminatory pricing essentially enlarges the set of strategic pricing options available to rival firms. Different discriminatory pricing schemes make it possible for firms to fine-tune their prices with respect to buyers' specific characteristics. When competitors are restricted to uniform prices, deviating to discriminatory pricing rules typically generates a strategic advantage to a given competitor. However, when all competing firms realize the strategic potential of price discrimination and apply discriminatory pricing, market competition is intensified. Consequently, under price discrimination all firms in the industry earn lower margins, whereas consumers benefit from more intense competition. Thus, with oligopolistic competition, the availability of discriminatory pricing traps firms in a classic "prisoners' dilemma." A commitment to refrain from engaging in price discrimination would benefit all the firms collectively, but each individual firm would have a strategic incentive to deviate from this agreement and introduce a discriminatory pricing scheme based on all available information on consumer characteristics.

### **Implications**

In terms of its implications for competition policy, the authors' model highlights how information exchange may serve as a device to better facilitate the extraction of consumer surplus. Together with alternative mechanisms emphasizing how information exchange may facilitate tacit collusion, the model gives strong support for policy conclusions that warn against exchanging information about individual customers or deals. At the same time, this study points to the limitations of the arguments presented by Padilla and Pagano (1997, 2000) in favor of information exchange as a mechanism to reduce the lock-in effects of asymmetric information in lending markets. In these studies of the credit market, information sharing has the advantage of making it possible to avoid granting funding to borrowers who belong to the rival's customer segment and who are not creditworthy. In view of this paper's findings, Padilla and Pagano's argument cannot be extended to industries that do not satisfy the stylized assumptions associated with their credit market model. In the model developed by the authors, information exchange achieves the double effect of inducing more aggressive prices targeted towards consumers with a low preference for a certain brand and less aggressive prices targeted to consumers with a high preference for this brand. Overall, information exchange reduces consumer surplus because it increases price variation across consumer types, thereby promoting the ability to extract consumer surplus. Lastly, with respect to the implications for competitive policy, the authors' second finding raises warnings against information exchange regarding individual customers in markets with asymmetric information about the preferences of individual customers.

The authors' study is conducted within the framework of a fairly general but nevertheless highly stylized symmetric model where the inherited proportions of correctly matched and mismatched consumers are equal. The analysis could be extended by adding structure to the model in a number of directions. It would be interesting to explore the implications of inherited asymmetries. Similarly, the authors' perspective has been restricted to a static analysis. It would be of obvious interest to explore potential dynamic implications of competition based on customer recognition. In a dynamic analysis it would be particularly interesting to trace the evolution over time of inherited asymmetries. Finally, the authors' conclusions regarding the consequences of information exchange are drawn following the standard assumption that the information is revealed to rival firms in a truthful manner. It would be interesting to explore the implications of information exchange under circumstances where firms use their knowledge of their customer base to strategically manipulate the information they choose to exchange with their rivals.

# On the Distribution of College Dropouts: Household Wealth and Uninsurable Idiosyncratic Risk

by Ali K. Ozdagli and Nicholas Trachter

complete text: <http://www.bostonfed.org/economic/wp/wp2011/wp1108.htm>  
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## Motivation for the Research

A large fraction of every cohort enrolled in a four-year U.S. college drop out before graduating. If a student comes from a lower-income family there is a greater tendency he or she will leave college and drop out sooner. Because obtaining a four-year degree leads to earning higher wages, the skewed dropout behaviors of rich and poor students perpetuate and exacerbate income inequality in the United States.

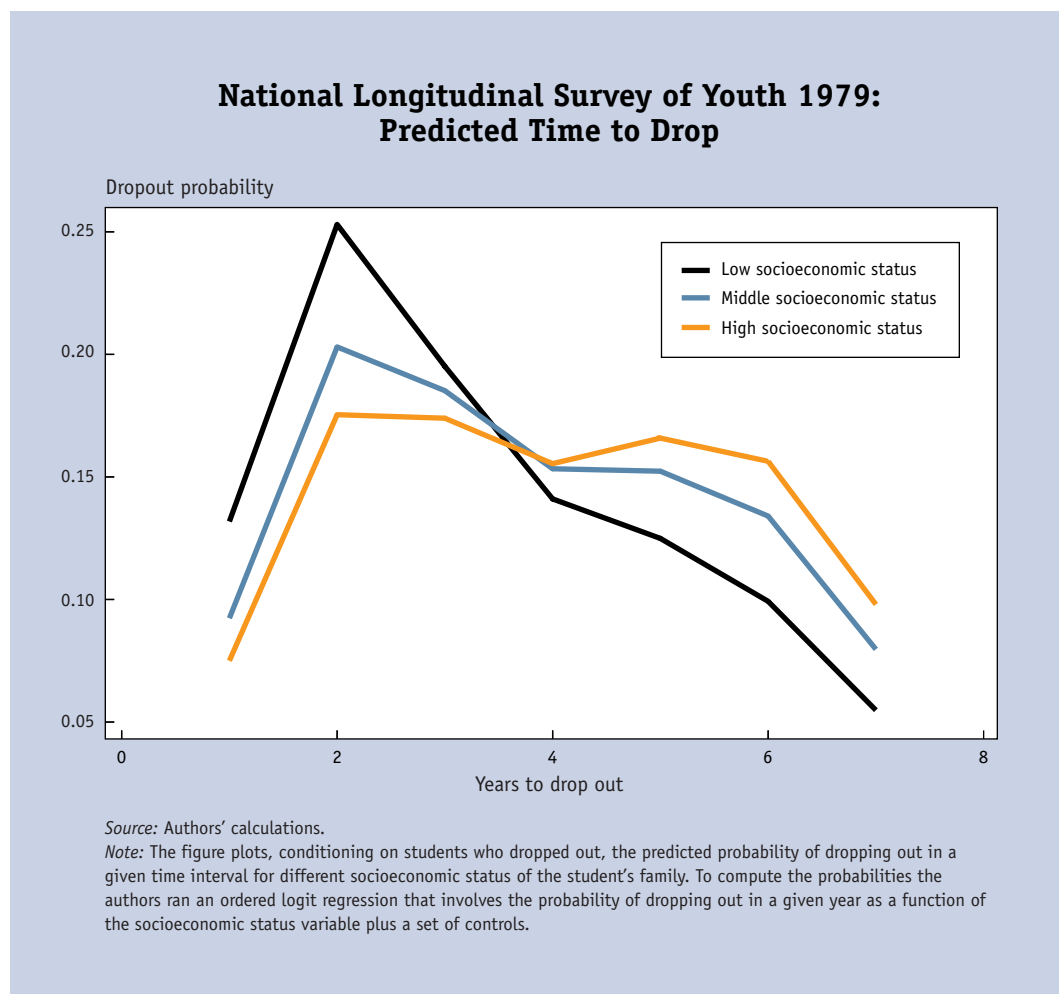
To better explain the connection between household wealth and dropout behavior, the authors propose a dynamic model of education choice. Their model treats the college enrollment decision as a risky investment in human capital, since students initially enter college not knowing their true academic ability. It incorporates Bayesian learning regarding the individual student's innate scholastic ability, knowledge of which the student updates after every exam period. In the model, the differences in the student's intrinsic academic ability and the initial wealth level of the student's family drive the high and skewed dropout rates among low-income students.

In brief, the authors' formal model posits that students enter college with a given wealth level and possess either low or high academic ability, albeit one that they are not fully informed about upon matriculation. At any point in time an individual can be enrolled as a full-time college student or be in the labor force working at either a low-skilled or high-skilled job. However, the high-skilled sector only employs workers who possess a four-year college degree, and one's lifetime wages depend on the time spent in college. At every period in college (say, a college semester or year) students receive an exam grade of excellent, pass, or fail, and then update their beliefs about their true academic ability. High-achieving college students never drop out and always graduate, but those students who learn that their ability is low find it better to drop out of college before graduation and enter the labor force. Students with average success update their beliefs and choose an optimal dropout time that equalizes the marginal gain from staying in college with the marginal loss from dropping out. Students from poorer families drop out sooner and more often; conversely, students from wealthier families are less likely to leave college and tend to drop out later in their college careers because they are more willing to take the risk of learning that they have low ability after paying the college tuition.

## Research Approach

To model the evolution of students learning about their innate ability and the decision to drop out, the authors use the Miao and Wang (2007) framework of entrepreneurial learning and survival and extend it to allow an individual's lifetime wage profile to depend on the time spent in the labor market and on the tenure in college, the latter as in Mincer (1974). In the standard Mincerian framework students choose the optimal amount of college education by comparing the marginal wage gain from attending an extra year of college with the marginal wage gain if they immediately enter the workforce. But Mincer's model is silent on the relationship between household wealth and educational profiles, and fails to account for students' almost unanimous claim, upon matriculation, that they intend to earn a four-year degree. This discrepancy suggests that a full explanation of the college dropout decision needs to explain how information about one's scholastic ability unfolds over time once a student enters university.

The authors use data taken from the National Longitudinal Study of the High School Class of 1972 (hereafter NLS-72) and the National Longitudinal Survey of Youth 1979 (hereafter NLSY) to compare the dropout behavior of students from low-income households and students from wealthy households. For the NLS-72, the authors focus on individuals who initially matriculated in a four-year college in 1972 and had no discontinuities in their college enrollment, while for the NLSY they focus on individuals who enrolled in a four-year college during or after 1979 and had no discontinuities in their tenure. The NLS-72 records the household's socioeconomic status at the time the respondent graduated from high school, and classifies 16.3 percent of families as low income, 41.7 percent as average/middle income, and 42 percent as wealthy. The authors compute aggregate dropout statistics, and also compare the dropout rates of rich and poor students in different years of college to test whether a larger proportion of low-income students drop out earlier in their college careers. They also control for available proxies of ability that are not strongly collinear with a household's socioeconomic status. To explore the distribution of dropout times across students with different household income, they run an ordered logit regression of the dropout time for students who leave college before completing a four-year degree. The results are robust to different specifications of the lifetime wage profile for students with different college tenures.



### Key Findings

- Based on the NLSY data, students from low-income families are more likely to drop out earlier than their wealthier counterparts. Wealthier students tend to drop out later than middle-income students, but the difference is not significant. The same pattern is observed in the NLS-72 data.

- Poor students are at least 27 percent more likely to drop out than rich students, and they tend to drop out a year earlier than their wealthier counterparts.
- The authors' model implies that investing in a college education is risky because the returns are uncertain, and that wealthier students behave as if they are less risk averse due to constant relative risk aversion (CRRA) preferences. Combined with the Bayesian learning mechanism, this generates the result that poorer students are less willing to assume the risk associated with the uncertain outcome of attending college and are not as willing to remain enrolled as are wealthier students. Thus, the more risk averse students from low-income households tend to drop out earlier and in greater numbers than their wealthier counterparts.

### Implications

The authors' explanation of the college dropout decision offers a complementary story to augment other mechanisms in the literature that rely on binding credit constraints and attitudes toward schooling to explain dropout behavior. Since the authors' model does not include explicit borrowing constraints, the results suggest that policies geared to reducing borrowing constraints, such as student loan programs, are not likely to eliminate the differential dropout rates observed between poor and rich students. A direct educational subsidy paid to poor college students might be more effective, as it would lower the cost of spending additional time in college, increase the expected gains from enrollment, and likely increase graduation rates among poor students. A topic for further research is determining the optimal subsidy, which would depend on the wealth level of the student's family and the distribution of ability for a given wealth level. The authors' model might also be extended to include the decision to participate in the labor force while enrolled in college, as students from low-income households are more risk averse and might opt for the safety of earning current income while attending college.

w-11-9

## Trade Adjustment and Productivity in Large Crises

by *Gita Gopinath and Brent Neiman*

complete text: <http://www.bostonfed.org/economic/wp/wp2011/wp1109.htm>

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### Motivation for the Research

Large crises such as the ones that took place in Mexico (1994–1995), East Asia (1997–1998) and Argentina (2001–2002) are characterized by substantial exchange rate depreciations and a collapse in imports, accompanied by a large decline in the economy's real gross domestic product (GDP) and total factor productivity (TFP). The international economics literature has provided both theoretical and empirical evidence of the aggregate impact that permanent shocks such as trade liberalizations have on the extensive margins of adjustment—meaning the entry and exit of firms or of products at the country level—through either a change in resource allocations across firms or through changing product varieties. But less well understood is how the mechanics of trade adjustment and productivity operate at the firm and product levels over the course of the business cycle.

Taking Argentina as a case study, this paper examines its firm- and product-level import activity between 1996 and 2008, a period that captures the complete range of normal cyclical activity plus a financial crisis. After an eight-year period with average annual growth a bit under 6 percent, in 1999 Argentina entered a recession that sharply accelerated in 2001:Q4. A severe banking and financial crisis ensued, such that in 2002:Q4 Argentina's real GDP fell 16 percent year-over-year and its currency unit depreciated by almost 200 percent against the U.S. dollar. Between 2000 and 2002 Argentina suffered a 12 percent decline in manufacturing productivity. In 2003 Argentina's economy began to recover—that year, compared with 2002, its terms of trade improved by 9 percent and its real GDP grew 8.7 percent; from 2004 to 2008 its annual real GDP growth

averaged 8.3 percent. The authors' analysis provides a deeper and more detailed understanding of how trade adjustment takes place on the microeconomic level and the implications of this adjustment for macroeconomic performance.

### **Research Approach**

The authors combine detailed transaction-level trade data from two different sources that record information collected by Argentina's customs agency. Taken together, these data track almost all the goods Argentina exported and imported between 1996 and 2008. The information from import and export shipping manifests includes the name of the importing or exporting firm, the declaration date, the source or destination country, the quantity, weight, price, and value of the goods, and detailed information disaggregated at the 10-digit Harmonized Tariff Schedule (HTS) classification codes. The authors match the importing firms with a third database that contains operating and financial information on 4,500 firms, including public, private, and domestic firms, as well as multinationals. While this additional database concentrates on Argentina's largest firms and does not include all the firms that appear in the combined trade data, the authors are able to match the firm and trade data to account for 60–70 percent of all the country's imports.

Using these transaction-level data, the authors construct a mechanical account of how trade reduction occurred in the wake of Argentina's 2001–2002 crisis. Based on this analysis of trade adjustment they establish three main empirical findings, which they use to build a model of trade in intermediate inputs with heterogeneous firms, fixed import costs, and round-about production. This model describes the specific channels through which a collapse in imports affects TFP in manufacturing. The authors numerically simulate the model to show that it reproduces the three facts established from their empirical analysis of the trade data—namely, that an imported input cost shock operating through the firm- and product-level mechanisms they identified can result in quantitatively significant first-order declines in TFP.

### **Key Findings**

- During Argentina's financial crisis a large number of firms exited the import market. Before the crisis over 15,000 firms in Argentina imported goods, but a year into the crisis this number dropped to fewer than 7,000 firms. Judged by distinct 10-digit HTS product codes, the number of imports dropped from approximately 13,000 to 10,000 over the same period. But when weighted by value these firm- and product-level exits along the extensive margin explain only a small share of the total decline in imports: the net contribution of firm entry and exit explains fewer than 8 percentage points of the total 69 percent decline in imports during the crisis, and product entry and exit accounts for only between 0 and 15 percentage points of the decline. This finding holds when examining quarterly or annual economic data, when looking at normal cyclical activity as well as the crisis period, and when each end-use category is considered individually.
- The high concentration of international trade activity among a few key firms and sectors accounts for the authors' finding that the extensive margin plays a small role in understanding trade adjustment during the crisis. The largest 5 percent of importing firms account for approximately 85 percent of Argentina's imports, a situation that did not change as a result of the financial crisis. Similarly, the largest 5 percent of 6-digit HTS categories of imported goods account for about 60 percent of imports.
- Since goods trade in Argentina, as in most countries, consists of intermediate inputs, it is important to examine what happens to the import bundle at the firm level as opposed to the country level. When the extensive margin is defined to include within-firm changes in the mix of imported input categories and supplier countries, it begins to play a significant role. This within-firm extensive margin, which the authors call the sub-extensive margin, is quantitatively important and explains almost 45 percent of the 69 percent aggregate decline in imports between 2000 and 2002. Standard practices for national income and product accounting ignore changes in varieties, which

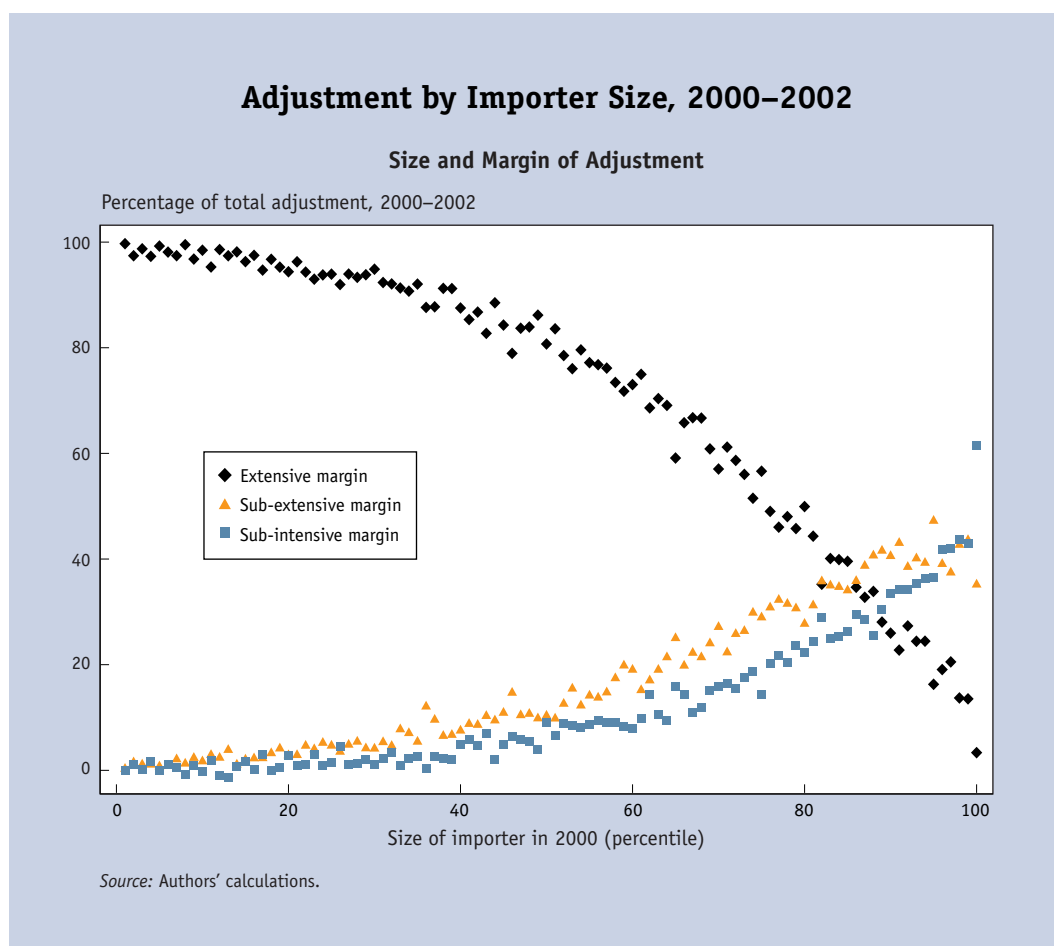
Feenstra (1994) showed must be adjusted to explicitly account for such changes in varieties. Failing to account for variety adjustment at the firm level impacts measured productivity.

- Trade adjustment varies with importer size, since the way firms adjust their imports varies with the size of the firm. The extensive margin, when a firm exits trade entirely, is the most prevalent margin of external adjustment for the smallest firms. The largest firms adjust primarily by reducing, but not completely dropping, their imports of particular products, using a combination of the sub-extensive margin, which entails dropping imported varieties or adding new ones, and the sub-intensive margin, which is the change in flows within a variety of continuing imports.

The figure plots the share of each of the three margins of the adjustment. A value along the y-axis equaling 1 for the extensive margin means that all the importers within that percentile exited trade in 2000.

The prevalence of the extensive margin clearly declines as firm size increases. Differences between the sub-extensive and sub-intensive margin are less stark, but the relative importance of the sub-intensive margin is greatest among the very largest firms. Heterogeneity in the importance of these margins underlies the heterogeneity in the degree of trade adjustment across firms of different sizes.

- Aggregate productivity in any economy depends on both the exogenous technology of each firm and the share of imported inputs in each firm's total input costs. In the presence of fixed costs, firms with better technology import a larger number of input varieties, as this strategy gives them a cost advantage over smaller firms. The change in manufacturing TFP in response to a shock depends on the elasticity of substitution between and within domestic and foreign varieties and



is amplified by a factor that depends on the share of intermediate inputs in production and on round-about production. These firm-level distortions appear endogenously through variations in the unit cost of production across firms due to heterogeneous importing activity. A reduction of import varieties will lower measured aggregate TFP, which is determined by the joint distribution of firm-level technologies and import shares.

### **Implications**

While the authors focus on Argentina because of the availability of long-dated and detailed transaction-level data before and after a sudden exchange rate shock, their analysis of this episode has broader relevance to other contexts. Although multiple shocks surely contribute to crises such as the one Argentina experienced and no single channel can explain the complete decline in TFP, the authors' simulations suggest that the reduced use of imported intermediate inputs plays a significant role in the manufacturing productivity losses experienced during a crisis. This provides a more thorough answer than is prevalent in the current literature as to how trade adjustment actually occurs and the impact such adjustment has on macroeconomic performance during normal business cycles and during crisis episodes.

w-11-10

## **Trends in U.S. Family Income Mobility, 1969–2006**

*by Katharine Bradbury*

complete text: <http://www.bostonfed.org/economic/wp/wp2011/wp1110.htm>

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### **Motivation for the Research**

Much of America's promise is predicated on economic mobility—the idea that people are not limited or defined by where they start, but can move up the economic ladder based on their individual efforts and accomplishments. Family income mobility—changes in individual families' income positions over time—is one indicator of the degree to which the eventual economic well-being of any family is tethered to its starting point.

Changes in economic mobility are of particular consequence when economic disparities among families are increasing over time, as has been the case in the United States in recent decades. If family income inequality is increasing, changes in the degree to which families move up and down the economic ladder can either offset or amplify longer-term inequality—and loosen or tighten the link between a family's circumstances in any given year and its later outcomes. Other things being equal, an economy with rising mobility—one in which families move increasingly frequently or traverse increasingly greater distances up and down the income ladder—will result in a more equal distribution of lifetime incomes than an economy with declining mobility. This paper examines time patterns of family income mobility for U.S. working-age family heads and spouses between 1969 and 2006.

### **Research Approach**

The paper uses data from the Panel Study of Income Dynamics (PSID) and a number of mobility concepts and measures, including a measure of the degree to which mobility equalizes long-term incomes. Calculating these measures for overlapping 10-year periods, the paper documents mobility levels and trends based on pre- and post-government measures of family income adjusted for family size.

An extensive literature explores the degree of economic mobility in the United States and other nations. Much of this research focuses on earnings mobility, examining how individuals' earned incomes change over time. Another set of papers focuses on family income mobility, measuring the degree to which individuals' family incomes change from one point in time to another, and a subset of this research investigates how family income mobility patterns have changed over time. The current paper contributes to this latter literature, measuring U.S. family income mobility with

a variety of measures and in many overlapping periods in order to explore their time patterns: it asks whether U.S. family heads and spouses were more or less likely to move up and down the family income ladder in recent periods than in earlier decades by comparing, for example, mobility during the 1996–2006 period (most recent available) with that during 1969–1979 (earliest available) or with some other 10-year period in the middle of the 1969–2006 span. And it explores whether the answer to this question depends on the specific measures of mobility or of family income or on a focus on specific parts of the income distribution. The paper reports a variety of measures on a consistent basis for overlapping 10-year time periods over a 37-year time span and is able to compare and contrast the trends in the literature with those observed here. Thus, this paper also contributes to the literature by examining mobility over a considerably longer time span and by investigating a broader range of mobility measures than previously done, and it offers a new categorization of mobility measures as well as comparisons of mobility based on pre- and post-government incomes.

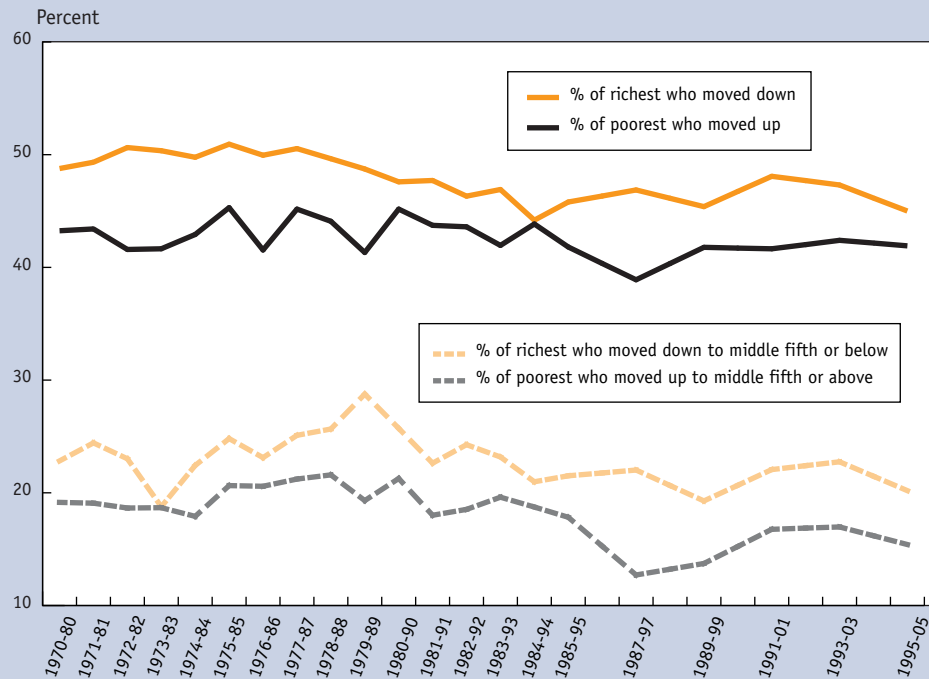
The paper begins by providing an overview of existing literature related to changes over time in family income mobility. It then discusses concepts of income mobility, outlines the concepts and measures considered in the paper, and describes the data and sample used in the analysis: the “base case” measure of income, how it is adjusted for family size, and the mobility “periods” examined. The heart of the paper computes and discusses results according to various mobility measures and examines their time trends. It then introduces comparisons of the post-government base case with the pre-government income case, looking at “mobility” for individuals from their pre-government income status to their post-government income status within a year and at 10-year mobility intervals based on pre-government income. Finally, it summarizes and discusses the results.

### **Key Findings**

- By and large, different mobility measures and income measures yield similar pictures of mobility trends. Most mobility measures indicate that family income mobility was lower in more recent periods (the 1990s into the early 2000s) than in earlier periods. Comparing 1977–1987 or 1981–1991, when many of the measures peaked, with the most recent period (1995–2005), mobility declined to a statistically significant degree according to most measures—both overall and for individuals beginning near the top or bottom of the income distribution. However, comparing periods ending in the most recent 10 years or so (1985–1995 through 1995–2005), depending on the mobility measure employed, trends are difficult to discern, except that mobility was lower in the last period (1995–2005 or 1996–2006) than in the period immediately before (1993–2003 or 1994–2004).
- One example of the decline in mobility is the fall in the fraction of members of the poorest one-fifth of families who advanced as far as the middle fifth or higher 10 years later, from 21 percent in the 1977–1987 period to 15 percent in 1995–2005.
- Comparing post-government trends with results based on pre-government income suggests that the redistributive impact of the U.S. tax and transfer system may have contributed more positively to mobility in the 1970s than it has since 1981.
- A key reason for studying mobility trends is a concern with lifetime income inequality. Although the calculations reported here track individuals over 10 years (far less than a lifetime), the distribution of long-term income (family income averaged over 10 years, or even 16 years) was much more unequal in recent periods than in the 1970s. The trend has been visibly steep, regardless of the inequality measure or income measure employed. Thus, whether the declines in measured mobility are significantly different from zero or not, mobility levels and trends have not been sufficient to offset the considerable rise in short-term inequality.



## Mobility for Families Starting a Period in Poorest and Richest One-Fifth of Families



Source: Author's calculations based on Panel Study of Income Dynamics and Cornell University Cross National Equivalent File.

Note: Base case uses post-government income adjusted with the square root of family size and two-year average endpoints. See appendix for definition of measures. Survey collected income data annually through 1995 and every other year thereafter.

### Implications

Increasing economic mobility is a widely shared policy goal, especially if mobility helps to equalize opportunity and lifetime incomes or takes the form of families at the bottom moving up (Economic Mobility Project 2009). Yet measured against this goal, the paper's findings are discouraging. Long-term income adjusted for family size is considerably more unequally distributed among families for periods ending in the 2000s than for periods ending in the 1970s and 1980s. That is, family income mobility has been insufficient to stem increases in the inequality of long-term income. Furthermore, other mobility measures indicate that a family's position at end of a period in the 2000s was more correlated with its starting position than was the case 20 years earlier.

What are the implications for policy? It appears that increasingly redistributive U.S. tax and transfer policies may have enhanced family income mobility from the 1970s into the 1980s, but then had decreasing impact as tax rates were reduced after 1981 (and intermittently thereafter). Beyond overall patterns, the data indicate that the typical individual in the poorest one-fifth of the family income distribution is less likely to move up beyond that group's real dollar ceiling within a decade than it was 15 to 20 years earlier. These facts suggest that policy remedies for those at the bottom of the income distribution should aim beyond short-term help, as those who are poor at any point in time are now likely to have low long-term incomes. Beyond this, the choice of policy presumably hinges, at least in part, on the reasons for the decline in mobility—for example, whether it reflects rising barriers to opportunity, other shifts in the economy, or changes in the U.S. tax and transfer system that increasingly reinforce rather than offset market disparities over time.

# The Role of Expectations in U.S. Inflation Dynamics

by Jeffrey C. Fuhrer

complete text: <http://www.bostonfed.org/economic/wp/wp2011/wp1111.htm>

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## Motivation for the Research

Much micro-founded macroeconomic research uncovers evidence that prices can be “sticky,” meaning likely to stay fixed at some value for many months, adjusting only sluggishly to changing economic circumstances. While most applied macro models do not provide a more detailed articulation for why price stickiness exists, if prices are expected to remain fixed for a certain period, then price-setters will likely take into account the conditions that are expected to prevail during this period. Therefore, expectations are widely thought to play an important role in the price-setting process. To date, most work on inflation dynamics has used the rational expectations assumption to generate these expectations. In brief, the rational expectations hypothesis assumes that agents form expectations using all available information efficiently, and therefore their forecasts differ from actual realizations only by errors that are not foreseeable at the time a forecast is made.

Despite the ubiquity of the rational expectations assumption, a number of authors have discovered that it is difficult to reconcile the slow-moving behavior of prices and inflation with the predictions of inflation models that assume rational expectations. John Roberts’s work in the 1990s suggested that inertial inflation behavior might reflect the nonrational nature of expectations, rather than other features of the price-setting mechanism. By substituting survey expectations of inflation for rational expectations, Roberts attained greater success in explaining U.S. inflation through the early 1990s. However, subsequent work on micro-founded dynamic stochastic general equilibrium (DSGE) macroeconomic models has largely continued using the rational expectations assumption. More recent work has revisited the role of survey expectations as a measure of the inflation expectations employed by price-setters, but the evidence is mixed, with some scholars finding little empirical support and others finding survey expectations do play an important role in determining inflation. This paper continues this more recent strand of research by focusing on the role that survey expectations may play in the inflation process.

## Research Approach

To begin, a variety of regressions were conducted to study how survey and rational expectations measures of inflation interact in reduced-form and structural models of inflation. The author uses quarterly data for inflation, output, unemployment, and real marginal cost. Short-term (four-quarter) inflation expectations come from the Survey of Professional Forecasters (SPF). The long-term SPF expectations (the 10-year average inflation rate) are taken as a proxy for trend inflation expectations. Ordinary least square (OLS) regressions estimated over the 1982:Q1–2010:Q3 period use the core inflation rate (proxied by the consumer price index excluding food and energy costs) as the dependent variable, and regress it on lagged inflation, the four-quarter SPF expectation, the long-run SPF inflation expectation, and the output gap as measured by the Congressional Budget Office’s estimation of the natural nonaccelerating inflation rate of unemployment, commonly known as the NAIRU. These OLS regressions suggest that core inflation is strongly correlated with the four-quarter survey expectation, has little dependence on lagged inflation, and is modestly correlated with the 10-year expectation. To impose some economic structure on this data, the author estimates Phillips curve regressions that constrain the sum of the coefficients on lagged inflation and the four-quarter survey expectation to 1, as these two measures normally serve as proxies for expected inflation in the next period. The four-quarter SPF expectations enter significantly throughout the sample, and lagged inflation is at best modestly significant. A test of whether inflation should be expressed as a deviation from “trend inflation,” where the trend is proxied by the long-run inflation

expectation, is strongly rejected. More generally, the long-run inflation proxies rarely if ever contribute to these Phillips curve regressions.

Next, to better understand how survey expectations differ from rational expectations, the author conducted two exercises that expand on the results in Del Negro and Eusepi (2010), a paper that explores the ability of a DSGE model to produce inflation expectations that match survey expectations. Finally, as a partial move toward modeling the short-term expectations that appear empirically relevant for explaining how inflation is determined, the author develops a New Keynesian model employing survey expectations. The model incorporates a survey expectations operator that can be iterated forward over the short horizon, and converges to the rational expectations at long horizons.

### **Key Findings**

- Short-run inflation expectations appear to play a significant role in explaining U.S. inflation over the past 20–25 years. Long-run expectations generally do not appear to have had a direct influence on U.S. inflation over the same period, although these enter indirectly as a key determinant of short-run inflation expectations. The restrictions implied by trend inflation models are generally rejected in the data.
- When nested in a model that allows expectations to be determined by a linear combination of rational expectations and survey expectations, the data strongly favor survey expectations, and in general assign a small and statistically insignificant role to rational expectations in explaining consumer price inflation. This finding is robust across a variety of estimation methods.
- The dominance of survey expectations in explaining consumer price inflation raises the question of what distinguishes survey expectations from the model-consistent expectations of inflation. Several exercises suggest that the rational expectations of inflation generated by DSGE models with a New Keynesian Phillips curve differ significantly from those measured by survey expectations.
- By employing a survey operator, the author develops a first pass at a structural model that explains U.S. inflation in the postwar era. The estimates suggest a particularly strong role for short-run survey expectations.

### **Implications**

The results in this paper join recent work in advocating for a renewed emphasis on using survey measures of inflation expectations in modeling inflation. Although the elegance of working with rational expectations is sacrificed to some extent, it is possible to use survey data on inflation expectations while maintaining a reasonable blend of theoretical and empirical rigor.

w-11-12

## **Further Investigations into the Origin of Credit Score Cutoff Rules**

*by Ryan Bubb and Alex Kaufman*

complete text: <http://www.bostonfed.org/economic/wp/wp2011/wp1112.htm>

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### **Motivation for the Research**

In an important paper Keys, Mukherjee, Seru, and Vig (2010b, hereafter KMSV) used variations in the default rate of loans by FICO score in a regression discontinuity design to investigate whether securitization led to lax screening of loan applications by lenders. In Bubb and Kaufman (2009, hereafter BK) the authors examined the theory underlying KMSV's research design—which the authors refer to as the securitization rule of thumb theory—and found that both institutional evidence and quantitative evidence are inconsistent with the theory. In a response paper, Keys,

Mukherjee, Seru, and Vig (2010a, hereafter KMSV2) argue that the quantitative evidence presented in BK is based on an inappropriate pooling of loans sold to private-label securitizers with loans sold to the government-sponsored enterprises (GSEs). Moreover, KMSV2 argues that the 620 FICO cutoff rule of thumb was used only for low documentation (low doc) loans, not for full documentation (full doc) loans, and hence that those two types of loans should not be pooled together. This paper investigates the issues raised in KMSV2.

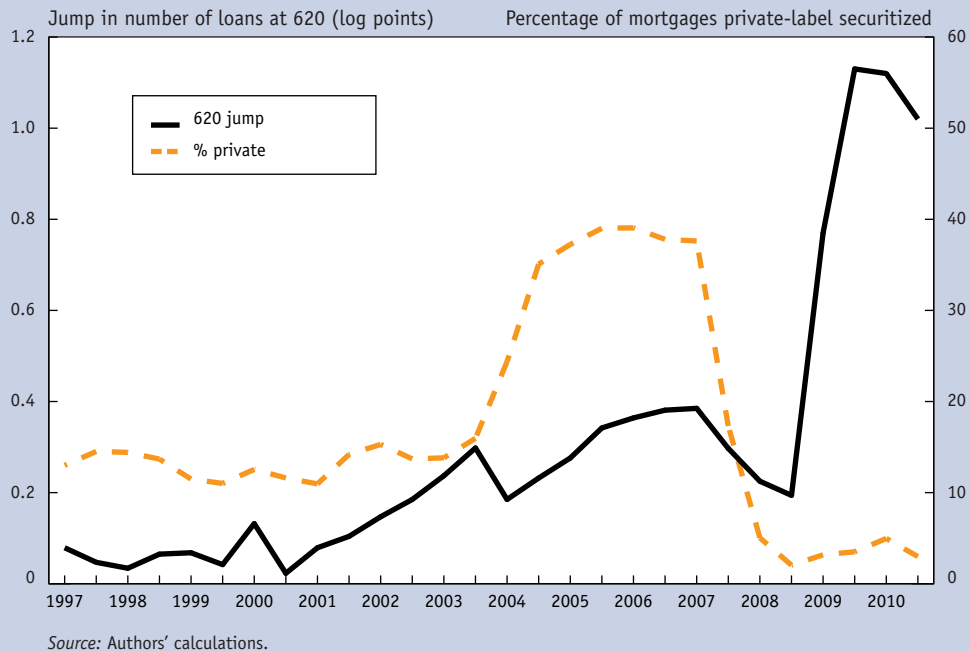
### Research Approach

The authors begin by reviewing the two competing theories of the origin of lender credit score cutoff rules, the securitization rule of thumb theory and the origination rule of thumb theory. They then consider how best to select a sample from the Lender Processing Services Applied Analytics (LPS) dataset to implement KMSV's regression discontinuity design and in particular the pooling issues raised by KMSV2. The authors begin this assessment by examining KMSV's selection of a sample of only low doc loans for their main analysis. They then consider whether GSE-securitized loans and private-label securitized loans should be pooled together in the conforming sample. In particular, they examine loans sold to the GSEs, loans originated in 2008–2009 after the private-label market shut down, and jumbo loans, which the GSEs are not permitted to securitize. Next, the authors examine the assumptions underlying KMSV2's separation of loans in the LPS data into agency and nonagency markets. They then estimate the size of the discontinuity at a FICO score of 620 for different cohorts of loans by origination date in order to investigate the time-series evolution of the 620 FICO cutoff, and turn to considering how best to measure ease of securitization. The authors next discuss the magnitudes of the estimates in KMSV2 and KMSV2's analysis of the evidence from state anti-predatory lending laws, and draw final conclusions.

### Key Findings

- Whether or not requiring full documentation of a borrower's income and assets serves as a measure of lender screening, the outcome of interest. By selecting on the outcome, KMSV introduces post-treatment selection bias into the paper's regression discontinuity design. Valid causal inference in a regression discontinuity design requires pooling together units with all different values of the outcome—in this case lender screening—as was done in BK. Subgroup analysis is still possible, but the selection must be done on pre-treatment covariates.
- Many samples that do not pool GSE securitized loans with private-label securitized loans still exhibit default discontinuities in the absence of securitization discontinuities. Results obtained by looking at loans sold to the GSEs, loans originated in 2008–2009 after the private-label market shut down, and jumbo loans, which the GSEs are prohibited from securitizing, confirm the findings in BK that lender cutoff rules in screening are not exclusively caused by a purchasing rule-of-thumb followed by private-label securitizers. Moreover, these findings provide further evidence against the identification assumptions underlying KMSV's research design. Lenders change their screening behavior discontinuously at these credit score cutoffs for reasons other than a change in the probability of securitization. Consequently, the jumps in default at these cutoffs are not evidence that securitization led to lax screening by lenders.
- Contrary to the assumption in KMSV2 that any given loan is at risk of being sold either to the GSEs or to private-label securitizers but not simultaneously to both, 18 percent of the 2003–2007 conforming sample loans were at one point owned by the GSEs and at another point owned by private-label securitizers. This is a lower bound on the overlap between the two types of purchasers—many loans that were both at risk of being bought by private-label securitizers and by the GSEs were in fact held by only one type of buyer. Moreover, the institutional evidence shows that in this period the GSEs and private-label securitizers actively competed over subprime loans in the secondary market. The fact that loans were simultaneously at risk of being sold to both GSEs and private-label securitizers implies that the discontinuity estimands in KMSV2, which are premised on separation of the two markets, are not well defined. GSE loans and private-label

### Size of Lending Jump at 620 FICO Score versus Percent of Loans Private-Label Securitized



securitized loans, as well as portfolio loans, must be pooled together to estimate the probability of securitization at any given FICO score, as was done in BK.

- Evidence exists that the 620 FICO cutoff existed for loans originated in the period 1997–2000, after the GSEs directed originators to adopt the 620 cutoff, and its influence grew steadily for later cohorts of loans through at least 2010. During this time the market for private-label securities rose, peaked in 2005–2006, and then, in 2008, collapsed to nearly nothing, where it has remained. The disconnect between the time-series pattern of the size of the 620 cutoff and the scale of the private-label mortgage-backed securities (MBS) market is further evidence that private-label securitization was not the driving force, and certainly not the only force, behind lenders’ use of the cutoff rule in screening.
- The data reveal no economically significant discontinuities in time-to-securitize or loan buy-backs at a FICO score of 620. With respect to KMSV2’s argument that the “unconditional probability of securitization” as measured by the number of securitized loans, is a better measure of “ease of securitization” than is the probability of selling a loan, what matters for a lender’s incentive to screen is the probability that the lender will be able to sell the loan: the securitization rate. If the number of securitized loans jumps at 620, it could be either because the lending rate jumps or because the securitization rate jumps. The analysis shows that the jump in the number of securitized loans first found in KMSV is driven by a jump in the lending rate, not the securitization rate.
- The changes in the securitization rate at 620 that KMSV2 estimates are too small to plausibly be the cause of the corresponding changes in the default rate. For example, using data from a single mortgage originator, KMSV2 estimates a jump in the securitization rate at 620 of 1.7 percentage points from a base of over 90 percent, and a corresponding 10 percentage point jump in the default rate, from a base of about 12 percent. Such an outsized effect of a 1.7 percentage point increase in

securitization seems implausible. In contrast, these magnitudes are consistent with the origination rule-of-thumb theory: originators change their screening behavior at 620, which in turn changes how easy it is to sell loans.

- KMSV2 argues that state anti-predatory lending laws had a differential effect only on securitization above and below 620, and not a differential effect on default directly. Hence, that paper argues, the laws provide a test of whether originators followed a credit score cutoff rule in screening for reasons other than a change in securitization. However, provisions in these laws were aimed directly at reducing defaults. For example, the Georgia Fair Lending Act required lenders to certify that the borrower has received counseling on the advisability of assuming a loan obligation before making certain loans. Because there are more defaults above 620 than below, the laws can be expected to have a differential effect on default above and below 620. Moreover, there are discontinuities in the terms of mortgage contracts at 620 for a range of contract terms associated with default, including loan-to-value ratios and whether the loan is interest only or allows for negative amortization. Thus, the passage of the laws does not provide a test of the two competing theories of the origin of the credit score cutoff rules.

### Implications

Although KMSV2 raises a number of interesting issues about the analysis in BK, after investigation the authors of this paper find that none of the issues KMSV2 raise changes their analytical approach or conclusions. The institutional and quantitative evidence strongly rejects KSMV's securitization rule-of-thumb theory. Lenders change their screening behavior at certain credit score cutoffs for reasons unrelated to changes in the probability of securitization. Evidently, when the GSEs directed lenders to adopt these cutoff rules in screening in the late 1990s, and lenders signed contracts in which they committed to follow the GSEs' underwriting guidelines and adopted automated underwriting systems that incorporate those cutoff rules, it had a direct effect on lender behavior. This means, unfortunately, that the regression discontinuity research design used in KSMV and KSMV2 is unable to answer the question of whether securitization led to lax screening. Researchers must continue to search for other sources of evidence that can be brought to bear on this important question.

w-11-13

## Core Competencies, Matching, and the Structure of Foreign Direct Investment

by *Federico J. Díez and Alan C. Spearot*

complete text: <http://www.bostonfed.org/economic/wp/wp2011/wp1113.htm>

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### Motivation for the Research

The decision of whether or not to invest in a foreign market is the first of many facing a multinational enterprise (MNE). Once the MNE decides to operate directly in a foreign market, the firm chooses from a number of different options regarding how to operate in the foreign market: greenfield investment (a form of direct foreign investment in which the investing entity builds new operational facilities from the ground up), acquisition, or joint ventures. Each type of investment seems to have an advantage in different host country and different industrial environments. For instance, developing economies tend to attract more greenfield investment than acquisitions, while the opposite pattern holds in developed economies. Joint ventures are a typical form of foreign investment in developing countries, but they are quite rare in developed countries, where wholly owned subsidiaries are the norm. Moreover, joint ventures tend to be very unstable entities, as most last only a few years. Finally, direct investment (greenfield or acquisition) tends to involve firms that have better technological capabilities than those that engage in joint ventures.

How do firms choose among these investment options? A crucial distinction between greenfield investment and acquisitions and joint ventures is that the latter two options both require matching by the MNE with a local partner before production takes place. If the matching occurs, the MNE must then choose the type of ownership structure that best utilizes the assets of both firms in the local market. Indeed, the quality of the match itself is likely to have a profound impact on the nature of the relationship that is chosen *ex post*. For example, an MNE may choose to bring a match under full ownership to eliminate any possibility that agency issues might ruin the potential of a good match. Of course, if the quality of the match itself is uncertain, the MNE may instead choose to test the match under a loose contractual arrangement prior to making costly integration decisions.

### **Research Approach**

In this paper, the authors develop a model of foreign direct investment in which MNEs choose whether to match with a local partner, and, if they do, whether to bring the match under full ownership. The elements of the investment model are twofold. First, production is viewed as a set of tasks that must be completed in order to manufacture a product in the foreign market, where each firm, local and MNE, possesses a unique core competency within the task space. Indeed, entering the market for corporate control is a way to increase efficiency by finding a local partner that can improve upon the MNE's deficiencies. However, as each task requires investment, an ownership structure involving multiple independent parties may bring about agency issues within the investment process. Hence, the model also allows the MNE to choose the contractual arrangement that governs the new foreign affiliate. Depending on the quality of the match with the local partner, the MNE may be compelled to complete the match through mergers and acquisitions rather than by operating under a joint venture with multiple owners sharing revenues of a final product. To examine the stability of joint ventures—a theoretical consideration mostly absent in the literature—the authors offer a simple two-period model based on their static framework.

### **Key Findings**

- In equilibrium, all *ex ante* identical firms will enter the foreign matching market to find a local partner. The result is an *ex post* group of heterogeneous firms that have been sorted into three forms of ownership. In particular, the matches of those firms that fall into the least efficient category are forgone, the mid-efficiency matches form joint ventures, and the most efficient matches take the form of mergers and acquisitions. The intuition for this sorting is straightforward. The least-efficient matches are forgone since in such cases the match does not offer joint profits sufficient to both compensate the MNE for forgoing the outside option of greenfield investment and provide profits for the local firm. However, for matches that reach a threshold level of efficiency, firms sort into either joint ventures or, if they have an advantage in efficiency, into acquisitions. Indeed, the incomplete contracts associated with a joint venture cause a holdup problem in coordinating joint investments in the final product. When the match potential is high, the loss of profits due to holdup is quite severe, and the MNE instead chooses to buy out the local firm, pay a fixed integration cost, and bring all investment responsibilities under one owner.
- Joint ventures are more common when the host country makes products that are inferior in quality to those produced in the source country, which explains why MNEs use joint ventures more frequently in less-developed countries than in developed countries.
- In the authors' two-period model, MNEs are heterogeneous in the quality of the product that they produce, and they enter the foreign market under match uncertainty in the first period and learn about their matches before the second period. In this simple framework of uncertainty, the high-quality MNEs choose wholly owned investment from the beginning, while low-quality firms use joint ventures to test the match prior to (potentially) paying fixed costs to integrate through acquisitions. Further, high-quality firms are more likely than low-quality firms to end joint venture agreements in order to pursue wholly owned investment opportunities.

## Implications

The authors' model provides a rationale for one of the more salient features of joint ventures, namely, their instability.

In future work, the authors intend to focus on the endogenous choice of the type of products that a firm brings to a local market as a function of the investment mode. Indeed, since many policies restrict the types of foreign investments that are permissible, this focus may elucidate the ramifications of such policies when technology transfer depends on the type of products that a firm brings into a local market.

w-11-14

## Managing Self-Confidence: Theory and Experimental Evidence

by Markus M. Möbius, Muriel Niederle, Paul Niehaus, and Tanya Rosenblat

complete text: <http://www.bostonfed.org/economic/wp/wp2011/wp1114.htm>

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### Motivation for the Research

Standard economic theory assumes that agents process information about their own ability as objective Bayesians do (that is, by modifying prior beliefs taking into account new information in a dispassionate, rational manner). Social psychologists have questioned this assumption by pointing out that people systematically rate their own ability as “above average.” To take one classic and widely cited example, 88 percent of U.S. drivers consider themselves safer than the median driver (Svenson 1981). A quickly expanding literature in behavioral economics (Koszegi 2006) and finance (Barber and Odean 2001; Malmendier and Tate 2008) has explored the implications that overconfidence poses for economic decisionmaking.

At the same time, economists have pointed out that much of the commonly cited evidence on biased information processing is in fact consistent with fully rational information processing. Zábajník (2004) and Benoit and Dubra (forthcoming) have shown that Bayesian updating can easily generate highly skewed belief distributions. For example, if there are the same number of safe and unsafe drivers, but only the unsafe drivers have accidents, then a majority of drivers—the good drivers and the bad drivers who have not yet had accidents—will rate themselves safer than average. People might also disagree on the definition of what constitutes a safe driver (Santos-Pinto and Sobel 2005) or tend to (rationally) choose activities for which they overestimate their true abilities (Van den Steen 2004). As these arguments illustrate, it is intrinsically difficult to make inferences about information processing from cross-sectional data

This paper makes two contributions. First, the authors analyze theoretically the problem of optimally managing one's self-confidence. Building on Brunnermeier and Parker's (2005) concept of optimal expectations, they show that agents who derive utility directly from their beliefs (for example, ego or anticipatory utility) will exhibit a range of distinctive and measurable biases in both the way they acquire and in the way they process information. This lets the authors interpret tests for these behaviors as tests of a unified theory, rather than as tests for isolated behavioral anomalies. Second, they implement these tests in a carefully controlled experimental environment; they repeatedly elicit subjects' beliefs about well-defined events in an incentive-compatible manner and study the evolution of these beliefs. In effect, the authors sidestep the ambiguities inherent in cross-sectional data by opening the “black box” of belief updating itself.



## Research Approach

The model describes an agent who has either high or low ability. She will at some point have to choose whether or not to take an action whose payoff is positive only if her type is high, so she places an instrumental value on information. She also derives utility from believing she is the high ability type; however, this belief is interpretable as ego or anticipatory utility. The authors suppose that the agent is a “biased Bayesian” updater who uses Bayes’ rule to process information but decides at an initial stage how to interpret the signals’ informative value and how to weigh this information, taking into account the competing demands of belief utility and decisionmaking. When the weight placed on belief utility is zero, the model reproduces “perfect” (unbiased) Bayesian updating.

Like other behavioral models, this one can explain why agents are asymmetric updaters, putting greater weight on positive information about their own ability than on negative information. The model also reveals close connections, however, between asymmetry and other biases. The authors predict that agents tend to be conservative, responding less than a perfect Bayesian would to updated information. Intuitively, asymmetry by itself increases the agent’s mean belief in her ability when she receives news about her ability that would send a negative signal if viewed objectively. However, asymmetry also increases the variance of the low-type’s beliefs: this increases the likelihood of costly investment mistakes where the low-type agent takes the action appropriate for the high type. By acting conservatively, the agent can reduce the variance of her belief distribution when the news she receives gives a negative signal. The model also predicts that less confident agents will be information-averse and willing to pay to avoid learning their true types, since this information would upset the careful balance they have struck between their beliefs and decision utility.

The authors test these predictions in a large-scale experiment with 656 undergraduate students. Subjects first take an IQ test, after which the authors elicit their universal belief that they all are among the top half of performers. The following procedure is then repeated four times. First, each subject is provided with an independent binary signal of his or her performance; each signal tells the student whether s/he is among the top or bottom half of performers, correct within a 75 percent probability. Second, after each signal the authors again elicit subjects’ beliefs that they are among the top half of performers. By explicitly measuring prior and posterior beliefs, and clearly defining the data-generating process, the authors eliminate the major confounds present in social psychology studies. Repeating the process four times provides a rich dataset to study how beliefs change with updated information.

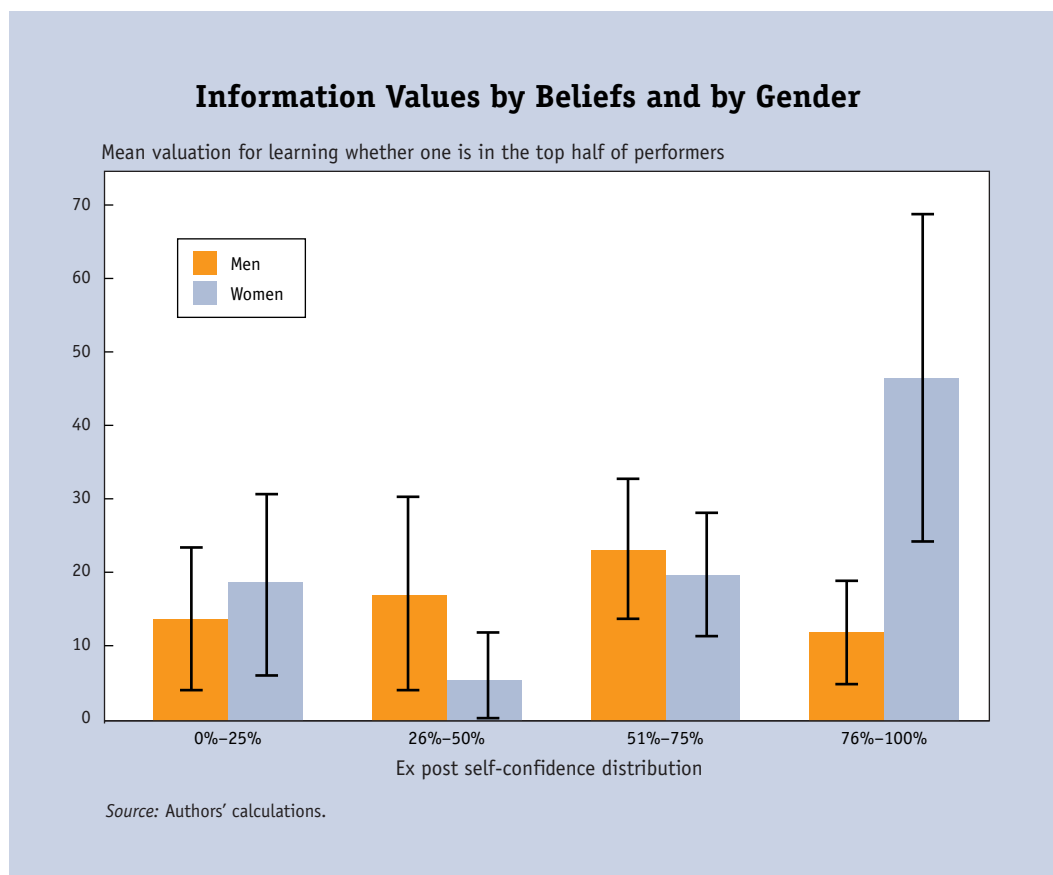
The authors’ focus on the binary event called “scoring in the top half” is a novel and convenient design feature that allows them to summarize relevant beliefs in a single number—the subjective probability of being among the top half of all performers. This facilitates a further methodological advance: they elicit beliefs by asking subjects for what value of  $x$  they would be indifferent between receiving a payoff with probability  $x$  and receiving a payoff if their score is among the top half. Unlike the widely used quadratic scoring mechanism, this approach is robust to risk aversion and to nonstandard models of preferences, provided that these are monotonic in the sense that lotteries paying out a fixed amount with higher probability are preferred. The authors estimate empirical specifications of belief updating that nest perfect Bayesian updating and their own model of biased Bayesian updating.

## Key Findings

- Consistent with both perfect Bayesian updating and the authors’ model of biased Bayesian updating, information is persistent in the sense that subjects’ prior beliefs are fully incorporated into their posterior ones. Consistent only with the authors’ model, subjects are both conservative and asymmetric updaters. On average, subjects revised their beliefs by only 35 percent as much as perfect Bayesians with the same prior beliefs would. Moreover, subjects who received positive

feedback revised their beliefs by 15 percent more on average than those who received negative feedback. Strikingly, even subjects who received two positive and two negative signals—and thus learned nothing new—ended up significantly more confident than they began. The authors interpret this result as unambiguous evidence of self-serving bias. An important question to ask is whether these results reflect motivated behavior as posited by the authors’ model or merely offer evidence of cognitive limitations. It is, in fact, widely recognized that standard Bayesian updating is an imperfect positive model even when self-confidence is not at stake.

- In an initial experiment, agents who are of high ability according to their IQ test, and hence arguably cognitively more able, were just as conservative and asymmetric as those who scored in the bottom half of the IQ test. In a placebo experiment, structurally identical to the initial experiment except that subjects reported beliefs about the performance of a “robot” rather than their own performance, belief updating was significantly and substantially closer to perfect Bayesian updating, implying that the desire to manage self-confidence is an important driver of biases that relate to receiving new information about oneself.
- When measuring subjects’ demand for feedback by allowing them to bid for noiseless information on their relative performance and testing the null hypothesis that subjects’ valuations for feedback are weakly positive (as would be the case if subjects used this information purely to improve their decisionmaking), the authors found that, on the contrary, approximately 10 percent of subjects were information-averse, and were willing to pay to avoid learning their type. The authors also found that less-confident subjects were more likely to be information-averse than more-confident subjects, as predicted by the model. To address the concern that confidence may be correlated with other determinants of information demand, the authors showed that this result continues to hold when they instrument for confidence using exogenous variation generated by their experimental design.



- There are three possible sources for gender differences in confidence: these could be driven by gender differences in prior beliefs, gender differences in updating about beliefs, and gender differences in demand for information. The authors' experiment is designed to answer which combination of these factors is present. In their data they find that women differ significantly from men in their prior beliefs about their abilities, are significantly more conservative updaters but not significantly more asymmetric, and are significantly more likely to be averse to feedback.

### **Implications**

The results provide support for recent theories that imply a demand for self-confidence management. In one strand of this literature, self-confidence directly enhances well-being (Akerlof and Dickens 1982; Caplin and Leahy 2001; Brunnermeier and Parker 2005; Koszegi 2006), while other papers examine self-confidence as a means to compensate for limited self-control (Brocas and Carrillo 2000; Benabou and Tirole 2002) or to enhance performance (Compte and Postlewaite 2004). These models differ in their assumptions about how people manage their self-confidence—some emphasize updating, others information acquisition, and still others selective memory. The overall results suggest that the first two mechanisms are relevant, but do not bear on the third, given the experiment's short time frame.

The most closely related empirical work is by Eil and Rao (forthcoming), who use the quadratic scoring rule to repeatedly elicit beliefs about intelligence and beauty. Their findings on updating (agents' posterior beliefs are less predictable and less sensitive to signal strength after receiving negative feedback) are not directly comparable with those of the authors of this paper (persistence, asymmetry, and conservatism) due to differences in the experimental design and analytical methods, but these results are broadly consistent with motivated information processing. Eil and Rao's estimates of information demand match the authors' estimates—subjects with low confidence are averse to further feedback—although they treat confidence as exogenous.

Finally, this paper also contributes to the research on gender differences in confidence. A large literature in psychology and a growing one in economics have emphasized that men tend to be more (over-)confident than women, with important economic implications. These gender differences are consistent with the authors' theoretical framework if a larger proportion of women than men value belief utility.

w-11-15

## **Games with Synergistic Preferences**

*by Julian C. Jamison*

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### **Motivation for the Research**

Game theorists have tended to assume that a game's base payoffs—the individual utility (benefit) that would result if the outcome involved a one-player setting or if the outcome's effects on the other players is unknown—indicate a player's final preferences. Although game theorists use this vantage point to study the game's resulting strategic interactions, they have generally not been concerned with how these preferences are formed and what differences might arise between an individual's base payoff and his or her ultimate preference regarding outcomes. Yet in real life, perhaps because of altruism or concerns about fairness, players often care about both their own payoffs and about how the game's outcome will affect other players; hence, when calculating their final preferences, players do take account of their opponents' welfare beyond any strategic considerations. A constant process that takes place in almost all games is the move from gauging base payoffs to calculating final utilities, so to remedy this missing theoretical connection the author provides a formal general link between a game's base payoffs and the player's resulting final utilities. Articulating a formal model

for how this ubiquitous action occurs and what it implies should help applied and experimental economists by eliminating their need to come up with new and ad hoc formulations every time it is important to supply the missing link.

### **Research Approach**

With the aim of providing a model that fits a broad array of game settings and reconciles certain inconsistencies, the author proposes the concept of synergistic utility to convey the idea that utility increases as one's own payoff increases and may increase or decrease as other players' utilities rise or fall. This theoretical concept is grounded in the author's comparative review of the broad literature on altruism and interdependent preferences. Some models in the broad literature posit that altruism is only one-directional, in the sense that there is no feedback effect between the players. Moreover, the results of a large number of experimental economics papers differ from those predicted by basic equilibrium concepts. For instance, Dawes and Thaler (1988) have conducted experiments with public goods, ultimatum games, and the prisoner's dilemma, and while they suggest altruism as a general explanation, they do not propose a model that explains this altruism. In the game theory literature, Bergstrom (1989, 1999) presents a general model in which a player's utility is an increasing transformation of the given player's payoff and the other players' utilities, an approach that is closest to the author's concept of synergistic utility, but differs in one respect: Bergstrom takes a fixed-point approach while the author takes a limit-point approach. The limit approach has some technical advantages and avoids producing some highly nonsensical outcomes.

In the author's model of synergistic utility, the base payoffs are taken to be the utilities for "thoughtless" players, those to whom it has not occurred that their actions might affect other players. The model assumes that players include in their base preferences any positive feelings that arise from doing good or being fair, and any negative emotions that may arise—for instance, from unfair treatment or betrayal. Synergistic utility involves a dynamic setting where far-sighted, rational players think more than one step ahead. Taking into account the welfare of other players may change a player's preferences, so in this model final utilities are a function of the other players' final utilities. Players may have different synergistic types, such as: 1) altruistic, 2) selfish, meaning that their final utility is equal to the base payoff regardless of the other players, and 3) deriving enjoyment from doing better than the other players, which the author calls the competitive "Jones type" after the idea of keeping up with (or besting) the proverbial Joneses. The author's model applies only to single-game settings, so it is possible for players to switch types over time or from one situation to the next, depending on the opponent's type. In the synergistic utility model it is possible for an altruistic player to want to cooperate even when facing an opponent who does not share this preference.

### **Key Findings**

- Compared with models in the previous literature, the author's model does not impose anything new on the game structure or analysis. The only difference is in the numerical value of the payoffs.
- Experimental game theory has often generated results that diverge markedly from what standard theory predicts. For instance, no positive quantity should ever be rejected in an ultimatum game, yet this result often occurs in experiments. This outcome can be explained using synergistic utilities: players of or similar to the Jones type will reject all offers up to some level. Altruism can explain extended play in a centipede game or a contribution made in a public goods game. The author contends that the relatively simple concept of synergistic utility is sufficient to explain these wide-ranging behaviors and outcomes. For example, the synergistic utility model can leave base utility equal to a monetary payoff and then use the more general approach to explain real-world behavior, thereby avoiding the ad hoc formulations that are often required when the outcomes based on final preferences differ from the base payoffs.

## **Implications**

As the synergistic utility model is defined, it makes no allowance for reciprocity, although most human interactions involve some reciprocal element. Yet many observed behaviors can be explained within this paradigm, so it may be necessary to expand the model to include reciprocity in order to fully explain behavior. Games with incomplete information take on an added dimension if one allows for the possibility that players may have different synergistic types, as signaling becomes an important component of strategy: it may or may not be beneficial for a player in a given situation to reveal his or her type. The author suggests aspects of synergistic games involving incomplete information as the most fruitful line for future theoretical research using the proposed synergistic utility model.

w-11-16

# **The Great Recession and Bank Lending to Small Businesses**

*by Judit Montoriol-Garriga and J. Christina Wang*

complete text: <http://www.bostonfed.org/economic/wp/wp2011/wp1116.htm>  
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## **Motivation for the Research**

In recognition of its severity the most recent U.S. business cycle downturn has been dubbed the Great Recession. The economy and especially small firms have suffered longer and steeper losses in output and employment than in any other postwar recession. The plight of small firms has been linked to the imposition of credit constraints, since this downturn is characterized by a serious erosion of bank capital, owing to sizable losses suffered by many major banks as a result of the subprime mortgage debacle and the ensuing deleveraging. To the extent that supply-side credit constraints have played a larger than usual role in this economic downturn, small businesses have likely been affected more adversely than large firms. A number of previous studies have shown that small businesses depend almost exclusively on bank financing and have suggested that financial constraints are more binding on small firms than on larger firms. As prima facie evidence of more severe credit constraint on small firms, some point to the fact that loans to small businesses have fallen more than total bank business loans.

This observation is of course subject to the well-known identification problem: a decline in the realized volume of bank lending to small businesses can be due to a decrease in demand, or supply, or both. To implement the appropriate public policy, it is important to sort out the causes of the observed lower volume of loans to small firms. If the lack of credit availability to small firms, as opposed to a lack of demand for credit by small firms, is an important impediment to the recovery, then the policy response should include measures that encourage small business lending. To the extent that small businesses are vital to job creation, this policy should help to stimulate employment growth.

In this paper the authors investigate whether small firms have indeed experienced a worse deterioration in the cost and availability of credit during the Great Recession than have large firms.

## **Research Approach**

The paper first develops a simple model of bank loan pricing to offer structural guidance for the empirical analysis. It adapts the costly state verification model to derive loan interest rates as a function of the aggregate state of the economy as well as borrowers' credit quality and loan attributes, such as principal amount and collateral status. The model can produce credit rationing in equilibrium and derives the condition for the interest rate paid by the marginal borrower with a particular set of characteristics. This model constitutes a methodological contribution to the literature on credit rationing, since it enables

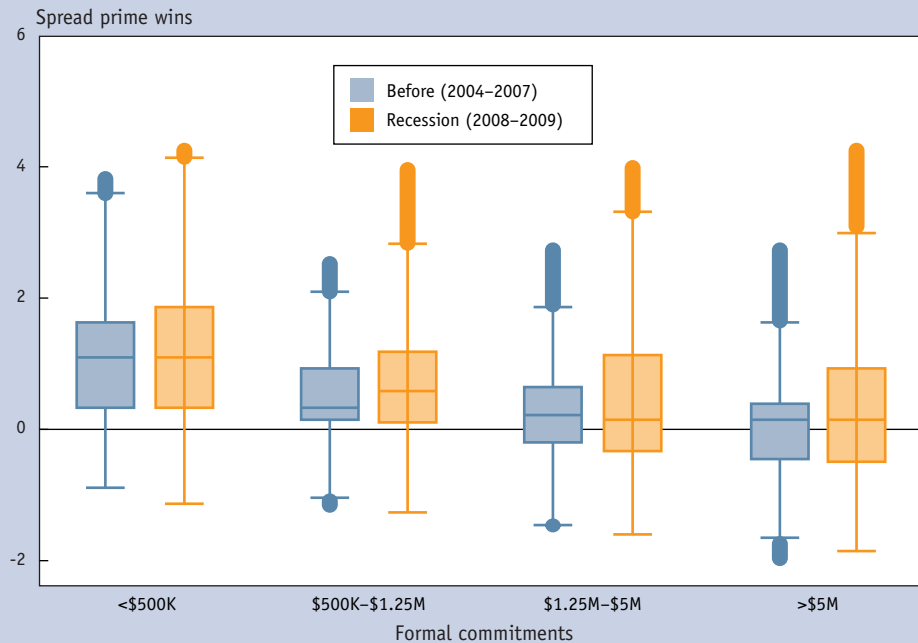
the authors to detect changes in the mass of borrowers left out of the loan market, using data on loans actually made by focusing on the change in the distribution of loan interest rates.

The paper then explores the relative changes in the terms of business loans granted during the Great Recession by using a loan-level dataset, focusing on the relative change in the interest rates of small versus large loans. This approach is akin to a difference-in-differences analysis in that it compares the interest rates on small versus large loans before and after the onset of the recession, except that in this case the estimation has to control for compositional changes within the pool of small loans versus that of large loans. The authors also examine the extent to which bank-level indicators of a firm's financial health have been found to influence a bank's willingness to supply credit, and how these indicators have affected the relative terms of its loan originations to small businesses. Furthermore, taking advantage of the large cross-section of loans in the dataset, the authors conduct quantile regressions to investigate whether the relative changes in the distribution of loan interest rate spreads exhibit signs of credit rationing as suggested by the model.

### Key Findings

- The model shows that credit rationing exhibits countercyclical movements, the degree of which can vary in the cross section depending on borrower quality, loan attributes, and the lending bank's financial health. In particular, the model indicates that during recessions small firms can be more subject to credit rationing than large firms, because small firms incur higher monitoring costs per dollar of funds borrowed. This result implies that the quality of the marginal small business borrower that obtains credit will in fact *increase* in a downturn relative to the quality of the marginal large business borrower. These results imply that during a downturn the presence of greater credit constraints on small firms can be detected through shifts in the distribution of interest rates among loans *actually made* (and thus observed). All else being equal, the interest rates on loans made to the riskiest firms should rise *less* for small firms than for large ones. More specifically, the authors' empirical analysis of the data show that the upper quantiles of loan interest rates would be expected to rise less for small firms than for large ones if the small firms faced more rationing during the recession.
- The analysis reveals that specific features of different types of loan contracts, largely neglected to date, can overturn the conclusion regarding the relative change in terms on loans made to small businesses during the Great Recession. In particular, the regression analysis explicitly accounts for two main contractual features of loans made under formal commitments to lend. First, since these loans are drawdowns of credit lines under pre-existing commitments, most of these loans carry a spread (over a base interest rate) that is predetermined—fixed at the level set in the commitment contract. Second, multiple types of base rates are used in commitment contracts, and the base rate is almost invariably allowed to float with the market interest rate. These pre-existing loan commitments contrast with new term loans, for which the entire interest rate is negotiated at the time of the loan contract.
- Once one takes into account these features of loans made under existing commitments, there is a significant *reduction* in the average interest rate spread of small loans (relative to large ones) in this downturn. The quantile regressions then reveal that the biggest relative reduction in loan rates occurred in the top interest rate percentiles, thus corresponding to the riskiest borrowers. These results are consistent with the pattern predicted by the model when credit rationing increases more for small firms than for large firms in an economic downturn. Further analysis of bank health indicators provides additional supporting evidence: the biggest relative decline in loan interest rates occurs for banks with an a priori high nonperforming loan ratio and a low share of small business loans in the total commercial and industrial loan portfolio, as well as for banks with greater exposure to the crisis—meaning banks that are more dependent on wholesale funding, are large, and/or have a high ratio of unrealized losses.

## Unconditional Distribution of Prime-Based Spreads by Loan Size, Before and During the Recession



Source: Authors' calculations.

Note: The figure shows the box plots of interest rate spreads for formal commitments that use the prime rate as base rate. The sample of loans has been divided by the size of the commitment into four categories (specified in the x axis) and into two time periods (before the recession and during the recession). The top and bottom edges of each box define the 25th and 75th percentiles of the distribution, respectively, while the horizontal line in between represents the median. The whiskers depict the tails of the distribution—1.5 times the inter-quartile range beyond the 25th and 75th quartiles, respectively.

### Implications

These findings imply that pre-existing lines of credit do not fully insure small businesses against liquidity shocks in the event of an economic downturn. The findings also have important policy implications. If a lack of credit availability is a significant impediment to economic recovery, then the policy response should include measures that encourage lending to small firms, as they are most subject to the negative effects of credit rationing during a recession. For instance, policies such as expanding government guarantees on small business loans through programs run by the Small Business Administration can prove effective in speeding up the recovery. Regulatory and supervisory policy can also play a useful role in this regard. For example, if some banks have curtailed their lending to small businesses in part to shore up their capital ratio in anticipation of the tighter capital regulation called for in Basel III, then regulatory agencies can consider issuing special exemptions for small business loans made during the recession and the early recovery. In addition, banks should be compelled to raise capital if a current or expected capital shortfall is hindering the growth of their loan portfolios.

# Inflation Dynamics When Inflation is Near Zero

by Jeffrey C. Fuhrer, Giovanni P. Olivei, and Geoffrey M.B. Tootell

complete text: <http://www.bostonfed.org/economic/wp/wp2011/wp1117.htm>  
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## Motivation for the Research

In the wake of the longest postwar U.S. recession, inflation has declined noticeably. In early 2011, inflation was running at an annual rate of 1 percent, the lowest it has been since the early 1960s. Since considerable slack remains in the U.S. economy, it is reasonable to ask how future inflation might behave in a low-inflation environment, defined as an annual inflation rate below 2 percent. Answering this question will help policymakers, as there is mounting evidence that the inflation process changes as the inflation rate approaches zero. But the forecasting task is complicated because the United States has had little recent experience with low inflation and because monetary policy is currently fixed at the zero lower bound. Will inflation continue to fall, or will it rise towards the central bank's implicit inflation goal? Will well-anchored expectations of long-run inflation mitigate or completely offset other disinflationary forces? If U.S. inflation falls further, will it behave as if it had a lower bound, as has been the case for Japan? What models might best capture U.S. inflation dynamics in a low-inflation setting?

## Research Approach

To provide some insight as to how U.S. inflation might evolve in the near-to-medium term, the authors first examine the period from 1954:Q1 to 1963:Q3, when annual U.S. consumer price inflation averaged about 1.6 percent and fluctuated within a relatively narrow range amid some relatively large fluctuations in real economic activity. They analyze the period's data and estimate a stable nonlinear Phillips curve relationship where the inflation rate is a deviation from long-run inflation expectations. An increase in the output gap from 2 to 4 percent raises annual inflation by 0.70 percent. The authors then use this estimated relationship to examine current inflation behavior in the United States by plotting actual core personal consumption expenditure (PCE) inflation, which excludes food and energy prices, against predicted inflation from 2008:Q4 onward. They also plot the period from 1954 to 1963 against observations spanning 2003:Q1 to the present, and merge these two periods to get a fuller estimate of the nonlinear Phillips curve. The rest of the paper critically examines two key features of this simple model: the role of long-run inflation expectations as a driver of inflation and whether downward nominal wage rigidity acts as a potential buffer to declining inflation.

To gauge how inflation in an advanced economy might behave during an extended period of low inflation, the authors examine Japan, which over the last two decades has experienced a prolonged recession and an extended period of very low inflation with occasional bouts of mild deflation. The goal of this exercise is to derive implications from the Japanese experience that may help predict the future course of U.S. inflation. The authors analyze the Japanese data over a variety of subsamples from 1980 to the present, using a number of Phillips curve specifications ranging from backward-looking (or accelerationist) Phillips curves to forward-looking rational expectations models and models that include survey expectations of inflation. Between 1998 and 2010, Japanese inflation fell significantly and persistently below zero, but appears to have been bounded by a -2 percent floor. Over the past 15 years, long-run (6-10 year) inflation expectations hovered around 1 percent, but these expectations proved to be an inaccurate forecast. However, during this same period the one-year inflation forecast tracked actual inflation reasonably well. The authors examine the influence on realized inflation of both short- and long-run expectations, using simple Phillips curves that explore the relationship among core inflation, inflation expectations, the output gap, marginal cost, and important relative price shifts.



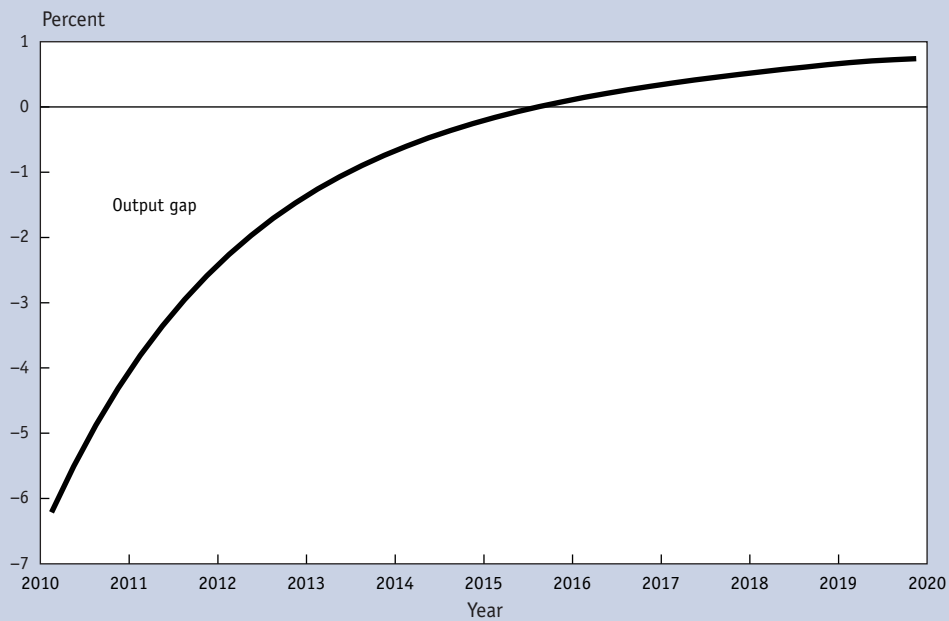
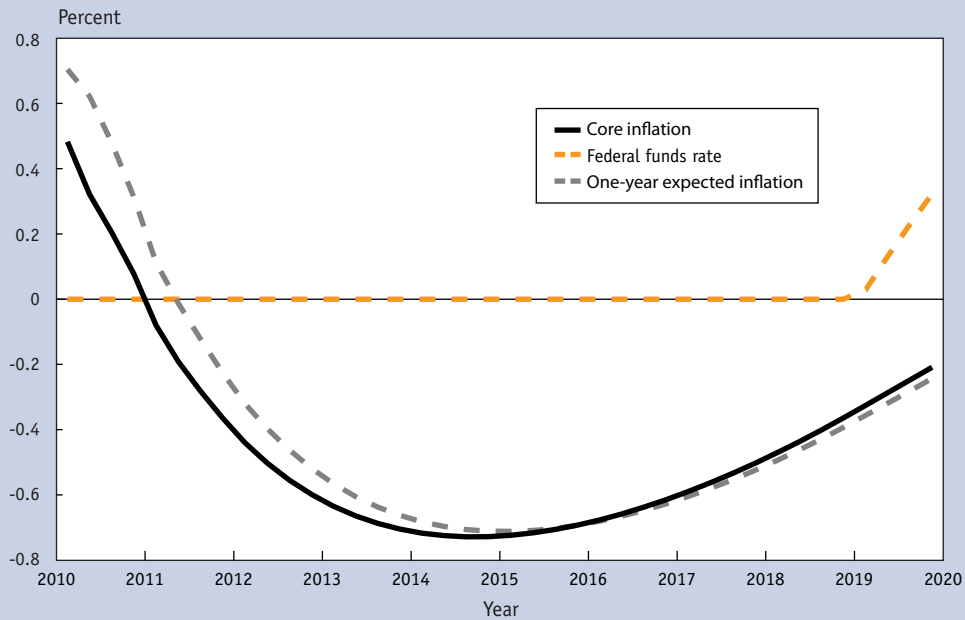
The authors apply their Japanese inflation model to the United States and find that it explains the recent path of U.S. inflation very well. In the core inflation equation, the coefficients on the one-year inflation expectations variable from the Survey of Professional Forecasters (SPF) and lagged inflation are very close to those estimated for Japan. To study the implications of the Japanese model for predicting the future path of U.S. inflation given the current low inflation environment and monetary policy at the zero lower bound, the authors simulate a model that imposes the zero lower bound on the short-term policy rate and where the target inflation rate is 2 percent. The initial conditions mimic the macroeconomic conditions in place at the start of 2010, when annual inflation was 1 percent, the federal funds rate was 25 basis points, the output gap was estimated to be -7 percentage points, and short-term inflation expectations stood at 1 percent.

### Key Findings

- Using a nonlinear Phillips curve estimation, the authors' analysis of the 1954:Q1–1963:Q4 period and the period from 2003:Q1 to the present predicted that U.S. inflation would bottom out during 2010 at slightly below an annual rate of 1 percent, and then gradually revert to its long-run level as the output gap improves. Based on this estimation, core PCE is expected to remain below 1.3 percent per year as long as the output gap is below -3 percent. The authors dub this prediction the “optimistic scenario,” noting that this analysis of the inflation path is based on a Phillips curve relationship estimated from the 1954-to-1963 period, which was characterized by fairly short recessions.
- The authors analyze the Japanese data over a variety of subsamples from 1980 to the present and find that predictions made using a standard backwards-looking Phillips curve estimated through the mid-to-late 1990s consistently and significantly mispredicted the level of inflation in the following years, suggesting that the accelerationist nature of the output gap and the nominal inflation rate that characterized the standard Phillips curve no longer hold.
- Using surveys of professional forecasters as an alternative way of measuring expected inflation, the authors find that one-year survey expectations have played a strong role in the evolution of Japanese core inflation. Based on analysis of the Japanese data from the late 1990s onward, the authors' findings suggest that long-run inflation expectations remained well-anchored in Japan but play little or no role in the evolution of Japanese core inflation.
- Using their finding that Japanese inflation is best modeled on one-year survey expectations, the authors apply this Japanese inflation model to recent U.S. data. They obtain a very good fit, with the coefficients on one-year SPF expectations and lagged inflation very close to those estimated for Japan.
- It is striking that long-run inflation expectations explain little or nothing of recent U.S. inflation fluctuations once one-year expectations are taken into account, as this finding contradicts the prevailing view that the stability of inflation depends on long-run inflation expectations remaining well anchored. But the authors find that long-run expectations may have an indirect effect on inflation via their influence on one-year expectations. This finding does not hold for Japan, where long-run expectations exhibit little relationship to either realized inflation or short-run inflation expectations.
- The optimistic scenario based on the 1954:Q1–1963:Q4 period in the United States predicts that inflation will go no lower than 75 basis points, and then gradually return to the 2 percent level in later years, while the simulation based on the Japanese style survey model suggests a prolonged period in which U.S. inflation remains negative and the policy rate is fixed at the zero lower bound while the output gap gradually recovers. Although inflation and expectations ultimately return to the 2 percent inflation target rate, the simulation suggests that it could take almost a decade to return to this long-run equilibrium. Conducting a simple test for non-nested hypothesis test-

## Simulated Values for U.S. Core Inflation, 2011 to 2020

Simulation of model with 2010 initial conditions



Source: Authors' calculations.

Note: The charts report simulated values for core inflation, the federal funds rate, and the output gap using the inflation specification  $\pi_t = a\pi_t^e + b\pi_{t-1} + c_s + c_0$ , and  $\pi_t^e = \sum_{\tau=0}^4 d\pi_{t-\tau} + f\pi_t^{LR} + \sum_{j=0}^2 e_j \tilde{y}_{t-j} + e_0$  as the law of motion for one-year inflation expectations. The model is augmented by a law of motion for the federal funds rate and the output gap and is initialized with the economic conditions prevailing in 2010.

ing developed by Davidson and MacKinnon (1981) shows that the Japanese-style survey model dominates the nonlinear Phillips curve model. This means that the more pessimistic scenario is more likely than the optimistic one.

- The concept of anchored expectations plays an important role in discussing the expected path of U.S. inflation, as these can offset changes in the output gap or declining marginal costs. The Japanese model and the U.S. model derived from it both predict that inflation will behave as if it had a lower bound or floor, which is often attributed to the presence of downward nominal wage rigidity (DNWR) acting as a disinflationary buffer. Yet studies supporting the existence of DNWR tend to be based on individual wages. Using firm-level data collected by the Bureau of Labor Statistics for the Occupational Employment Statistics, the authors find evidence that there is some flexibility in firms' labor costs, which suggests that firms might be able to adjust these costs by making compositional changes in their labor force.

### Implications

Because the process that generates one-year expectations is a reduced-form inflation equation, the authors' models based on recent Japanese and U.S. data do not have the status of more thoroughly tested and theoretically grounded micro-founded models of inflation. However, the authors' models appear to fit the historical data very well, be reasonably stable, and for the sample periods examined to dominate the purely forward-looking or the hybrid rational expectations models, the more optimistic nonlinear Phillips curve model, and the old-style accelerationist Phillips curves. U.S. policymakers should read a cautionary tale in the authors' results, which question the widely held view that stable long-run inflation expectations and downward nominal wage rigidity will offset deflationary pressures.

wn-11-2

## Designing Formulas for Distributing Reductions in State Aid

by Bo Zhao and David Coyne

complete text: <http://www.bostonfed.org/economic/neppc/wp/2011/neppcwp112.htm>

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### Motivation for the Research

Local governments depend on state aid to provide their residents and businesses with vital public services, such as education, police and fire protection, and safe public roads. According to the U.S. Census Bureau's *Survey of State and Local Government Finance*, transfers from state government accounted for 33 percent of local government general revenue in the United States in FY 2008. After local taxes, state aid was the second-largest revenue source for local governments.

However, because of the economic downturn and the current fiscal crisis, state aid to local governments has become an increasingly important and contentious budgetary issue across the nation. State policymakers tend to reduce local aid quickly and deeply during a fiscal crisis (Dye and Reschovsky 2008; Clemens 2011). Indeed, the Congressional Budget Office (2010) confirms that 22 states reduced aid to local governments in FY 2010, and notes that 20 states have proposed additional cuts in FY 2011. For example, Michigan cut 9.7 percent of total payments to cities, villages, and townships, and 15.6 percent of aid to 20 counties in FY 2010 (National Association of State Budget Officers 2009). Oregon cut state aid to K–12 education by 5.7 percent during 2009–2011, compared with the previous two-year period. In FY 2011, Minnesota cut aid to cities and counties by 35 percent, while New Jersey cut the two major components of state aid to municipalities by a total of 17 percent (National Association of State Budget Officers 2010).

Cuts in state aid increase the fiscal stress on local governments, which in turn undermines their residents' quality of life and the local business environment. Dye and Reschovsky (2008) and Wu (2009) find that cuts in state aid lead to increases in local property taxes, although those increases only partially offset the loss of state aid. Anderson (2007) and Skidmore and Scorsone (2011) show that local governments respond to declining state aid by cutting public services. Some city governments have even initiated large-scale layoffs. For example, in 2011 Camden, New Jersey laid off half its police force in response to declining state aid (Denvir 2011). San Diego adopted a FY 2012 budget that eliminates more than 750 teaching jobs and 600 other positions in order to deal with California's reductions in state education aid (Magee 2011).

States tend to cut aid to local governments either on an ad hoc basis or across the board, with every community receiving the same percentage aid cut (Fisher and Prasad 2009). Both approaches are widely considered to be unfair. Ad hoc cuts are not based on an objective rationale and lack a transparent decisionmaking process. Across-the-board cuts ignore differences in the underlying fiscal health and levels of existing aid among communities. This type of aid reduction often puts more of the burden on poorer communities (for example, Murphy 2011; Norton 2011). Because poor communities tend to receive a larger amount of state aid than wealthier communities, across-the-board percentage cuts mean larger per capita aid cuts for poor communities. Cuts in state aid also tend to have a disproportionately large effect on total local spending in lower-income communities because state aid typically constitutes a larger share of total spending in these communities. As a result, local officials have raised concerns that across-the-board aid reductions will widen the gap between wealthier and poorer communities, effectively undoing years of fiscal equalization (Robertson 2009; Jaklich 2011; Post-Standard Editorial Board 2011).

States often distribute local aid to address the inequity and inefficiency stemming from disparities in local fiscal health. The literature bases assessments of underlying local fiscal health on three different concepts: revenue-raising capacity, the expenditure-need for local services (that is, the underlying costs of providing those services), or need-capacity gaps. Revenue-raising capacity reflects the underlying ability of local governments to raise revenues from local sources. Cost-based measures of underlying fiscal health incorporate factors that affect spending on local public services but are outside the direct control of local officials. Need-capacity gap, or fiscal gap, measures the difference between a community's underlying costs and its revenue-raising capacity. Such a gap is a more comprehensive measure of underlying local fiscal health than capacity-only or cost-only measures.

To address concerns with current ways of modifying the distribution of state aid, this paper develops a new aid-reduction framework based on underlying local fiscal health and the distribution of existing aid. Under this framework, communities that are less fiscally healthy and receive less existing aid would see smaller aid cuts.

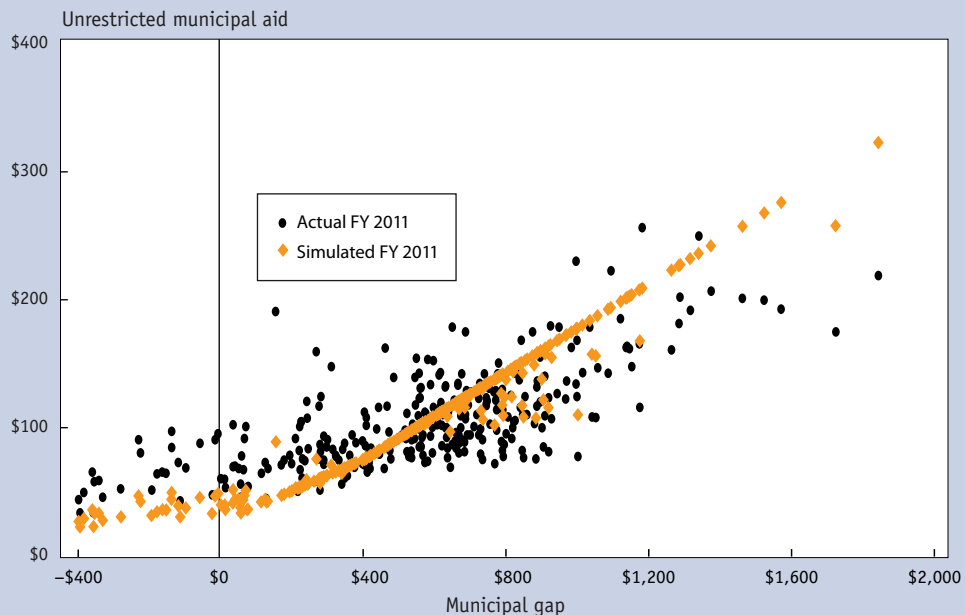
### **Research Approach**

The authors develop a framework of distributing aid reductions based on the fiscal gaps of local communities and the existing distribution of local aid. Under the authors' framework, policymakers must select a maximum aid cut and a minimum aid cut, which they can define either as a percentage of the previous year's aid or as a per capita amount. They must also select a baseline gap such that cities and towns with a per capita gap lower than the baseline gap will receive the maximum aid cut. The authors then generalize the framework to distribute aid increases, resulting in a single tool that policymakers can use to accommodate all changes in aid, whether cuts or increases. Finally, the authors use Massachusetts data on the Commonwealth's 351 cities and towns to conduct simulations to explore the policy implications of their gap-based framework.

## Key Findings

- Under the actual aid cuts from FY 2008 to FY 2011, communities in each quintile of the gap distribution lose roughly the same percentage of their municipal aid—slightly more than 31 percent. However, if Massachusetts had used the authors’ gap-based framework to cut aid, between FY 2008 and FY 2011, higher-gap communities would have received a smaller total percentage aid cut than lower-gap communities. For example, under the authors’ percentage-cut scenario, communities in the fifth gap quintile would have lost 24 percent, on average, compared with an average loss of 66 percent for communities in the first gap quintile.
- When the maximum and minimum cuts are defined in dollar amounts, the gap-based framework could give even more favorable treatment to higher-gap communities. Because the authors’ dollar-cut scenario cuts almost all the aid from some low-gap communities, those communities with higher gaps retain more of their aid. Communities in the first gap quintile would have lost 97 percent of their aid from FY 2008 to FY 2011. In comparison, the average aid cut would have been only 21.5 percent for communities in the fifth gap quintile.
- More than half of all Massachusetts communities—representing about 52 percent of the state-wide population—would receive smaller aid reductions under the gap-based scenarios than under the actual across-the-board aid cuts implemented from FY 2008 to FY 2011. These communities tended to have relatively large fiscal gaps.
- Use of the gap-based aid cut framework would have strengthened the relationship between state aid and fiscal gaps. The share of communities receiving aid in proportion to their gaps would increase from 11 percent in 2009 to 38 percent in FY 2011. As a result, fiscal gaps gain more power in explaining the distribution of municipal aid over time.

### Comparing Simulated Aid Distribution with Actual Aid Distribution in Massachusetts (FY 2011, per capita)



Source: Authors’ calculations.

Note: To show the general pattern more clearly, 40 communities with a per capita gap below -\$400 have been omitted.

- Simulations of future increases in aid using the gap-based approach provide greater aid to larger-gap communities and steadily strengthen the relationship between fiscal gaps and state aid.

### **Implications**

This paper provides the first framework that is suitable for allocating aid reductions based on both local fiscal gaps and existing aid distributions. Most previous research that focuses on gap-based formulas, such as Bradbury et al. (1984) and Zhao and Bradbury (2009), considers only distribution of increases in aid, while preserving existing aid distributions or holding them harmless, and does not address aid-reduction scenarios. To the authors' knowledge, Reschovsky and Schwartz (1990) is the only other paper that has explored designing a gap-based formula for aid reduction. However the formula in the Reschovsky and Schwartz paper ignores the existing aid distribution, which state governments typically use as a starting point for aid cuts.

The authors' analysis can be useful for both policy debate and policymaking. First, their framework provides a more rational and equitable approach to cutting local aid than ad hoc or across-the-board methods. Second, their framework helps to move the distribution of state aid from nongap-based to gap-based—even in years of decreased state aid. This allows states to accelerate the reform process without having to wait for aid increases to implement a gap-based formula that holds existing aid harmless. Third, this research is practical and timely, because many states are making or plan to make additional local aid cuts in coming fiscal years. Finally, policymakers can apply the framework to any kind of aid used for fiscal equalization, and the framework is potentially applicable to all states.

While the authors use Massachusetts as a case study, the gap-based framework is potentially applicable to all states. In principle, researchers can measure the underlying local fiscal health in other states using regression analysis similar to that in Bradbury et al. (1984) and Bradbury and Zhao (2009), while controlling for state-specific institutions. The authors' gap-based framework is also general enough for use with any school or nonschool aid program that aims for fiscal equalization across communities.

wn-11-3

## **Childhood Lead and Academic Performance in Massachusetts**

*by Jessica Wolpaw Reyes*

complete text: <http://www.bostonfed.org/economic/neppc/wp/2011/neppcwp113.htm>

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### **Motivation for the Research**

Children today are exposed to numerous environmental toxins, and a large body of research indicates that these toxins can substantially damage their health and development. One particularly insidious toxin, lead, has been aggressively targeted by U.S. public policy. This paper examines how society has benefited from the public health efforts on lead and, more specifically, seeks to discover whether we can see improvements in children's cognitive performance as a consequence of their lessened exposure.

Although lead is extremely useful in improving the performance of paint, gasoline, and plumbing, it is also dangerous. Extensive evidence (Bellinger 2008) indicates that even moderate exposure in childhood can have long-lasting adverse effects on an individual's neurological development, behavior, and cognitive performance. Happily, lead is one of the great success stories of environmental and public health policy. At the national level, it was removed from paint and gasoline in the 1970s, yielding broad reductions in lead levels across all ages and demographic groups. At the state level, public health campaigns have systematically reduced exposure for children in many places.

Massachusetts has been at the forefront of these efforts. Since the 1970s, the Massachusetts Childhood Lead Poisoning Prevention Program (CLPPP) has overseen the mandatory lead screening of all children under the age of 6, the provision of appropriate medical and environmental services to affected families, and the implementation of policies aimed at eliminating sources of lead exposure. These endeavors have drastically reduced levels among Massachusetts children, so that in recent years fewer than 1 percent of screened children have exhibited elevated lead levels.

Given what we know about the levels at which lead affects child development, it is likely that the low and moderate levels that were common in the 1990s in Massachusetts would have impaired children's cognitive performance. Accordingly, it is plausible that lead policy had measurable effects on academic performance as children born in the 1990s grew up in the 2000s.

### **Research Approach**

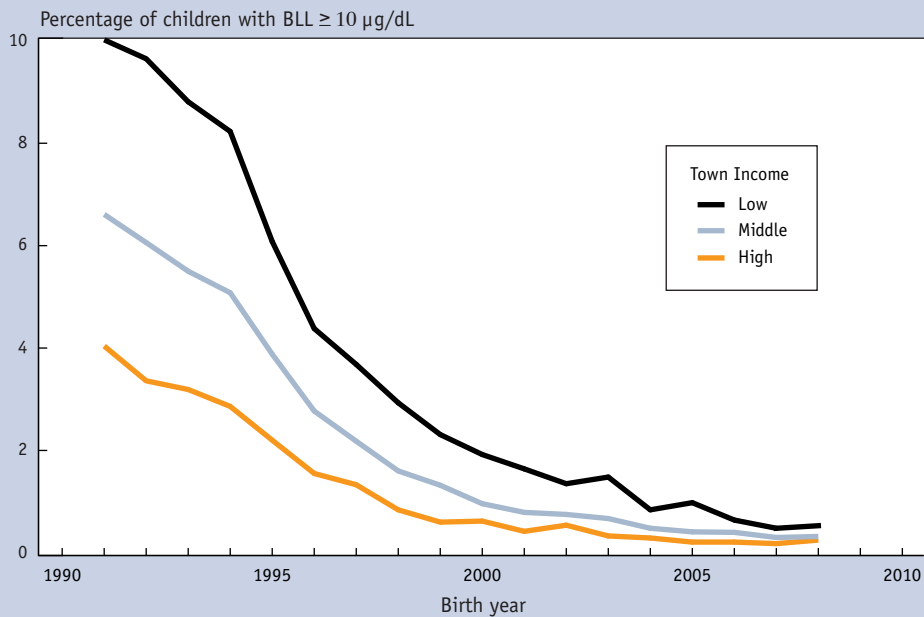
Using data from Massachusetts in the past two decades, the author studied the link between lead exposure in early childhood and academic performance in elementary school. The dataset was constructed from blood-lead data collected by the CLPPP and test score data collected by the Massachusetts Department of Elementary and Secondary Education. The sample included nearly all children who were born between 1991 and 2000 in Massachusetts and who attended public elementary schools in the state between 2000 and 2009. The approximately 700,000 children were grouped into school cohort groups by the elementary school they attended (out of approximately 1,200 in the state) and by their age cohort. Measures of each group's early-childhood lead levels were constructed from measurements of individuals' blood lead. Measures of each group's elementary-school academic achievement were constructed from individuals' scores on the Massachusetts Comprehensive Assessment System (MCAS) in the third and fourth grades. The data included numerous controls for characteristics of the schools and communities.

### **Key Findings**

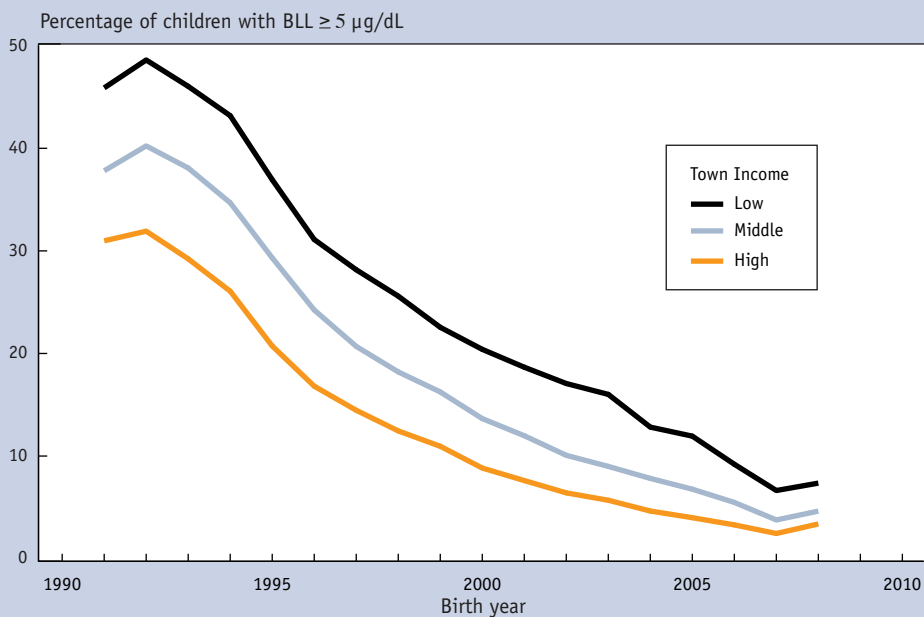
- The results support the hypothesis that childhood lead exposure adversely affects academic performance and that policies targeting lead had substantial benefits. First, there is a strong cross-sectional relationship between early-childhood lead levels and elementary school test scores. Towns where children have higher lead levels tend to have lower MCAS scores. Moreover, a comparison of relative changes over time reveals that, for the most part, schools whose student population experienced larger decreases in lead exposure in the 1990s also experienced larger increases in MCAS scores in the 2000s.
- Since characteristics of towns or schools could be driving some of these relationships, it is important to control for factors such as school spending, the share of low-income students, the town's per capita income, and its demographic composition. Panel data analysis that included such controls also yielded strong results: the share of a group with elevated blood lead had a statistically significant positive effect on the share of that group scoring unsatisfactory on the MCAS in both English language arts and mathematics.
- In the fully controlled specification, a 1 percentage point increase in the share of children with lead above the Centers for Disease Control's level of concern (a technical measurement of 10 µg/dL, 10 micrograms per deciliter) was associated with an increase of 0.2 percentage points in the share of that group getting an unsatisfactory score. For higher lead levels, the effects were larger: a 1 percentage point increase in the share with lead level above 20 µg/dL was associated with a 1 percentage point increase in the share of that group scoring unsatisfactory. That is, in a group of 100 children, the movement of one child's lead level past the 20 µg/dL mark causes one child's performance level to fall below satisfactory. In short, school cohorts that include more children with elevated blood lead levels in early childhood also include more children who score unsatisfactory, even removing the influence of other determinants that might be associated with lead levels.

## Prevalence of Elevated Blood Lead Levels (BLLs) in Massachusetts Children by Birth Year (1991–2008)

**Panel A. Prevalence of BLLs  $\geq 10 \mu\text{g/dL}$**



**Panel B. Prevalence of BLLs  $\geq 5 \mu\text{g/dL}$**



Source: Author's calculations.

Note: Income categories are based on town per-capita income in the year 2000. "Low" includes towns with income in the bottom quartile ( $< \$20,000$ ), "Middle" includes towns in the middle two quartiles ( $\$20,000$ – $\$30,000$ ), and "High" includes towns in the top income quartile ( $> \$30,000$ ).



- To understand what this means for Massachusetts, the author performed several straightforward simulations. The exercises indicated that public health policy was responsible for modestly reducing unsatisfactory test performance statewide. In the 1990s, policy reduced the share of Massachusetts children with blood lead levels above 10 µg/dL from 11 percent to 3 percent. That decline is estimated to be responsible for a 2 percentage point decline in the share of children scoring unsatisfactory on the MCAS. When considered in view of the fact that approximately one-third of children score unsatisfactory in any given year, this amounts to an approximate 5 percent reduction in unsatisfactory performance. This reduction is equivalent to the performance improvement that would have been associated with an across-the-board increase in income per capita of \$1,000–\$2,000.
- Moreover, simulations that separate communities by income indicate that lead policy also was responsible for reducing achievement gaps between low-income and middle-income communities. This can be seen by comparing the effects of lead policy with the effects of tax or spending policy that would increase family income in low-income communities. To achieve—without the 1990s decline in lead exposure—the same “time path” of test-score performance that was seen over the sample period, per capita income would have had to go up by 15 percent for low-income communities. By closing the lead gap, lead policy achieved test-score improvements similar to what would have been achieved by closing one-fifth of the income gap between low- and middle-income communities.

### **Implications**

Studying lead and academic performance in a state that has significantly reduced children’s blood lead levels confirms that lead does adversely affect academic performance and that the societal impact of aggressive public health policy was significant. Moreover, the benefits appear to be a bargain. Annual government spending on lead policy in Massachusetts is currently less than \$5 million—several orders of magnitude less than annual government spending on education in Massachusetts. The results suggest not only that public health policy has been effective in improving academic outcomes and reducing inequality, but also that it has done so in a relatively frugal manner. Continuing research will employ individual-level data to identify these effects better and will employ a more comprehensive benefit-cost analysis of lead policy in the context of broader social policy.

One lesson to take from the research is that policymakers concerned with improving academic outcomes may want to broaden their view, looking beyond traditional education policies to consider other environmental and public health policies that can dramatically alter children’s cognitive and social development. A growing body of research (Almond and Currie 2010) has yielded diverse evidence that early childhood influences and events can have long-lasting effects on individual outcomes. By focusing additional efforts on actionable early life influences, policymakers may be able to take advantage of early high-yield interventions.

# Public Policy Briefs

b-11-3

## Potential Effects of an Increase in Debit Card Fees

by Joanna Stavins

complete text: <http://www.bostonfed.org/economic/ppb/2011/ppb113.htm>

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### Motivation for the Research

Debit cards have become the most common noncash payment method used in the United States. As part of the Dodd-Frank financial reforms, the Federal Reserve Board limited the interchange fees charged on debit transactions to approximately 24 cents per transaction for banks with assets over \$10 billion, effective on October 1, 2011. This reduction from the previous rate of around 44 cents per transaction is expected to cut revenues, so banks have an incentive to raise other fees in order to recover these losses. While the paper was written before the reforms were enacted, it analyzes the potential effects on consumers of these changes on debit card fees, including which individuals are most likely to be affected and how these changes might motivate changes in consumer payment behavior.

### Research Approach

The author uses data from the Federal Reserve Bank of Boston's 2008 and 2009 Surveys of Consumer Payment Choice (SCPC) to analyze debit card use in order to predict how the lower interchange fees might impact consumers. The SCPC shows that in 2008 and 2009 debit cards were held by 80 percent of U.S. consumers. Older consumers were less likely to use debit cards, and adoption was lowest for those over 65 years old. Respondents with less than a high school education and an annual income below \$25,000 were the lowest debit adopters, but there was no apparent pattern among other education and income levels. The adoption and use of debit cards during 2008 and 2009 are analyzed using the Heckman two-step regression model, which allows the author to estimate payment use conditional on adoption and avoid a potential bias from estimating adoption and use separately. The author includes separate measures for the perceived cost of debit cards relative to every other payment instrument and for how consumers rate the security of debit cards relative to checks and credit cards. For all other payment method characteristics—convenience, acceptance, speed, control, records, and setup—the author created a composite variable measuring each respondent's average rating of debit cards relative to other payment methods. To estimate how changes in banks' pricing of debit card services might impact consumer payment choice, three different scenarios were simulated: 1) an increase in the cost of debit card adoption (measured as setup), 2) an increase in the cost of using a debit card, and 3) a broader increase in the cost of maintaining bank accounts.

### Key Findings

- The cost of using debit cards seems to be an important factor affecting consumer payment decisions: consumers who ranked the cost of debit cards low relative to the cost of using other payment methods were significantly more likely to adopt and to use debit cards. Banks have not typically charged for setting up debit cards, but in the wake of the new rule on debit transaction fees banks might institute a one-time setup cost. The simulation yielded a substantial decline in debit adoption of 8.2 percentage points relative to the baseline adoption rate of approximately 80 percent.
- While some consumers might elect to forego debit cards entirely in response to an increase in debit card fees, it is more likely that consumers would respond by reducing the number of their debit card transactions. The simulated increase in the cost of debit resulted in a 1.6 percentage point reduction in debit use relative to the baseline share of 27.5 percent of all transactions in the 2009 SCPC survey.

- In regressions of payment use, the relative cost of debit cards had a significant effect on the use of credit cards, and vice versa, indicating that credit cards are viewed as a close substitute for debit cards. If the cost of debit use rises, consumers are most likely to substitute credit cards for some of their debit card transactions. The simulations showed that credit card transactions would increase by 1.1 percent relative to the baseline share of 15.8 percent of all transactions in the 2009 survey.
- A specific increase in the cost of debit cards is expected to have a greater effect on debit card use than would a broader increase in the cost of maintaining a bank account, for the simple reason that most consumers need a bank account to pay for transactions. Since there is an inelastic demand for deposit accounts, banks might be more likely to raise account fees.
- Consumers with the lowest education level, less than a high school degree, the lowest annual income (below \$25,000), and under 25 years old consider the cost of use to be the most important characteristic of a payment method. These consumers are the ones likely to be most affected by an increase in debit card fees and therefore most likely to respond by changing their payment behavior.

### **Implications**

The paper finds that debit card use is sensitive to its cost. In fact, consumer reaction to the Bank of America's announcement of a \$5 per month debit card fee shows that demand for debit card fees is more price elastic than banks had anticipated. Banks are more likely to try to recover their lost revenues by imposing other types of fees. Any fee changes resulting from the decrease in debit card interchange fees are likely to be spread out over time, so the full impact of the reform will take a while to assess. The author points out some likely scenarios based on an econometric analysis of the 2008 and 2009 SCPC.

b-11-4

## **Inflation Expectations and the Evolution of U.S. Inflation** by Jeffrey C. Fuhrer

complete text: <http://www.bostonfed.org/economic/ppb/2011/ppb114.htm>  
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### **Motivation for the Research**

In the aftermath of the Great Recession, unemployment has remained stubbornly high and unit labor costs have been extremely subdued. Yet inflation during the same period has responded at best modestly, dipping below 1 percent in late 2010, but rising more recently to a range between 1.5 and 2.5 percent. A widely held theory suggests that this stability of inflation may be the result of “well-anchored” long-run inflation expectations, which serve as an important counterweight to the otherwise depressing effects of unemployment and low production costs. This brief examines the way these inflation influences have operated in recent years.

### **Research Approach**

The author gives a largely qualitative overview of the empirical research underpinning current models of how inflation expectations are formed. These models support one of the foundational principles of current monetary policy theory and practice, the idea that well-anchored inflation expectations—meaning expectations that adhere fairly closely to the explicit or inferred long-term inflation goal set by a nation's central bank—prevent recent inflation that deviates from the long-term trend from unduly influencing nominal price increases. The belief in well-anchored expectations depends on price-setting firms' confidence that the monetary authority will guide any deviations in current inflation back to the long-run goal in a reasonable time period. This implies that current inflation is anchored to long-run expectations (proxied in the brief by the average inflation rate expected over the next 10 years).

While many models of inflation assume that price-setters have rational expectations—meaning that agents form expectations by efficiently using all available information—these models have achieved only partial empirical success. Recent work has proposed that survey expectations might serve as a reasonable middle ground between loose expectation proxies (such as simple moving averages of past inflation) and the more theoretically rigorous rational expectations hypothesis. While it is difficult to identify with precision the role that long-run expectations have played in influencing short-term inflation over the past dozen years, the author develops evidence that suggests that long-run inflation expectations anchor short-run inflation expectations, which in turn are a key determinant of inflation. He uses predicted unemployment from the Survey of Professional Forecasters to proxy for short-run expectations of resource utilization in an equation estimating the relationship linking short-run expectations, long-run expectations, and expected unemployment.

### **Key Findings**

- When short- and long-run inflation expectations diverge, which one ends up providing the best signal of the path of inflation expectations? An answer is provided by a simple “error-correction” test. The test shows that over the past 30 years discrepancies between short- and long-run inflation are resolved by movements of the short-run expectations toward the long-run, and not the reverse. This suggests that the long-run inflation expectation anchors the short-run inflation expectation.
- While short-run inflation expectations ultimately revert to long-run expectations, short-run expectations are influenced by other factors as well. The Phillips curve suggests that short-run inflation expectations should depend on short-run expectations of resource utilization. The brief finds that the coefficient on the unemployment gap is sizable, significant, and fits the 2000–2011 period reasonably well.
- The simple survey-based model explains the fluctuations in inflation and short-run economic fluctuations quite well over the last 12 years. It establishes that short-run inflation expectations are anchored by long-run expectations in determining U.S. inflation.
- The author uses the survey-based model to conduct a simulation to predict the current trajectory of inflation. It suggests that recent elevated inflation rates are transitory and that the U.S. inflation rate will remain at 1.0 before gradually rising to 1.5 percent by 2014:Q4.

### **Implications**

Despite an elevated unemployment rate and recent below-trend inflation, the long-term outlook for U.S. inflation remains anchored to long-run expectations, although the United States may experience a prolonged period of low inflation, somewhat below the Fed’s 2 percent annual inflation target.

# Research Reports

r-11-3

## State Foreclosure Prevention Efforts in New England: Mediation and Assistance

by Robert Clifford

complete text: <http://www.bostonfed.org/economic/neppc/researchreports/2011/rr1103.htm>

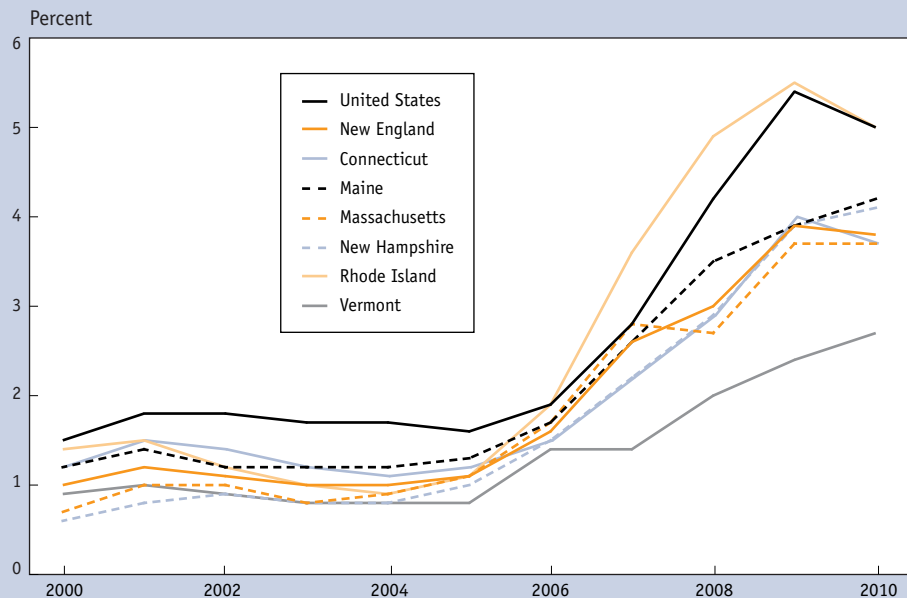
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### Motivation for the Research

Declines in house prices from 2006 onward resulted in a large number of foreclosures of residential properties. Although initially concentrated among subprime borrowers, by late 2008 as the U.S. economy plunged into a deep recession, foreclosures among prime borrowers began to outpace subprime foreclosures. With foreclosure filings hitting record levels and expected to weigh heavily on the housing market and the nation's economic recovery, federal, state, and local policymakers continue to search for ways to stem the tide. The attempts have led to an "alphabet soup" of federal programs aimed at preventing foreclosures.

In the six New England states early foreclosure prevention efforts included referral programs, consumer awareness campaigns, education and counseling for homeowners, and a refinancing program aimed at subprime borrowers. States in the region have recently expanded these programs and developed new ones focused on two major strategies: foreclosure mediation and financial assistance. Five

### Foreclosures Started as a Share of Outstanding Mortgages 2000–2010



Source: Mortgage Bankers Association/Haver Analytics.

Note: "Foreclosures started" refers to the percentage of all mortgages in the pool sent to the foreclosure process each year.

New England states have created foreclosure mediation programs, and two have developed financial assistance programs that target unemployed homeowners and those with negative equity, meaning that the home is worth less than the amount owed on the mortgage.

### **Research Approach**

This report focuses on assessing these newer foreclosure prevention programs. It describes how these programs are funded, weighs their benefits and shortcomings, and offers a preliminary evaluation of the resulting outcomes. After providing a brief overview describing foreclosure trends in New England, the challenges these trends pose, and why it is good public policy to find alternatives to preventable foreclosures, the author examines various foreclosure mediation programs and shows how a program's design determines how well it succeeds at or falls short of the goal of finding viable alternatives to foreclosure. He then reviews financial assistance programs in New England and examines how borrower qualifications for receiving assistance affect the programs' ability to help distressed homeowners. Finally, the author combines the lessons learned from his review of both mediation and financial assistance programs to offer general policy recommendations for current and future foreclosure efforts.

### **Key Findings**

- The review shows that mediation programs have the potential to play a role in nearly all residential foreclosures by facilitating a conversation between homeowners and lenders. Although this sounds simple, it requires that policymakers design programs with adequate incentives to ensure the participation of both parties. Mediation programs in which incentives are correctly aligned have been fairly successful in finding alternative solutions to foreclosures. However, in order to evaluate their long-term effectiveness, further information and analysis are needed so as to better understand which aspects of these programs have enabled them to succeed at foreclosure prevention.
- In comparison to mediation efforts, financial assistance programs are narrowly targeted at providing direct financial assistance to distressed homeowners who, by receiving such aid, are likely to avoid foreclosure and/or the challenges of negotiating with a lender. These programs require a combination of foresight to address the changing nature of foreclosures and flexibility to react to the shortcomings of the programs' initial designs. The major challenge facing financial assistance programs has been the scale of funding required, although the assistance typically provided comes in the form of loans the homeowner repays over time.
- The overall lessons for effective foreclosure prevention suggest that foreclosure prevention programs will have a better chance of achieving their goals if the following steps are taken: intervening early, designing incentives that compel homeowners and lenders to negotiate, tapping existing expertise found in a state's judiciary system and housing finance agencies, using nontraditional funding sources if appropriate, devising and analyzing clear metrics that track what approaches are and are not working, and proactively implementing the results of such assessments.

### **Implications**

With the scale of foreclosures expected to remain at elevated levels for some time, the need for an effective policy response remains urgent. Given tight fiscal conditions, policymakers will have to make hard choices regarding the best options for addressing the challenges posed by foreclosures. By developing programs to find alternatives to foreclosures, policymakers can attempt to mitigate some of the problems foreclosures pose for homeowners, lenders, communities, and government. This report provides lessons that can help policymakers design, implement, and administer successful foreclosure prevention programs. By applying these lessons—whether to mediation, financial assistance, or other prevention programs—new and existing policies can help to overcome many of the initial challenges that have hampered such efforts in the past, and should have greater positive impact against the still formidable tide of foreclosures.

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