

research review



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Public Policy Discussion Papers

p-10-3

Who Gains and Who Loses from Credit Card Payments? Theory and Calibrations

by Scott Schuh, Oz Shy, and Joanna Stavins

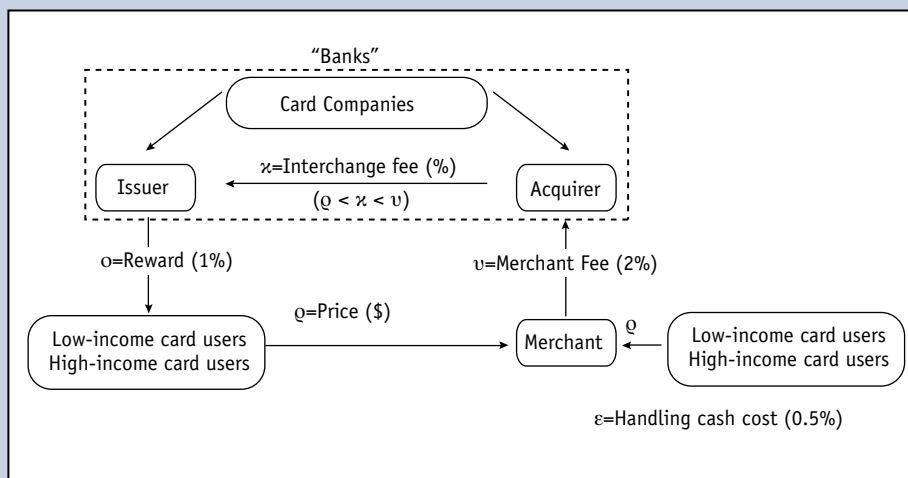
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Motivation for the Research

The typical consumer is largely unaware of the full ramifications of paying for goods and services by credit card. Faced with many choices—cash, check, debit or credit card, and so on—consumers naturally consider the costs and benefits of each payment instrument and choose accordingly. For credit cards, consumers likely think most about the benefits of this method: delayed payment—“buy now, pay later”—and perhaps the rewards earned—cash back, frequent flier miles, or other enticements. What most consumers do not know is that their decision to pay by credit card involves merchant fees, retail price increases, a nontrivial transfer of income from cash to card payers, and consequently a transfer from low-income to high-income consumers. (For simplicity, the authors refer to consumers who not pay by credit card as cash payers, where “cash” represents all payment instruments other than credit cards: cash, checks, debit and prepaid cards, and so on.)

In contrast, the typical merchant is acutely aware of the ramifications of customers’ decision to pay with credit cards. For the privilege of accepting credit cards, U.S. merchants pay banks a fee that is proportional to the dollar value of the sale. The merchant’s bank then pays a proportional interchange fee to the consumer’s credit card bank. Naturally, merchants seek to pass the merchant fee to their customers. Merchants may want to recoup the merchant fee only from the consumers who pay

Fee and Payments in a Simple Market with a Card Network



Source: Authors' illustration.

by credit card. In practice, however, credit card companies impose a “no-surcharge rule” (NSR) that prohibits U.S. merchants from doing so, and most merchants are reluctant to give cash discounts. Instead, merchants mark up their retail prices for all consumers by an amount high enough to recover the merchant fee from credit card sales.

This retail price markup for all consumers results in credit-card-paying consumers being subsidized by consumers who do not pay with credit cards, a result that was first discussed in Carlton and Frankel (1995) and later in Frankel (1998), Katz (2001), Gans and King (2003), and Schwartz and Vincent (2006). Thus, cash buyers must pay higher retail prices to cover merchants’ costs associated with the credit cards’ merchant fees. Because these fees are used to pay for rewards given to credit card users, cash users also finance part of the rewards given to credit card users.

If the subsidy of card payers by cash payers results from heterogeneity in consumer preferences and utility between cash and card payments, the subsidy may not be harmful in terms of consumer and social welfare. However, U.S. data show that credit card use is strongly and positively correlated with consumer income. Consequently, the subsidy of credit card payers by cash payers involves a regressive transfer of income from low-income to high-income consumers. This regressive transfer is amplified by the disproportionate distribution of rewards, which are proportional to credit card sales, to high-income credit card users. Frankel (1998) was the first to connect the wealth transfers to the average income of groups of consumers (that is, subsidies from noncardholders to wealthier cardholders). This idea was later discussed in Carlton and Frankel (2005) and Frankel and Shampine (2006). This paper is the first to compute who gains and who loses from credit card payments in the aggregate economy.

Research Approach

The authors compute dollar-value estimates of the actual transfers from cash payers to card users and from low-income to high-income households. They propose a simple, model-free accounting methodology to compute the two transfers by comparing the costs imposed by individual consumer payment choices with actual prices paid by each buyer. To conduct a welfare and policy analysis of these transfers, the authors construct a structural model of a simplified representation of the U.S. payments market and calibrate it with U.S. micro data on consumer credit card use and related variables. Their analysis is consistent with, but abstracts from, three features of the U.S. payments market.

First, it focuses on the use of credit cards for convenience (payments only) and does not incorporate a role for revolving credit, which is an important feature of the total consumer welfare associated with credit cards. Revolving credit is a one-time application for a line of credit that has no fixed payment schedule, can be drawn upon repeatedly up to the limit of the credit line, and leaves the repayment plan (which is really the credit decision) up to the card holder (except for a minimum payment). The authors use the term “revolving credit” to indicate credit that is not paid off completely at the end of each billing cycle.

Second, the study abstracts from the supply-side details of the payments market for both cash and cards. The authors take as given the well-established seminal result of Rochet and Tirole (2006) concerning the critical role of an interchange fee between acquiring and issuing banks in the two-sided credit card market, a result that notes that the optimal level of the interchange fee is an empirical issue. By incorporating both merchant fees and card reward rates, they can assume that the interchange fee lies between these two rates and is set internally in the banking sector to the optimal level conditional on fees and rewards.

Finally, they do not include a role for the distribution of bank profits from credit card payments to households that own bank stocks, due to a lack of sufficient micro data. Given these three simplifications, they

can assess only the consumer welfare implications of the payment instrument transfers but not the full social welfare implications.

Key Findings

- On average, each cash payer pays \$149 to card users and each card payer receives \$1,133 from cash users every year, a total transfer of \$1,282 from the average cash payer to the average card payer.
- On average, and after accounting for rewards paid to households by banks, when all households are divided into two income groups, each low-income household pays \$8 to high-income households and each high-income household receives \$430 from low-income households every year. The magnitude of this transfer is even greater when household income is divided into seven categories: on average, the lowest-income household (\$20,000 or less annually) pays a transfer of \$21 and the highest-income household (\$150,000 annually) receives a subsidy of \$750 each year. The transfers among income groups are smaller than those between cash and card users because some low-income households use credit cards and many high-income households use cash.
- About 79 percent of banks' revenue from credit card merchant fees is obtained from cash payers—and this comes disproportionately from low-income cash payers.
- According to the authors' model, high-income households appear to receive an inherent utility benefit from credit card use that is more than twice as high as that received by low-income households. Eliminating the merchant fee and credit card rewards (together) would increase consumer welfare by 0.15 to 0.26 percent, depending on the degree of concavity of utility, which also can be interpreted in an aggregate model as the degree of aversion to income inequality in society.

Implications

The authors do not allege or imply that banks or credit card companies have designed or operated the credit card market intentionally to produce a regressive transfer from low-income to high-income households. They are not aware of any evidence to support such an allegation nor do they have any a priori reason to believe it. However, the existence of a nontrivial regressive transfer in the credit card market may be a concern that U.S. individuals, businesses, or public policymakers might wish to address. If so, the authors' analysis suggests several principles and approaches worth further study and consideration.

Recent U.S. financial reform legislation, motivated by concerns about competition in payment card pricing, gives the Federal Reserve responsibility for regulating interchange fees associated with debit (but not credit) cards. The authors' analysis provides a different but complementary motivation— income inequality—for policy intervention in the credit card market.

\$1.25 Trillion is Still Real Money: Some Facts About the Effects of the Federal Reserve's Mortgage Market Investments

By Andreas Fuster and Paul S. Willen

complete text: <http://www.bostonfed.org/economic/ppdp/2010/ppdp1004.htm>
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Motivation for the Research

On November 25, 2008, the Federal Open Market Committee (FOMC) announced that the Federal Reserve Bank of New York would purchase \$500 billion of mortgage-backed securities (MBS) issued by Fannie Mae and Freddie Mac, the two main government-sponsored entities (GSEs) for housing, as well as ones guaranteed by the government agency Ginnie Mae. This plan, informally termed the large-scale asset purchase program (LSAP), was intended to reduce the spread between mortgage interest rates and other interest rates of similar duration. The LSAP program was largely meant to assist the U.S. housing market, which had slowed considerably, and to help stabilize broader financial markets. In March 2009, the FOMC expanded the LSAP program, and before its conclusion on March 31, 2010, the Federal Reserve bought a total of \$1.25 trillion of agency debt, including \$175 billion of GSE debt and \$300 billion of U.S. Treasury securities. This FOMC action was substantial; the total LSAP intervention corresponds to about 22 percent of the total outstanding stock of these securities. Despite the LSAP program's scope and scale, relatively little is known about its effect on the U.S. mortgage market and the overall U.S. macroeconomy. This paper investigates the program's impact on the U.S. mortgage market in terms of credit availability and macroeconomic effects, and draws lessons for similar policy interventions in the future.

Research Approach

The authors employ an event-study approach and measure the movements in both interest rates and the quantity of loan applications around the initial LSAP announcement in late November 2008 and subsequent announcement dates. The complex manner in which lenders price mortgages makes it challenging to discover how borrower opportunities changed after the LSAP program was announced. Obviously interest rates differ depending on the amount of the loan, the borrower's credit score, and whether the loan is fixed-rate or variable-rate, prime or subprime. But the borrower's choice set is further complicated by discount points tied to bond market pricing, the par value of the loan (meaning the amount the lender is financing), and the market value of the loan, which is the price paid by investors in the secondary market for MBS. To bridge the gap between the market price and the par value of the loan, lenders pay or receive discount points at the loan closing, and for a given loan, lenders may offer a combination of different contract interest rates and corresponding discount points. Discount points can be positive or negative and can influence whether it makes sense for a borrower to purchase or refinance. Positive discount points mean that the lender pays. Brokers often use positive points to offer "no points/no close" mortgages, meaning that the borrower is not liable for paying points or closing costs. Negative discount points mean that the borrower or sometimes (in the case of a purchase mortgage) the property seller must pay. For instance, if a borrower wants an interest-only mortgage, the lender requires the borrower to pay points to obtain these terms. The authors define the borrower opportunity set as the combined set of available discount rates and interest rates for a given mortgage transaction at a given time.

There are two ways that the authors' analysis is innovative. First, they focus on the entire menu of price options available to prospective borrowers, rather than focusing on a single interest rate. Second, unlike previous researchers they measure how many borrowers searched for loans, applied

for loans, were rejected for loans, and received loans immediately before and after the LSAP program was announced, as well as further along in the life of the program. By examining the credit market conditions prevailing before and after the initial LSAP announcement, and by employing micro-level data, the authors are able to examine whether borrower characteristics changed after the program was announced—in other words to answer the question, did the LSAP program help borrowers?

The authors use three different datasets each of which provides a different view of the primary U.S. mortgage market just before the program's inception and during its administration, and which taken together provide a broad view of mortgage market activity. The first dataset, from LoanSifter, a firm that aggregates lending rates and terms offered by over 140 lenders, provides a snapshot of a significant portion of the entire U.S. mortgage lending industry. Updated on a daily basis, the LoanSifter database allows a mortgage broker to search many variables that influence lending rates and terms, including the loan amount, the borrower's FICO score (a measure of creditworthiness based on a scale of 300 to 850, with the median around 720), the state where the property is located, whether the loan is intended for a purchase of a new home or a refinance of an existing loan, the borrower's loan-to-value and debt-to-income ratios, whether the loan is fixed rate, variable rate, or requires a balloon payment, and whether the property is being purchased as a primary residence or for investment purposes. When using the LoanSifter database, a broker enters either a desired number of discount points or a desired interest rate and receives various offers. The authors have access to LoanSifter's daily database from October 16, 2008 to February 9, 2009 (excluding December 8–14, 2008 due to a backup failure). The authors pose as a certain broker and access the offers that would have been received from affiliated lenders—on average, each broker in the sample has access to 20 lenders, although there is considerable variation in this number. The authors have access to loan offers made from January 1, 2008 to April 9, 2009, and have the history of actual searches conducted by brokers and, after February 2009, by borrowers directly via Zillow, a consumer web site. Thus, the authors can see borrower and loan characteristics, as well as the best offer received by the broker.

The second database is from the Home Mortgage Disclosure Act (HMDA), which requires lenders to provide information about all applications for mortgage credit. HMDA collects information on an applicant's race, income, gender, occupancy status, loan amount, and property loan. The lender must also disclose whether the loan application was approved, denied, or withdrawn by the borrower. The authors have access to confidential data files that include the loan application and action dates, information that is not disclosed in the public data. Thus, the authors have access to when borrowers took a potentially costly step to obtain a new loan, while the origination date allows them to link the application to loan-level data sets, which offer a wealth of additional information about the borrower and the loan. The HMDA data cover over 90 percent of the total U.S. mortgage market.

The third database, a collection of records from loan-servicing agencies maintained by Lender Processing Services (LPS), records the loan amount, the property value and location, whether it is a prime or subprime mortgage, whether it remains in the lender's portfolio or was packaged into a MBS, whether it is a first lien or a second lien loan, and the interest rate terms—including when an adjustment might take place. The LPS dataset covers about 60 percent of the U.S. mortgage market, but Avery et al. (2010) note that it appears to overrepresent GSE lending and to underrepresent jumbo and subprime lending. The authors perform some analyses by matching the HMDA and LPS data using a loan's origination date, the loan amount, and the property's zip code—this permits getting detailed loan information for about 35 percent of the loans reported in the HMDA data.

Key Findings

- The initial November 25 announcement of the LSAP program led to an immediate and large increase in borrower activity in the primary mortgage market. The LoanSifter data show an approximately 300 percent increase in the number of borrowers shopping for refinance

mortgages on November 25 compared with preceding days. The nonpublic HMDA data show that this increase in searches translated into a 150–200 percent increase in the number of applications and subsequent originations. The increase in search activity peaked in mid-December and early January, and again after the program's extension was announced on March 18.

- The LSAP program resulted in significant interest rate reductions for prospective borrowers. But due to the complex interaction of FICO scores, interest rates, and discount points, for some borrowers the LSAP program was a boon, while for other very similar and sometimes even observationally equivalent borrowers, the LSAP program was irrelevant. Mortgage lenders typically impose cutoff points at FICO scores of 680, 700, and 720, and in all three cases the data show that loan originations were over 25 percent higher immediately above the cutoff than right below it.
- The initial LSAP program announcement resulted in a marked shift in borrower characteristics. Refinancing activity became highly skewed towards borrowers with high credit scores. The authors document this by using a matched sample of loans from LPS and HMDA that determines the application date of originated mortgages. On November 25, there was over a doubling of refinance applications for borrowers with FICO scores below 700 from the previous day, the one preceding the initial LSAP announcement. For borrowers with FICO scores between 700 and 720, the application volume more than tripled; it quadrupled for borrowers with scores between 720 and 740, quintupled for those with scores between 740 and 760, and for highly creditworthy borrowers with FICO scores above 760, reapplication activity increased over seven-fold. These differences in refinancing activity persisted throughout the life of the LSAP program.
- In the days immediately after November 25, the reduction in rates available to borrowers was more pronounced for loans that required borrowers to pay discount points than for loans for which borrowers expected the lender to pay points. The authors' data show that a prototypical borrower who expected to pay one point at closing saw the interest rate fall by 60 basis points, on average, across lenders, while a borrower who expected the lender to pay one point saw the interest rate fall by only 16 basis points. This asymmetry became more pronounced over time—by the first week of January 2009, the average rate differential obtained by paying one discount point instead of receiving one point had gone up to 120 basis points, compared with 70 basis points in the weeks before the LSAP program was announced.
- The HMDA information on applicant income shows that denial rates increased for all applicants in all income categories after the LSAP program began.
- The LSAP program did not significantly affect the market for purchase mortgages or originations. The LoanSifter data show little effect even on search activity, suggesting that the program announcement did not increase interest among prospective buyers who did not already own a home.
- Borrowers with poor credit are at higher risk of default, and are required to pay additional points when closing a mortgage. The LSAP program did not reduce rates for borrowers with poorer credit scores as much as it did for borrowers with good credit.
- The authors suggest that the presence of additional fees, known as loan-level price adjustments (LLPAs), charged by the GSEs may account for the overrepresentation of borrowers with high credit scores benefiting more from the LSAP program. LLPAs were announced by Fannie Mae on November 6, 2007, and Freddie Mac followed its lead a week later. The existence of price adjustments tied to borrowers' creditworthiness was a relatively new aspect of the agency loan market, with the fee depending on the mortgage's loan-to-value ratio and the borrower's FICO score. The relationship between borrowers' FICO scores and refinancing activity after the LSAP program began was not smooth, but instead displayed discontinuities that coincide exactly with increases

in fees charged to borrowers. Since these additional fees interact with the changes in borrowers' rate-point opportunity set, the new fees may have had a particularly large impact on the cost of refinancing. Hence, many borrowers with low FICO scores may have found that they did not have a sufficient incentive to refinance. It is also quite possible that borrowers with lower FICO scores are more credit-constrained and hence less able or willing to pay discount points or other fees involved with financing or refinancing a mortgage.

- Borrowers with less robust credit may also have been prevented from refinancing if they had little positive equity in their homes, or if they were simply not as financially attuned to the benefits of refinancing as more creditworthy borrowers, and hence did not pursue the opportunity to refinance their mortgages

Implications

The authors' results raise important policy implications. First, the LSAP announcement had immediate and large effects on U.S. mortgage prices and ignited activity in what had been a moribund market. This greatly contrasts with other economic stimulus programs, such as tax cuts or "shovel ready" construction projects, which typically lag before impacting economic activity. Yet it is questionable whether the LSAP program truly stimulated consumption and stabilized house prices. The program did not result in a large increase in new purchase mortgages, although increased search activity could be interpreted as indicating that more households were considering a purchase. Rather, the data suggest that most of the borrowers who took advantage of more favorable terms enabled by the program were creditworthy homeowners looking to refinance an existing mortgage. Such borrowers are less apt to funnel any savings realized from refinancing into additional consumption expenditures. Homeowners more constrained by credit or income, such as subprime borrowers, were not always able to take advantage of potentially lower rates. The authors suggest that since the inception of the LSAP program resulted in such a dramatic change in the FICO-score distribution of successful applicants, this outcome merits further investigation as to the possible unintended consequences.

p-10-5

Reasonable People Did Disagree: Optimism and Pessimism About the U.S. Housing Market Before the Crash

By Kristopher S. Gerardi, Christopher L. Foote, and Paul S. Willen

complete text: <http://www.bostonfed.org/economic/ppdp/2010/ppdp1005.htm>
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Motivation for the Research

Much of the blame for the recent mortgage crisis and ensuing "Great Recession" can be traced to unrealistically high expectations for U.S. housing prices. Starting in the mid-to-late 1990s, house prices experienced an almost decade-long expansion, with real house prices rising 72 percent according to the Case-Shiller repeat-sales index, and 41 percent according to the OFHEO (now FHFA) repeat-sales index. This inflation-adjusted price growth was unprecedented; from the late 1940s through the mid-1990s, real house prices were essentially flat. In hindsight, it seems that by the mid-2000s, housing prices had risen to unsustainable heights, so a crash in housing values could have easily been foreseen. But the crash caught many observers unaware. This paper pieces together the real-time evolution of beliefs about U.S. house prices during the peak of the recent housing boom. The goal is to provide a retrospective understanding of why so many observers were unconcerned about housing prices during the housing boom—a boom that set the stage for the largest financial crisis since the Great Depression.

Research Approach

The authors review the work of prominent academic and professional economists who wrote about the U.S. housing market during the last decade. They pay particular attention to opinions written about the 2004–2006 period. Collectively, these views take one of three positions: (1) a “pessimistic” minority assessment of the U.S. housing market; (2) a strong “optimistic” assessment; and (3) an “agnostic” majority viewpoint that was unwilling to take a strong position either way about U.S. house prices.

Key Findings

- Among the pessimists, Dean Baker was one of the first economists to claim that the U.S. housing market was experiencing a bubble. He wrote in 2002 that the price-rent ratio in the housing market had risen almost 50 percent in nominal terms during the previous seven years. The implication was that this increase was out of line with previous norms and thus unsustainable. Karl Case and Robert Shiller (2003) found that overall U.S. housing prices tracked market fundamentals fairly well, but they discovered some evidence of speculative thinking in a survey that measured attitudes among housing-market participants. Given the decline in housing prices that actually occurred, these pessimistic economists now seem prescient. But some of them argued for a bubble years before the housing market peaked, so they lost credibility when those predictions did not materialize.
- One housing pessimist, Paul Krugman, claimed in 2005 that the U.S. housing market could be divided into “Flatland,” where prices remained in line with fundamentals, and a “Zoned Zone,” where restrictions on new construction contributed to large house-price increases. The authors of the paper present some empirical work indicating that many land-scarce cities, such as Boston, New York, and San Francisco, did indeed experience sizeable price increases during the boom. But the authors also found that some of the largest price increases were in cities like Las Vegas and Phoenix, which had ample land to accommodate new construction. The authors conclude that the data do not support Krugman’s claim that differences in city-level house-price growth stemmed mainly from varying housing-supply elasticities interacting with a uniform rise in demand.
- Among the optimists, Himmelberg, Mayer, and Sinai (2005) offered the most widely cited case against the existence of a housing bubble. They took issue with the empirical measures used by the pessimists, such as the price-rent ratio or the price-income ratio. Instead they studied the user cost of housing, a concept that recognizes the many factors that either raise or lower the true cost of homeownership. These factors include property taxes, maintenance costs, anticipated capital gains, the mortgage interest deduction, and the risk of large capital losses. In their empirical work, Himmelberg, Mayer, and Sinai found that user costs varied substantially across U.S. cities, but that these costs did not indicate the presence of a nationwide housing bubble, as they were generally within the range of historical experience.
- The majority of professional economists were agnostic on the question of whether a housing price bubble existed in the United States. Krainer and Wei (2004) studied the price-rent ratio for housing using statistical techniques to predict stock market returns. While they found evidence that beliefs about future returns were important in driving current prices, they did not take a strong stand on whether a bubble existed. Davis, Lehnert, and Martin (2008) constructed a long time-series of rent-price ratios going back to 1960, and found that up until 1995 the rent-price ratio fluctuated between 5 and 5.5 percent, but that it declined sharply to 3.5 percent between 1995 and 2006. They concluded that a return to the historic average would require a modest decline in housing prices.

Implications

Clearly, well-respected economists looked at the U.S. housing market during the early-to-mid-2000s and arrived at vastly different conclusions about the future trajectory of house prices. Moreover, many if not most of the economists who studied the housing market were not comfortable making predictions one way or the other about where prices would go. The authors conjecture that this majority agnostic opinion is a natural outgrowth of the type of training that Ph.D. economists receive. In general, economists are taught that asset markets are efficient, in that these markets already contain relevant information about the future supply of and demand for traded assets. This efficiency assumption implies that asset prices are fundamentally unpredictable, so economists will be loath to take on the heavy burden of proof to claim otherwise. While the assumption of efficient asset markets is common among economists, it appears that large and systemic departures from efficiency do take place. Such deviations have been discussed in the theoretical literature, but matching such models to real-world data is difficult. The recent housing crisis may prove helpful in this regard. In any case, the authors claim that understanding how economists think about asset prices in real time is critically important when crafting policy. Given widely held views about asset markets, policymakers and regulators may not be able to prevent a bubble from forming, nor may they be able to identify a bubble after the fact. Rather than try to prevent or pop asset bubbles, a more promising policy stance might be to ensure that potential investors not only understand the risks associated with investments but also be well prepared for them. As an example, individual homeowners should be insured against significant declines in housing values. A standard way to do this—which was sadly ignored by many homeowners during the housing boom—is to make a substantial down payment, which guards against incurring negative equity if and when house prices fall.

p-10-6

A Profile of the Mortgage Crisis in a Low-and-Moderate-Income Community

By Lynn M. Fisher, Lauren Lambie-Hanson, and Paul S. Willen

complete text: <http://www.bostonfed.org/economic/ppdp/2010/ppdp1006.htm>
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Motivation for the Research

It is widely accepted that the U.S. foreclosure crisis has damaged communities, especially those whose residents fall into the low-and-moderate-income category. Yet systemic community measures of the precise effects that falling house prices have had upon sale and foreclosure activities have not been so common, and as a result many assertions about how low-and-moderate-income communities have fared during the crisis do not have solid empirical backing. This paper is an attempt, admittedly quite narrow in scope, to study the effects of the foreclosure crisis upon one hard-hit community.

Chelsea, Massachusetts, a city located just north of Boston, was particularly affected by the foreclosure crisis. Ninety percent of its 34,356 residents live in census tracts identified by the Federal Financial Institutions Council as low-and-moderate-income. Over 56 percent of its residents are Hispanic or Latino, and communities with high concentrations of minority and low-income residents, as well as borrowers with limited credit records (like immigrants) became targets for high-cost mortgage lending during the recent housing boom. The 2008 census recorded 12,798 housing units in Chelsea, of which 8,158 (almost two-thirds) of the housing units were built before 1940. Only 4,609 of Chelsea's housing units are owner-occupied, and only 17 percent are single-family homes. The city's most typical residential structure is a small multifamily building, as 6,579 of the units are two-to-four-unit buildings. Chelsea's residential property market peaked in 2005, and by 2009 house prices had fallen by almost 50 percent. Lenders foreclosed upon or agreed to short sales

on almost 8 percent of the city's one-to-three-family properties. For the purposes of this study, the authors define a short sale as a transaction for which the seller receives less than 75 percent of the total amount of the purchase mortgage.

Research Approach

The authors exploit an exceptionally good dataset to explore five specific items impacted by the housing crisis: (1) repeat-sales prices, (2) foreclosure activity, (3) the accumulation of bank-owned properties, (4) investments made by owners to improve their properties, and (5) sales activity. The dataset they use is a combination of three individual sources. The first is public record property-level transactions assembled by the Warren Group, a Massachusetts company that collects residential property records in New England. The Warren Group dataset has information on all one-to-three-family home and condominium transactions taking place from 1987 on, including mortgage originations, foreclosure petitions, foreclosure auctions, and deed transfers for both nonforeclosure and foreclosure sales. This dataset distinguishes between properties sold at foreclosure auction to a third party from those that become bank-owned properties; it also gauges how long a property is retained by the bank before being resold. The Warren Group data also contain information on the property's structural characteristics and assessed valuations since 1987, which the authors supplement with information from the Chelsea assessor's office. Over 90 percent of the city's one-to-three-family and condominium units are tracked by the Warren Group. The second dataset is assembled by LPS Applied Analytics, and collects records from large loan-servicing organizations, including the original amount borrowed, the value and location of the property that secures the loan, whether the loan is classified as prime or subprime, whether the mortgage is held in the lender's portfolio or was packaged into a mortgage-backed security, whether the loan is a first-lien or second-lien loan, and whether the interest rate is fixed or variable, and if the latter, the rules for changing it. Since Massachusetts public records do not identify short sales, the authors matched a sample of loans from the Warren Group data to the First American CoreLogic LoanPerformance dataset of securitized subprime loans, which do report investor losses on the disposition of a loan—allowing the authors to identify short sales. The third main dataset consists of records of every building permit filed with Chelsea's inspectional services department between January 1996 and July 2009. Each permit lists the property address, issue date, permit fee paid, and a description and cost estimate of the scheduled work. After cleaning and standardizing the addresses, the authors matched the building permit records to the Warren Group data for one-to-three-family dwellings. Condominiums were excluded because it is difficult to determine which unit the permit applied to at a given address. The authors regard the building permit data as a good approximation of the improvements owners made to their properties.

The authors used methods developed by Case and Shiller (1987 and 1989) to construct annual weighted repeat sales price indices for one-to-three-family units and condominium properties, excluding properties sold through foreclosure or reverting to bank-owned status. The authors also constructed indices separately by property class and a hedonic index measuring housing quality; sales priced to reflect outlier appreciation rates or prices were removed to avoid unduly skewing the results. The authors looked at the Warren Group public record data and the LPS data to track the monthly delinquency status of loans, though these data only cover a subset of servicers and thus understate the actual amount of foreclosure activity in Chelsea.

Key Findings

- Disallowing distressed sales, in Chelsea the average house price more than doubled between 2000 and 2005, then fell by about 40 percent by 2009. There was less price appreciation, and hence less volatility, in the condominium market than in the market for one-to-three-family properties. While this 40-percent figure is less than the almost 50-percent decline recorded if one includes distressed sales due to foreclosure or short sale, it has a substantial deleterious effect on an owner's housing investment, especially if the home was purchased near the peak of the recent housing boom. Since a typical homeowner is highly leveraged, falling house prices likely wiped out any

downpayment investment for most Chelsea homeowners who purchased since 2000. In contrast, house prices across Massachusetts rose less dramatically than in Chelsea and fell by less than 13 percent by 2009.

- After a period of exceptionally low activity, and no foreclosures between 2003 and 2004, Chelsea saw a foreclosure increase beginning in 2006, peaking at 125 foreclosures in 2008 and then dropping to about 50 foreclosures in 2009. From 2006 through 2009, lenders had foreclosed on 263 properties, or roughly 6 percent of homes; 8 percent if short sales are included. As of April 2010, 98 properties were identified as being in post-petition, pre-deed, foreclosure status, and another 152 properties were more than 90-days delinquent on the mortgage payment. Buyers who purchased homes after the price drop had stabilized had better credit scores, and may be in a better position to avoid any eventual distressed sale.
- The foreclosure crisis has resulted in a large accumulation of bank-owned properties [real-estate owned (REO) in the industry lingo], and this inventory build-up has concerned policymakers, in part because of the perception that vacant homes invite theft, vandalism, and a deterioration of property values that may generate more foreclosures. Such policy concerns are especially pronounced for low-and-moderate-income communities. While Chelsea did experience a build-up in REO properties after the foreclosure crisis began in 2006, with these stocks increasing after the financial crisis began—tellingly, there were 41 bank-owned properties in 2007 and 120 in 2008—by 2009 there were two positive developments. Lenders made increasing use of short sales, so that properties passed directly from one owner to another. Banks also increased their sales of distressed properties at foreclosure auctions. The main point is that banks did find willing buyers for the properties, indicating that even at depressed prices Chelsea remains an attractive community to many. In most cases, these sales have gone to owner-occupants, not to investors concerned with flipping the property.
- While some observers argue that owners with no positive home equity are unlikely to invest in the property's upkeep, Chelsea tells a more optimistic story. Judging from the building permit data, Chelsea's homeowners remain quite willing to invest in their properties even if current house prices in the city are depressed. While work permit fees for improvements made to one-to-three-unit properties peaked in 2006 at almost \$1.2 million in 2006:Q3, then fell to \$738,000 in 2008:Q3, these rebounded to \$900,000 in 2009:Q2. There are some interpretation problems associated with these data, given that a post-2006 drop in home equity may have precluded obtaining cash-out refinances or second mortgages, the two traditional sources for funding home improvements. Furthermore, there was a possible credit crunch in 2008 following the collapse of Lehman Brothers and AIG. But despite credit supply issues that continued into 2009, home improvement investment, as proxied by the issue of building permits, increased. Over the last decade in Chelsea recent homebuyers (those making purchases one to three years ago) have accounted for a 27 to 35 percent share of these permits, and some of these owners saw their property values drop by 20 to 50 percent, depending on the year they bought the house. So, while Chelsea residents may have lost equity in their homes, they did not lose an ongoing interest in investing in these properties.
- The homeowners who exited the Chelsea market seem to consist mainly of individuals who purchased at the market peak in the mid-2000s, not the city's long-term residents. During the 2004–2005 height of the housing boom, about 45 homes, or 1 percent of the city's residential housing stock, changed ownership each month, and given this period's rising prices, almost none of these transactions represent distressed sales. By 2007, the total monthly sales were cut in half, and over 25 percent of these were distressed sales. While total sales in 2008 and 2009 rose to about 28 sales per month, the majority of these were distressed sales, and this volume is still 40 percent lower than before the housing crisis. While some argue that foreclosures drive down house prices by increasing the supply of properties on the market, the drop in both prices and transactions implies

a reduction in demand. Chelsea's long-term owners are not prone to selling, and should be able to take advantage of higher prices when a recovery in house prices eventually occurs.

Implications

The authors' analysis of Chelsea paints a picture of a fundamentally viable community coping, albeit imperfectly, with a bad situation. While many homeowners lost equity in their homes, or lost their homes outright, other buyers stepped in and assumed ownership of these properties. Chelsea's story offers a more positive take on what is often a cautionary tale about how low-and-moderate income communities respond to a housing crisis. Yet the authors are well aware that Chelsea's location close to Boston, an economically diverse city, may account for much of the hopeful picture it paints. For similar cities located elsewhere in New England or in the Midwest, the collapse of manufacturing industries underpinning the local economy has raised doubts about their long-term viability, and this is reflected in the local housing market.

Working Papers

w-10-9

In Search of Real Rigidities

by Gita Gopinath and Oleg Itskhoki

complete text: <http://www.bostonfed.org/economic/wp/wp2010/wp1009.htm>

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Motivation for the Research

Real rigidities are mechanisms that dampen price responses of firms because of factors such as strategic complementarities in price setting, real wage rigidity, the dependence of costs on input prices that have yet to adjust, and others. A large literature has recently emerged that documents patterns of nominal price stickiness at the very micro level—the goods level. The documented durations of a given level of nominal prices are significantly shorter than the estimated real effects of money on output. The long-lasting real effects of monetary shocks can be reconciled with moderate price stickiness if real rigidities are an important phenomenon.

An important empirical literature has emerged recently that evaluates the question: are quantitatively important real rigidities present in the data? The answer appears to depend on what data one examines. In international economics, there is a large and growing literature that estimates exchange rate pass-through from exchange rate shocks into prices. The estimated exchange rate pass-through is found to be incomplete; that is, if the U.S. dollar depreciates by 10 percent relative to the euro, the dollar prices of goods imported from the euro area increase by less than 10 percent even in the long run. This incomplete pass-through is argued to be consistent with the presence of important real rigidities. Changes in exchange rates generate relative price movements for the same good across markets despite costs being the same. This destination-specific markup is argued to be consistent with the presence of significant strategic complementarities in price setting. The closed economy literature, on the other hand, uses indirect tests of real rigidities in the absence of well-identified and sizeable shocks like exchange rate shocks. The recent work based on micro evidence for retail prices argues that real rigidities are not an empirically important phenomenon.

There are many developments in the measurement of real rigidities in the closed and open economy literatures, but these developments have taken place in parallel and have not been reconciled. In this paper the authors bring together the closed economy macro literature, which focuses mainly on indirect tests of real rigidities, with the international pricing literature, which uses an observable

and sizeable shock—namely the exchange rate shock—to evaluate the behavior of prices, and in particular, the behavior of strategic complementarities in pricing. The paper presents new empirical results on price adjustment using international data; a closed economy model with differential markup variability in the retail and wholesale sector and sluggish price adjustment; and a model of bargaining and variable markups in intermediate-goods pricing

Research Approach

The authors first review the recent evidence on real rigidities to evaluate whether a consensus is emerging on the importance of these rigidities in the data. Second, since the two literatures use different metrics to evaluate the importance of real rigidities, the authors use unpublished international price data collected by the U.S. Bureau of Labor Statistics (BLS) to estimate both metrics using the same data. Third, they present new evidence on the dynamic response of international prices to exchange rate shocks and the response to competitor prices. Fourth, they calibrate sticky-price macro models (Calvo and menu cost) with a retail and wholesale sector to the evidence on the variable markup channel of real rigidities. They evaluate their ability to match the behavior of prices in the data and to measure the extent of monetary nonneutrality that this channel generates.

In reviewing the literature, the authors group evidence based on whether the prices studied refer to retail (consumer) prices or wholesale prices. Wholesale prices can alternatively be viewed as intermediate-good prices in business-to-business transactions. The literature on exchange rate pass-through into at-the-dock prices of goods refers to wholesale prices. The authors next use the BLS import price data to perform tests of real rigidity, using measures employed in the closed economy literature, namely, the persistence of reset-price inflation (Bils, Klenow, and Malin 2009, henceforth BKM) and measures employed in the open economy literature, namely, the dynamic response of prices to exchange rate shocks. Next, the authors evaluate the importance of strategic complementarities in price setting for incomplete pass-through, using some measures that capture the pricing behavior of competitors and measures that capture the extent of competition in sectors. These measures are not perfect but provide useful information about pricing behavior. The authors also evaluate the sensitivity of firm pricing to shocks to competitors by measuring the response of prices to movements in the U.S. trade-weighted exchange rate that is orthogonal to the bilateral exchange rate for the country.

An important distinction between retail prices and wholesale prices is that the latter capture business-to-business transactions. Consequently, the strength of the buyer's bargaining power can impact the extent of the pass-through. The authors use unpublished measures of market concentration in the import sector provided to them by the BLS—specifically, the Herfindahl index and the number of importers that make up the top 50 percent of trade—to evaluate this hypothesis.

Lastly, the authors use estimates from the data to calibrate a closed economy model with different degrees of variable markup elasticity at the wholesale and retail level. In the existing monetary literature there is typically no interesting distinction made between the retail and wholesale sectors. The authors calibrate the parameters for the wholesale sector, using the evidence from international prices. In the benchmark model, they use Calvo price setting and later evaluate the case of menu cost pricing.

Key Findings

- A review of the existing literature reveals one surprisingly consistent result across several studies—surprising since these studies use different methodologies and datasets. This result is that strategic complementarities—for example, operating through variable markups—play only a small role in affecting retail prices yet appear to have quite an important influence on wholesale prices.

- The actual import-price inflation series has a monthly persistence of 0.56, while the corresponding reset-price inflation series has a persistence of -0.04 . In comparison, BKM estimate for retail prices that the inflation series has persistence of -0.05 , while the reset-price inflation series has a persistence of -0.41 . In comparison to retail prices, import prices have greater persistence, but the magnitude of this persistence suggests very little sluggishness in price adjustment.
- Projecting the aggregate import reset-price inflation on lags of the trade-weighted nominal exchange rate changes yields autocorrelation of the fitted series substantially higher than that of unconditional reset-price inflation (0.33 versus -0.04). Individual import prices, conditional on changing, respond to exchange rate shocks prior to the last time the price was adjusted and these lagged effects are large and statistically significant. The pass-through, conditional on a price change to the cumulative exchange rate change since the last price adjustment, is 0.11 and the response to the cumulative exchange rate over the previous price duration is 0.08. Both these pieces of evidence evaluating the response to a specific shock suggest a more important role for real rigidities than for the point estimate of the autocorrelation of reset prices.
- The prices set by competitor firms (firms in the same 10-digit or 4-digit harmonized code in the import price sample) have an important positive effect on firms' pricing, reducing the direct pass-through of the exchange rate into prices. The point estimates are consistent with a markup elasticity of 1.5, which implies a 40 percent pass-through for purely idiosyncratic shocks.
- The response of prices to movements in the U.S. trade-weighted exchange rate that is orthogonal to the bilateral exchange rate for the country is sizeable and significant. In a similar vein, comparing the response to bilateral exchange rate shocks versus trade-weighted exchange rate shocks shows that the exchange rate pass-through is higher in response to a more aggregate shock than to more idiosyncratic shocks. The incompleteness in pass-through is also related to certain sectoral features that proxy for the level of competition among importers.
- Point estimates, using the Herfindahl index and the number of importers that make up the top 50 percent of trade, suggest that in many cases sectors dominated by a few large importers have lower pass-through from foreign firms; however, the estimated standard errors are large.
- The model shows that sluggishness in the response of wholesale prices to monetary shocks feeds into slow adjustment of retail prices. However, inflation, as measured by the aggregate inflation and reset-price inflation series, exhibits little persistence, since the movement of these series is dominated by more transitory shocks. Yet, conditional on monetary shocks or exchange-rate-like shocks, inflation series exhibit considerable persistence. Similarly, output series can exhibit significant monetary non-neutralities. Second, while calibrated real rigidities in the form of variable markups increase the size of the contract multiplier, these effects are limited unless coupled with exogenous sources of persistence. But the model fails to match the slow dynamic in price adjustment that is documented in the empirical data, suggesting that additional sources of persistence are missing from the model.

Implications

Why does one observe differences in markup variability at the wholesale and retail level? The authors do not provide a definitive answer here, but conjecture that this result can be consistent with differences in the competitive environment at the two levels. That is, the retail sector can be described as monopolistically competitive, while the wholesale sector is better described as a bilateral bargaining environment. The authors present a static bargaining model of wholesale price setting that results in variable markups and incomplete pass-through of shocks into wholesale prices. Specifically, each final good producer bargains with its intermediate good suppliers regarding the price of intermediate goods. Given these bargained prices, the final good producer is free to choose quantities of the

intermediate inputs, as well as to set the price of its final good in the monopolistically competitive consumer market. This model results in constant markups at the retail stage, but in variable markups at the wholesale level that depend, among other things, on the relative bargaining power of the final good producer and on the market share of the intermediate good supplier. Important outstanding questions are whether wholesale prices are allocative and also whether contracts specify fixed prices at fixed quantities. While there is no simple way to test this, Gopinath and Rigobon (2008) show that in the case of contracts for international prices they typically involve a fixed price with a quantity range specified, as opposed to a fixed quantity. Moreover, firms export the same good at the same price to multiple destinations and consequently prices behave in many cases like list prices. Further, the behavior of prices is consistent with models of monopolistic price setting where prices are allocative, as discussed in the papers by Gopinath, Itskhoki, and Rigobon (2010), Gopinath and Itskhoki (2010), and Neiman (2009). Also, as the authors make clear, changes in intermediate good prices affect final good prices, as these fully pass through into retail consumer prices. These separate pieces of evidence are consistent with wholesale prices being allocative.

w-10-10

Strategic Choice of Preferences: The Persona Model

by David H. Wolpert, Julian C. Jamison, David Newth, and Michael Harre

complete text: <http://www.bostonfed.org/economic/wp/wp2010/wp1010.htm>

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Motivation for the Research

In behavioral evolution of preference (EOP) models, it is well established that even in an anonymous single-shot game where every player knows he will never interact with his opponent(s) again, human players often exhibit “nonrational” behavior (Camerer 2003; Gächter and Herrmann 2009, and references therein). (“Nonrational” is a term used in the literature to remove the negative connotations of “irrational.”) Stated more precisely, often in an anonymous single-shot game where there are exogenously provided (often material) underlying preferences, humans do not maximize these underlying preferences. A great deal of research has modeled such nonrational behavior by hypothesizing that humans have behavioral preferences that differ from their underlying preferences and that they maximize these behavioral preferences rather than maximizing their underlying preferences. We refer to such models as behavioral preference models, and the nonrational behavior given by simultaneous maximization of every player’s behavioral preferences as a behavioral preference equilibrium. Different kinds of behavioral preference models arise for different choices of how to formalize the underlying and behavioral preferences.

Perhaps the most prominent example of a behavioral preference model is the work on interdependent, other-regarding social preferences (Sobel 2005; Bergstrom 1999; Kockesen et al. 2000). In that work, both the underlying and the behavioral preferences are formalized as expectations of von Neumann-Morgenstern utility functions. Accordingly, these behavioral preference models presume that people do not maximize expected underlying utility subject to the play of their opponents, but instead maximize expected behavioral utility. Often in this work on interdependent preferences the behavioral utility function of player i is a parameterized combination of i ’s underlying utility function and the underlying utility functions of i ’s opponents. A typical analysis in this work seeks to find parameters of such behavioral utility functions that provide a good fit for some experimental data. Other work has explored behavioral preference models when the behavioral preferences are not expected utilities. An example is the (logit) quantal response equilibrium (QRE).

In the interdependent preferences and QRE experimental work the researcher’s task is simply to ascertain the parameters of real-world behavioral objective functions from data. Two important issues are unaddressed in that work. The first such issue is how the players acquire common

knowledge of one another's behavioral objective functions before the start of play. This issue is particularly pronounced in nonrepeated games, and even more so when the games are played anonymously. The second issue is how to explain why the parameters of the behavioral objective functions have the values they do. The interdependent preferences and QRE experimental work does not consider the issue of why a human should try to optimize a particular behavioral objective function rather than his underlying objective function. In this paper, the authors address this second issue.

Research Approach

The authors note that, by definition, the strategy profile adopted by the players in any strategic scenario is an equilibrium solution of the game specified by the players' behavioral objective functions rather than an equilibrium solution of the game specified by their underlying objective functions. Therefore, changing the values of the parameters in the behavioral objective functions changes the equilibrium strategy profile. In particular, for a fixed set of behavioral objective function parameters for all players other than player i , by varying the parameters of i 's behavioral objective function, the authors create a set of equilibrium profiles of the associated behavioral games. The profiles in that set can be ranked in terms of player i 's underlying objective function. In this way, the possible values of the parameters in i 's behavioral objective function can be ranked according to i 's underlying objective function.

In a nutshell, the authors' thesis is simply that over the course of a lifetime a person learns what parameter values of his behavioral objective function have the highest rank in terms of his underlying objective function. In this way, the parameters of an individual's behavioral objective function are determined endogenously, in a purely rational way, as the values that optimize his underlying objective functions.

Key Findings

- Many of the formal difficulties of EOP models can be removed by modifying the two-timescale games studied in the literature so that the strategic process on the long timescale is learning by an individual across his or her lifetime rather than natural selection operating on genomes over multiple generations.
- Two-timescale games with the modified process can provide endogenous explanations for why humans sometimes adopt interdependent preferences and sometimes exhibit logit quantal response functions.
- By trying to maximize the behavioral preferences (and in particular publicly committing to doing so), a person in fact strategically maximizes his underlying preferences. So what we observe is maximization of particular [optimal] behavioral preferences, but this is not inconsistent with an ultimate goal of maximizing underlying preferences.
- The modified process explains experimental data in the Traveler's Dilemma and allows the authors to show how cooperation can arise in nonrepeated versions of the Prisoner's Dilemma. In the Prisoner's Dilemma the modified process predicts a crowding out phenomenon, in which introducing incentives to cooperate instead causes players to stop cooperating, and enables the authors to predict a tradeoff in the Prisoner's Dilemma between the robustness and the benefit of cooperation.

Implications

One response to the observation that humans and some animals sometimes exhibit what appears to be nonrational behavior when they play noncooperative games with others is to simply state this observation as a fact and leave it at that. Under this response, essentially the best that can be done is to catalog the various types of nonrationality that arise in experiments (loss aversion, framing effects, the endowment effect, sunken cost fallacy, confirmation bias, reflection points, other-regarding preferences, uncertainty aversion, and so on). Inherent in this response is the idea that "science stops at the neck"—that somehow logic suffices to explain the functioning of the pancreas but not of the brain.

There has been a lot of work that implicitly disputes this and tries to explain apparent nonrationality of humans as actually being rational, if we appropriately reformulate the strategic problem faced by the humans. The implicit notion in this work is that the apparent nonrationality of humans in experiments does not reflect “inadequacies” of the human subjects. Rather it reflects an inability of scientists to know precisely what strategic scenario the human subjects are considering when they act. From this point of view, the work of scientists should be to try to determine just what strategic scenario really confronts the human subjects, as opposed to the one that apparently confronts them.

One body of work that adopts this point of view is evolutionary game theory, which holds that humans (or other animals) really choose their actions in any single instance of a game to optimize results over an infinite set of repetitions of that game, rather than to optimize it in the single instance at hand. The persona framework is based on the same point of view—the view that the apparent game and the real game differ. In the persona game framework, the apparent game is the underlying game, but the real game the humans play is the persona game.

There are many interesting subtleties concerning when and how persona games arise in the real world. For example, a necessary condition for a real-world player to adopt a persona other than one of perfect rationality is that he believes that the other players are aware that they can do that. The simple computer programs for maximizing utility that are currently used in game theory experiments do not have such awareness. Accordingly, if a human knows he is playing against such a program, he should always play perfectly rationally, in contrast to his behavior when playing against humans. This distinction between behavior when playing computers and playing humans agrees with much experimental data, for example, data concerning the Ultimatum Game (Camerer and Fehr 2006; Camerer 2003; Nowak et al. 2000).

What happens if the players in a persona game are unfamiliar with the meaning of one another’s signals, say, because they come from different cultures? This might lead them to misconstrue the personas (or more generally persona sets) adopted by one another. Intuitively, one would expect that the players would feel frustrated when this happens, since in the behavioral game each does what would be optimal if his opponents were using the misconstrued persona—but, in fact, his opponents are not doing that. This frustration can be viewed as a rough model of what is colloquially called a “culture gap” (Chuah et al. 2007).

Persona games provide a very simple justification for nonrationality (often disparaged in popular parlance as “irrationality”) with very broad potential applicability. They also make quantitative predictions that can often be compared with experimental data. (In work currently being written for submission, two of the authors have found that the predictions of the persona game framework also agree with experimental data for the Ultimatum Game.) While in this paper the authors have considered only personas involving degrees of rationality and degrees of altruism, there is no reason not to expect other kinds of persona sets in the real world. Risk aversion, uncertainty aversion, reflection points, framing effects, and all the other “irrational” aspects of human behavior can often be formulated as personas.

Even so, persona games should not be viewed as a candidate explanation for all nonrational behavior. Rather they complement other explanations, for example, those involving sequences of games. Indeed, many phenomena probably involve sequences of persona games (or more generally, personality games). As an illustration, say an individual i repeatedly plays a face-to-face persona game involving signaling, persona sets, and so on, and adopts a particular persona distribution for these games. By playing all these games, i would grow accustomed to adopting this persona. Accordingly, if i plays new instances of the game, where signaling is prevented, he might at first continue to adopt the same persona distribution. However, as he keeps playing signal-free versions of the game, he might

realize that the persona he adopted in the game with signaling makes no sense in this new context. This would lead him to adopt the fully rational persona instead. If, after doing so, he was to play a version of the game where signaling was no longer prevented, he could be expected to return to the original persona fairly quickly. This behavior agrees with experimental data (Cooper et al. 1996; Dawes and Thaler 1988).

w-10-11

Some Evidence on the Importance of Sticky Wages

by Alessandro Barattieri, Susanto Basu, and Peter Gottschalk

complete text: <http://www.bostonfed.org/economic/wp/wp2010/wp1011.htm>
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Motivation for the Research

It is difficult to explain the estimated real effects of monetary policy shocks without assuming that some nominal variables adjust sluggishly. In the *General Theory*, Keynes (1936) assumed that nominal wages were rigid, and thus that expansionary monetary policy would reduce real wages and increase employment and output. Fischer (1977) and Taylor (1980) showed that nominal wage contracts would have similar effects even in explicitly dynamic models with rational expectations. Recent macro-econometric models have typically followed the important contribution of Erceg, Henderson, and Levin (2000) and assumed that both prices and nominal wages are slow to adjust.

The large number of recent models with such features has inspired researchers to examine micro data on the frequency of price changes for individual products, with notable papers by Bils and Klenow (2004) and Nakamura and Steinsson (2008). However, to date there has been little research using micro data to estimate the rigidity of nominal wages—even though Christiano, Eichenbaum, and Evans (2005, henceforth CEE) find that nominal wage rigidity is more important than nominal price rigidity for explaining the dynamic effects of monetary policy shocks. This paper attempts to address this gap in the literature.

Research Approach

The lack of previous work on the business cycle implications of nominal wage rigidity using micro data may be due in part to a lack of suitable datasets. The authors provide evidence about the frequency of wage adjustment in the United States using data from the Survey of Income and Program Participation (SIPP). The SIPP, a survey run by the Bureau of Labor Statistics, provides individual wage histories for a large and representative sample that is followed for a period of 24 to 48 months. Importantly, the individuals are interviewed every four months. These data allow the authors to examine wage changes using high-frequency data. Most previous work on nominal wage rigidity using U.S. micro data has used the Panel Study of Income Dynamics, which is an annual survey and thus less useful for high-frequency analysis. Other well-known sources of micro wage data, the Current Population Survey and the Employment Cost Index, do not provide sufficiently long time-series data on individual wages and thus cannot be used for the authors' purpose. The authors use the longest SIPP panel for which complete data are available: the 1996 panel (run from March 1996 to February 2000).

The authors focus on the frequency of nominal wage adjustments disregarding employment history. This is arguably the concept that is most relevant for macro models with nominal wage rigidities, particularly medium-scale dynamic stochastic general equilibrium models à la CEE. The reason is that most business cycle models with nominal wage rigidity follow Blanchard and Kiyotaki

(1987) and assume that all workers are monopolistically competitive suppliers of differentiated labor services. In this framework, the worker sets the wage and revises it occasionally on his/her own schedule, thus making the sequence of wages the relevant series to examine regardless of employment history.

As a baseline the authors use the results for hourly workers (or wage earners) who reported their hourly wages to the SIPP interviewer. The reason is that computing wages as hourly earnings increases measurement error. For the baseline results they chose to focus on the statistic measured with least error, the hourly wage, at the cost of making the sample less representative. However, they also present results for the sample of salaried workers, using their monthly earnings as their “wage” measure. By reporting the results for both hourly workers and salaried workers, the authors leave the decision of the “right number” for macroeconomics to individual researchers who may be interested in calibrating their models using the estimates presented in this paper.

Regardless of the sample used, it is clear that the data are contaminated with a significant amount of measurement error. This is a disadvantage of working with data on individual wages, which in U.S. survey data are always self-reported. The authors deal with this problem by applying to the reported wage and earnings series the correction for measurement error introduced by Gottschalk (2005), who built upon the work of Bai and Perron (1998 and 2003). The application uses the identifying assumption that wages are not adjusted continuously but are changed by a discrete amount when an adjustment takes place, which corresponds to our usual intuition about labor market institutions. The implied statistical model says that the true wage (or earnings) is constant for an unspecified period of time and then changes discretely at unspecified breakpoints. Thus, true wage changes in a noisy series can be estimated as one would estimate structural break dates in a standard time series. The Bai-Perron-Gottschalk method is to test for a structural break at all possible dates in a series. If one can reject the null hypothesis of no break for the most likely break date, then one can assume that there is a break at that point in time. One examines the remaining subperiods for evidence of structural breaks, and continues until one cannot reject the hypothesis of no break for all remaining dates. The adjusted series have wage (earnings) changes at all dates where one can reject the no-break hypothesis, and are constant otherwise. This is a systematic way of excluding many instances of transitory wage changes that look very much like measurement error. The authors apply this method to SIPP data for individuals in their sample.

Key Findings

- After correcting for measurement error, wages appear to be very sticky. In the average quarter, the probability that an individual will experience a nominal wage change is between 5 and 18 percent, depending on the samples and assumptions used.
- The frequency of wage adjustment does not display significant seasonal patterns.
- There is little heterogeneity in the frequency of wage adjustment across industries and occupations, although wages in manufacturing appear to be somewhat stickier than wages in services.
- The hazard of a nominal wage change first increases and then decreases, with a peak at 12 months. Thus, at a micro level, the pattern of wage changes appears somewhat more in keeping with the staggered contracting model of Taylor (1980) than with the constant-hazard model of Calvo (1983). However, the second result suggests that the timing of wage contracts is uniformly staggered throughout the year, which is the pattern that gives maximum persistence of nominal wages following a shock.
- The probability of a wage change is positively correlated with the unemployment rate and with the consumer price inflation rate.

- Higher wage stickiness makes it easier for macroeconomic models to match the stylized fact that monetary shocks cause persistent changes in real output and small but relatively persistent changes in prices.

Implications

The authors' results shed some light on a small but interesting literature on the seasonal effects of monetary policy shocks. Recently, Olivei and Tenreyro (2008) have found that monetary policy shocks that occur in the first half of the year have larger real effects than those that occur later in the year. They explain this result by positing a model where wage changes are more likely to occur in the second half of the year. The authors of this paper find that while the frequency of wage changes is indeed slightly higher in the second half of the year, the magnitude of the difference is much smaller than assumed in the calibrated model of Olivei and Tenreyro, suggesting that a different model might be needed to explain their very interesting empirical finding.

With respect to directions for future research, the authors suggest a number of areas to explore. First, it is important to understand why the stickiness estimated from micro data is greater than that estimated from aggregate data using Bayesian techniques. Idiosyncratic measurement error, such a large concern in the analysis of micro data, is unlikely to be the explanation. Such errors would average out and contribute little to the variance of any aggregate wage series. One possibility is that the difference is due purely to aggregation issues: for example, if high-wage workers' wages also adjust more frequently, then the aggregate wage will appear to be more flexible than the average worker's wage. The authors plan to investigate this possibility using their data, but since high-wage workers are likely to be salaried workers, whose adjusted earnings they find to be stickier than the wages of hourly workers, this explanation appears unlikely. The reasons for this micro-macro gap should shed light on the perplexing issues of aggregation that must concern all macroeconomists interested in structural models. Second, the lack of sizeable seasonality in wage changes raises the question: what can explain the estimated differential effects of monetary shocks occurring in different quarters? Nakamura and Steinsson's (2008) finding that price adjustment is seasonal suggests one possible answer. Third, the findings on the shape of the hazard functions suggest that one should explore the properties of models based on fixed-length wage contracts, as in Taylor (1980), in addition to the very tractable stochastic-length contracting models in the style of Calvo (1983). Fourth, the authors' desire to estimate the key parameter of one particular macro-labor model led them to focus on wage histories and disregard employment histories. However, the implication that employment history is irrelevant is not shared by all macro models of the labor market. For example, in the literature on search and matching in business cycle models, the wage stickiness that matters for macroeconomists is the degree of (real) wage rigidity for new hires. The authors plan to further explore these issues in future research. Finally, from an epistemological point of view, the authors hope that this work will increase the awareness that greater communication between economists working in different fields (in this case, macro and labor economics) can produce valuable insights at relatively low cost.

Imputing Household Spending in the Panel Study of Income Dynamics: A Comparison of Approaches

by Daniel H. Cooper

complete text: <http://www.bostonfed.org/economic/wp/wp2010/wp1012.htm>
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Motivation for the Research

Performing microeconomic analysis of macroeconomic issues often requires a comprehensive measure of household expenditures as well as detailed wealth and income data. Household-level data allow researchers to investigate heterogeneity in household behavior—something that cannot be addressed with aggregate data. Investigating and/or controlling for household heterogeneity is particularly important when analyzing issues such as the recent housing market and financial crises. Yet for economists the usefulness of household surveys has been limited by a lack of comprehensive household wealth and expenditure data in the same dataset.

The Panel Study of Income Dynamics (PSID) is an ongoing, nationally representative longitudinal study of households and their offspring that began in 1968, and until 1999 gathered data primarily on households' food expenditures together with detailed information on household wealth, income, and other demographics. In contrast, the Consumer Expenditure Survey (CEX) collects very detailed data on household expenditures but only limited data on income and wealth. Other household surveys such as the Current Population Survey (CPS) and/or the Survey of Income and Program Participation (SIPP) contain little if any information on household expenditures.

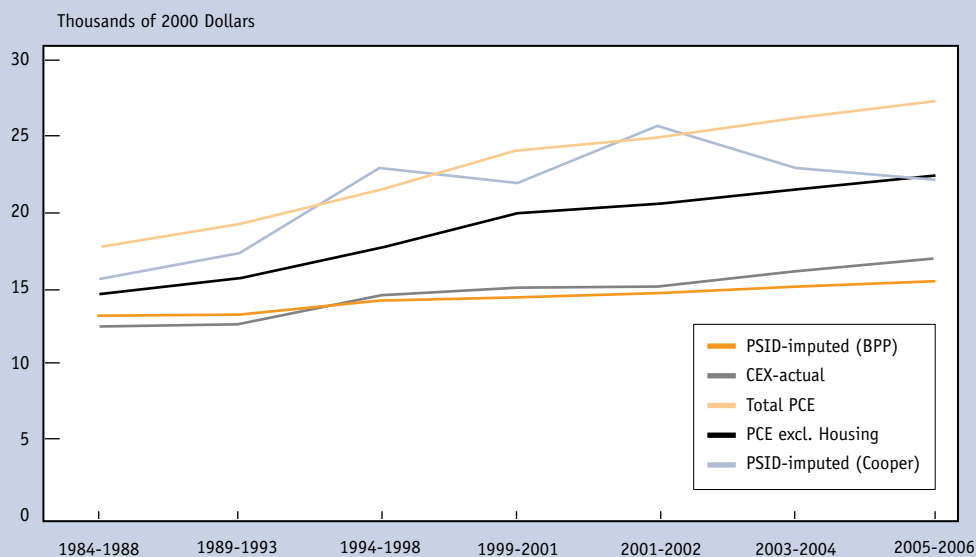
The PSID appeals to researchers because, unlike most household-level datasets, it has a long panel dimension, which enables the researcher to control for household-specific effects and changes in household behavior over time. In addition, the PSID is nationally representative in the cross-section. Until 1999, however, the only consistent measure of household spending in the PSID was households' expenditures on food, so the dataset failed to provide a comprehensive picture of households' overall spending decisions. Questions were added to the survey beginning in 1999 that now provide a broader picture of household expenditures.

Several approaches have been proposed to circumvent the dearth of expenditure data in the PSID. Skinner (1987) imputed nondurable consumption in the PSID, based on the observed relationship between nondurable consumption, food consumption, and a group of demographic variables that are common to both the PSID and the CEX. Blundell, Pistaferri, and Preston (2006) (BPP) expanded on Skinner's approach and estimated food demand relationships in the CEX, which they then inverted to get nondurable consumption in the PSID. The contribution of their paper is the use of an instrumental variable approach to deal with potential bias in the imputation process. In addition, Cooper (2009) used an in-sample method to impute households' nonhousing expenditures in the PSID, based on households' budget constraint and the available income and saving data. This paper compares the different techniques for imputing a broader basket of household expenditures in the PSID.

Research Approach

In particular, this paper analyzes and extends the approach in BPP through 2007 along with that of Cooper (2009) and compares the data from BPP's out-of-sample imputation method and Cooper's in-sample approach to aggregate benchmarks. The paper also looks at how well BPP's imputation method captures the actual spending data reported in the PSID from 1999 onward. The analysis also extends the work in Charles et al. (2007) to provide a mapping between the disaggregated CEX expenditure categories and the additional PSID spending questions added in 2005.

Total Household Expenditures



Sources: Blundell, Pistaferri, and Preston (2006); Consumer Expenditure Survey; U.S. National Income and Product Accounts; Cooper (2009).

Key Findings

- BPP's out-of-sample approach does a good job of imputing households' nondurable expenditures in the PSID. The imputed data line up well with the actual CEX data, but tend to be somewhat lower than the equivalent data from the National Income and Product Accounts (NIPA). The divergence between the micro data and the aggregate data worsens when one imputes a broader basket of expenditures than BPP's nondurable expenditure measure. In particular, total per capita imputed household expenditures and the actual CEX data are substantially lower than per capita total personal consumption expenditures (PCE) in the NIPA. This finding is consistent with recent work by Sabelhaus (2010) and others showing that the CEX data under-report aggregate household spending.
- In comparison, the in-sample imputation approach of Cooper (2009), based on households' budget constraints, does a much better job of capturing total household expenditures in the PSID. As predicted, these data lie somewhere between total PCE and total PCE excluding housing, and follow the general trend observed in the NIPA data. This budget constraint-based approach clearly dominates BPP's imputation approach when a researcher is interested in examining households' total expenditures in the PSID. This method also is preferable to using households' reported expenditure data recorded in the PSID from 1999 onward in terms of measuring households' total composite consumption. The actual PSID data, however, are reasonable and worth using when a researcher is interested in households' more disaggregated spending behavior. The actual PSID data from 1999 onward are also preferable to using BPP's technique to impute a comparable basket of goods.

Implications

This paper shows that none of the imputation techniques used to compute household expenditures is perfect. The perceived accuracy of the imputation approaches depends somewhat on what one believes is the appropriate spending benchmark for comparison purposes. The CEX under-reports expenditures relative to the NIPA, but this under-reporting does not mean that the CEX data should be hastily dismissed as a valid benchmark for disaggregated household expenditure measures,

especially given the proposed reasons for the CEX's shortcomings. More work needs to be done to improve the accuracy of imputed expenditures in the PSID, but, as this paper demonstrates, the two existing techniques are reasonable given their goals.

w-10-13

The Distress Premium Puzzle

by *Ali K. Ozdagli*

complete text: <http://www.bostonfed.org/economic/wp/wp2010/wp1013.htm>

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Motivation for the Research

The conventional wisdom suggests that firms with high risk exposure should have high expected returns and low market values and as a result of the latter should be closer to default than other firms. Consequently, firms' default probabilities should be positively correlated with market-based risk characteristics, such as dividend-price, earnings-price, and book-to-market ratios, and firms that are more likely to default should have higher expected equity returns. Indeed, Fama and French (1992) claim that size and value premiums result from distress risk. However, using empirical estimates of default probabilities, recent empirical research, including Dichev (1998), Griffin and Lemmon (2002), and Campbell, Hilscher, and Sziglayi (2008), has reached the opposite conclusion: financially distressed firms have lower returns than other firms. This paper aims to reconcile the apparent contradiction.

Research Approach

The author develops and calibrates a model, using Compustat/CRSP data, that aims to capture the following three empirical regularities observed in the distress premium literature: (1) firms with higher default likelihood have lower returns than other firms, (2) firms with higher earnings-price ratios and higher book-to-market values have higher returns than other firms, and (3) when firms are ranked according to their bond yields, firms with higher bond yields have higher returns.

Key Findings

- The apparent contradiction between the conventional wisdom, which suggests that firms exposed to a high degree of risk should have high expected returns and low market values and should therefore be more financially distressed than other firms, and recent research, which shows that financially distressed firms have lower returns than other firms, can probably be understood once one realizes that the default measures employed in recent research aim to capture the probability of observing a default under the real probability measure—and that this probability does not necessarily line up with the risk-neutral default probability that governs the market value of equity and the risk characteristics based on it. Therefore, one could not back out risk-neutral default probabilities using default observations from the data even if one had the perfect model, because one is trying to fit the econometric model to observed defaults rather than to risk-neutral defaults.
- The author's model successfully matches the three regularities it set out to match and in addition successfully captures the following patterns noted in the literature, which involve book-to-market value, financial leverage, and stock returns. (1) Stock returns are positively related to market leverage but are insensitive to book leverage. (2) Stock returns are less sensitive to market leverage than to book-to-market leverage. (3) Market leverage is only weakly linked to stock returns after controlling for book-to-market value. (4) Book leverage remains insensitive to stock returns after controlling for market leverage.

Implications

Both Fama and French (1992) and the studies that find a negative relationship between stock returns and the likelihood of default are right. On the one hand, as empirical studies suggest, firms with a higher observed likelihood of default should have lower returns, given risk-neutral default probabilities. On the other hand, firms with a higher default probability under the risk-neutral measure should have higher market-based risk characteristics and higher returns, given observed default probabilities.

The paper makes an additional claim: firms with a higher default risk under the risk-neutral measure should have higher returns than other firms. This claim could be checked empirically, for example, by using market data on credit default swaps. Given that the credit default swap instruments are relatively new and currently do not cover the entire Compustat/CRSP universe, testing this hypothesis will be problematic with current data. So far, the findings of Anginer and Yildizhan (2010) using bond yields seem to support this claim.

w-10-14

Characterizing the Amount and Speed of Discounting Procedures

by *Dean T. Jamison and Julian C. Jamison*

complete text: <http://www.bostonfed.org/economic/wp/wp2010/wp1014.htm>

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Motivation for the Research

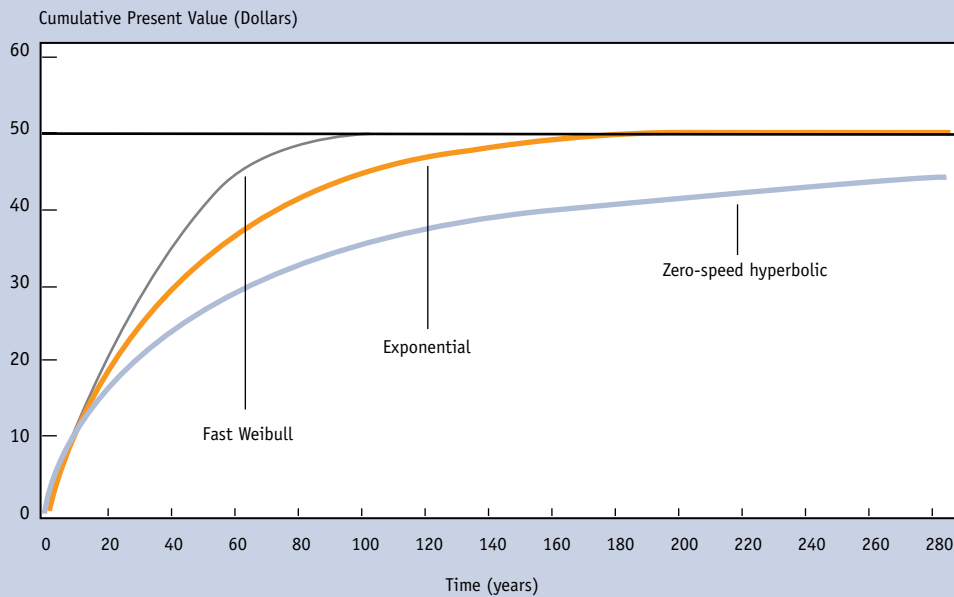
Economists in a diverse range of specialized fields—including behavioral economics, environmental economics, financial economics, and health economics—rely on discounting procedures in order to evaluate the potential outcomes of policies and projects. The relevant time interval being evaluated can range from a relatively short period, as is often the case in behavioral economics, to hundreds of years, as might be the concern when implementing an environmental policy to curb greenhouse gas emissions. Discount functions evaluate possible outcomes according to a present value function, and the inverse of the present value of a unit stream of benefits (usually gauged in dollars or some concept of utility, such as improved health outcomes) is a natural measure of the amount by which a procedure discounts the future. Different procedures use different speeds to arrive at the present value, with the result that, depending on the particular discounting procedure used, there can be major differences in the weight given to the far future.

Exponential discounting, the procedure most commonly employed by economists, uses a constant discount rate that fails to fully capture the variety of preferences of those individuals that differentially value the present or near term versus the distant future; in other words, exponential discounting does not take a stand on the relative weights of the near and far future, thus fixing the total amount of discounting at a constant rate. The profession has recognized that there is a great need for nonconstant rate discounting procedures that decline slowly with time in order to more reasonably balance far-future outcomes relative to nearer-term outcomes, and some alternatives have been proposed. Exponential discounting combines the concepts of amount and speed into a single parameter that must be disaggregated in order to characterize nonconstant rate procedures. Yet while the exponential discounting procedure has many disadvantages, it remains the dominant discounting method used in economics.

Research Approach

The authors categorize the increasingly diverse literature using nonconstant rate discounting procedures by distinguishing the speed of discounting from the total amount by which the future is

Three Discounting Procedures with Present Value(∞)=50



Source: Authors' calculations.

discounted. The framework they develop facilitates a systematic comparison of these procedures and enhances their tractability. Second, the authors identify the inadequacies in existing approaches to using the average discount rate (ADR) or an average of the discount functions (ADF) to generate an aggregate social discounting procedure. The authors consider four different discount functions: exponential, hyperbolic, quasi-hyperbolic, and fast Weibull. They propose an alternate social discounting procedure that better reflects the preferences of all members of a society—meaning that the preferences of those who value the present or near term are better balanced against the preferences of individuals who place more emphasis on the distant future. The paper's overall aim is to improve the tools available for using discounting procedures and to facilitate the wider use of nonconstant rate discounting procedures.

Key Findings

- Each of the four measures considered has a present value of 50 but they differ in how rapidly the present value is acquired. By using geometrical- and time horizon-based measures of how rapidly a procedure acquires its ultimate present value, and showing that these values are the same, the authors establish an unambiguous measure of the speed of discounting. A value of 0 is slow, and a value of 2 is fast. Exponential discounting has a speed of 1, while the fast Weibull has a speed of $\pi / 2$ (1.57).
- On the question of how to trade off between two future time points when individual members of a society are heterogeneous in terms of their time preferences, the ADR method counts all their opinions equally, even those who do not value the future. The ADF method can be nonconvergent, generating infinite present value, a shortcoming that negates its viability as a general aggregation procedure. To overcome the shortcomings of the ADR and the ADF methods, the authors propose what they call the average normalized discount function (ANDF) aggregation process. While the other two methods each satisfy only one requirement, the ANDF process satisfies both criteria: (1) the aggregate procedure discounts the future by an amount that is the average of the individual amounts; and (2) the aggregate procedure's discount rates in the future place greater weight on individuals who value the future more

highly. This results in a more socially representative aggregation of multiple individual discounting procedures and better reflects a range of preferences over both the short run and the long run.

- The authors argue that a specific slow procedure they call the zero-speed hyperbolic (ZSH) function is a good alternative candidate to the widely used exponential procedure used for social discounting with long time horizons. The ZSH procedure has a speed of 0 and a single parameter equal to the amount of discounting, which renders it a simple yet flexible procedure for social discounting. The ZSH function provides an analytically tractable way to give substantial weight to the far future in policy analyses while preserving reasonable discount rates in the short term.

Implications

The authors suggest that their proposed approach to discounting, ANDF and ZSH, provides answers to the practical objections that have inhibited a wider use of nonconstant rate discounting procedures and provides a missing framework for integrating and comparing results in the existing literature. Yet transforming the empirical literature into useful discounting procedures will require two additional steps. First, to the extent that it is practical, the data underlying the reported literature needs to be characterized in terms of estimates of the amount and speed of individual discounting procedures. Second, the ANDF aggregation algorithm can be used to generate candidate social discounting procedures.

w-10-15

Internal Sources of Finance and the Great Recession

by Michelle L. Barnes and N. Aaron Pancost

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Motivation for the Research

The financial crisis and ensuing credit supply shock that began in August 2007 was distinguished in part by the largest and most persistent drop in real private nonresidential equipment and software investment growth since the Bureau of Economic Analysis (BEA) began data collection in 1947. At the same time as the crisis began, aggregate cash holdings as a share of total assets for nonfinancial corporations were at a 30-year high and should have provided firms with a very large cushion to absorb any shock to the supply of credit.

In this paper the authors seek to shed light on two basic questions. One, what role did cash and its attributes play in the investment performance of firms during what has been called the Great Recession and how does this compare with its role in previous recession and credit crunch episodes (Bernanke and Lown 1991)? Two, in terms of investment, what are the characteristics of firms that were hit hardest during the recent recession? In particular, the authors seek to contribute to the current policy debate regarding the need to restore the flow of credit to small firms (Bernanke 2010; Duygen-Bump, Levkov, and Montoriol-Garriga 2010).

The striking upward trend in corporate cash holdings has been noted earlier (Bates, Kahle, and Stulz 2006, later published as Bates, Kahle, and Stulz 2009), as has its potential role in alleviating credit constraints in the recent recession (Duchin, Ozbas, and Sensoy 2010, henceforth DOS). However, the authors do not know of any paper on investment financing that looks as deeply as this paper does into firms' sources of cash holdings. By using variables not hitherto examined in the literature, they are able to decompose firms' cash stocks by source and show how the use of these sources has varied over time. In particular, the authors examine the role of cash and its sources over business cycles, with an emphasis on understanding the role of cash from these various sources during the Great Recession. In this

context, they also study the role of firm size in investment financing over the business cycle, because in the literature firm size has been identified as indicative of financial-constraint status.

Research Approach

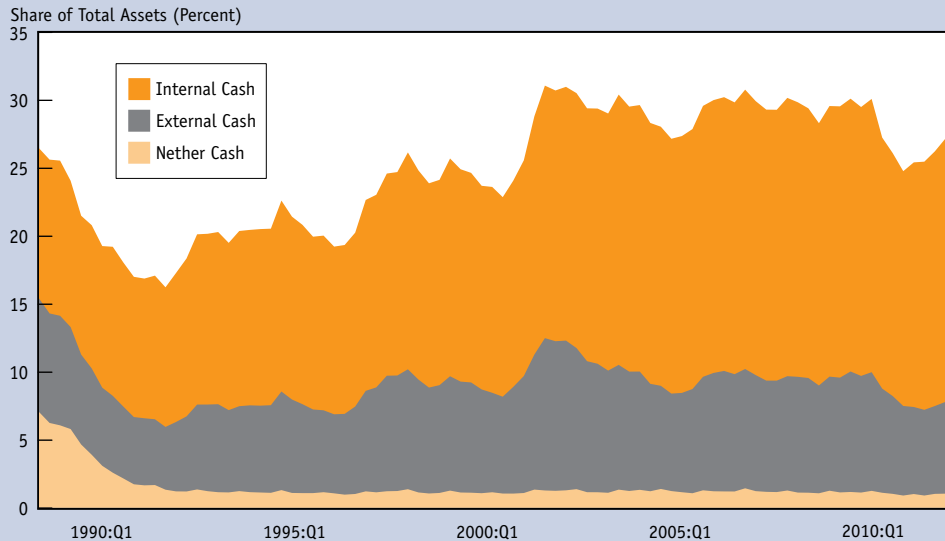
Bates, Kahle, and Stulz (2009) (henceforth BKS) argued that the rise in cash holdings was due in part to an increase in cash-flow volatility. Consistent with the BKS story, firms at the extreme ends of the cash-flow distribution do indeed have higher than usual stocks of cash. However, given that these cash stocks do not come from current operating inflows, at least not for the firms at the bottom (negative) end of the cash-flow distribution, it is natural to ask how these firms financed their cash holdings—by raising funds externally, or by saving systematically out of cash flows over time? Which behavior would indicate a firm facing financial constraints? In an earlier paper, Almeida, Campello, and Weisbach (2004) (henceforth ACW) showed theoretically that firms expecting future funding shortfalls (for example, because they need to finance losses) will systematically save more cash out of income. ACW identified these “hoarding” firms empirically, and showed that they are firms that are typically considered to be more “financially constrained”—smaller, without bond ratings, and not paying dividends. This suggests that in order to understand how firms might be financially constrained, one needs to identify the sources of firms’ accumulation of cash.

The financial-constraint literature stems from a seminal paper by Fazzari, Hubbard, and Petersen (1988) (hereafter FHP) documenting the sensitivity of investment to operating cash flows at the firm level. FHP argued that the apparent sensitivity of investment to cash flows, even after controlling for future investment opportunities using Tobin’s Q , indicates that capital market frictions prevent firms from investing in all profitable opportunities, and that internal cash flows provide an additional source of financing. Most of the literature since FHP has similarly focused on cash flows, despite the theoretical results of Gomes (2001) and Altı (2003) that empirical investment/cash-flow sensitivities can be observed even in the absence of financial constraints; the argument of Erickson and Whited (2000) that cash-flow sensitivities disappear when measurement error in Q is treated; and work by Cleary, Povel, and Raith (2007) and Kaplan and Zingales (1997) showing that the positive cash-flow sensitivities are largely a result of sample selection. Regardless, cash flows were originally intended only as a proxy for firm liquidity—although current cash flows may indeed be important, it also seems reasonable to suspect that previous cash flows, saved to the present, should also be considered as affecting firms’ investment choices, particularly against a backdrop of a large secular increase in cash holdings.

Other than ACW and Opler et al. (1999), comparatively little attention has been paid to the stock of cash as it relates to financial constraints, despite its secular rise as documented by BKS. One exception is DOS, who showed that large cash stocks before the crisis are correlated with higher investment during the crisis and argue that this result is consistent with the identification of the period from 2007:Q3 to 2008:Q2—which partly coincides with the NBER dating of the Great Recession—as one characterized by a supply shock to external credit markets, a shock that firms with higher internal liquidity were better able to weather. If external financial markets were functional prior to the crisis, then firms’ cash stocks are choice variables and thus probably endogenous to most dependent variables of interest, as argued above. For example, firms may issue a large amount of debt prior to embarking on a large investment project for transaction reasons; this could induce a cash-stock/investment correlation even though in this scenario financial markets are perfectly functional.

A standard way around these difficulties is to use a difference-in-differences regression specification, which controls for lower investment demand during recessions, as well as the “usual” correlation of cash and investment during normal times. In this set-up we would use the estimated interaction between recessions and the stock of cash to measure the presence of financial constraints; this is essentially the approach taken by DOS. In addition, firm fixed-effects arguably control for any time-invariant

Average Cash Stock as a Share of Total Assets, Decomposed



Source: Authors' calculations.

investment demand effects at the firm level, and the inclusion of Tobin's Q could be expected to control for some time-varying future investment opportunities.

However, even a difference-in-differences methodology does not get around the fact that the stock of cash is a matter of firm choice and therefore—even lagged one year, or sampled prior to the crisis, as in DOS—it is not truly exogenous to investment if firms are forward-looking. The authors of this paper propose to mitigate this issue by decomposing firms' cash stocks by component source, using data from an unbalanced quarterly panel of almost 9,000 publicly traded firms from 1989 to 2009 from the Compustat database.

Since firms that accumulate cash by issuing debt or equity in order to finance future investment would not, under normal credit conditions, be considered financially constrained, whereas firms that meticulously save out of operating cash flows in order to finance future investment opportunities would be, it is important to distinguish between the two sources of cash. It is only financially constrained firms that one would expect to invest more out of their internally generated cash stocks. The authors include in internal sources such items as income before extraordinary items; depreciation and amortization; deferred taxes; sale of plant property and equipment; inventory decreases; and net disinvestment, while external sources include such items as sale of equity stock, debt issuance, decreases in accounts receivable, increases in accounts payable, and changes in current debt. The authors also experiment with excluding working capital components, as these are arguably used to fund normal day-to-day operations as opposed to the more irregular investment in equipment, software, and structures. Although the authors argue that they are better able to identify firms that are financially constrained using this breakdown of cash stock into its sources, they do not claim to identify a supply shock.

Key Findings

- The rise in cash stocks first documented by BKS has been financed largely from internal sources.
- The rise in internal funds has been driven primarily by small and medium-sized firms, as well as by firms that do not pay dividends.

- Lagged cash stocks are always correlated with investment, but much more so in the last recession.
- The components of cash to which investment is sensitive have changed: in “normal” times investment is most sensitive to externally generated cash, and this did not change during the last recession. The increase in cash-sensitivity was due to an increase in the sensitivity of investment to internally generated cash. Furthermore, it is not just small firms that appear constrained by this metric during the Great Recession.

Implications

The paper’s results have important implications for the policy response to the recent financial crisis. The evidence suggests that the recent financial turmoil has affected the real side of the economy by constraining firms financially; thus policies that aim to ease credit conditions should be helpful in increasing investment and speeding up the recovery. The findings also show that these financial constraints are greatest on smaller firms, suggesting that measures specifically designed to make credit available to smaller firms might also be helpful.

Yet since a “small firm” in the Compustat data is still large relative to the rest of the economy (the 5th percentile of total assets in 1982 dollars, the median for firms below the 10th percentile, is about \$10 million), this biases the authors’ results against finding a size effect, and they conjecture that financial constraints on even smaller, nonpublicly traded firms may be even greater. Furthermore, the results suggest that firms as high as the 50th percentile of the Compustat size distribution were affected by financial constraints in this recession. These firms are not small; thus credit-easing policies aimed at the economy as a whole are also important in combating this recession.

There are numerous directions for future research along these lines. In particular, a closer look at the behavior of some of the detail components estimated—for example, income before extraordinary items, depreciation, net debt issuance, or sale of investments—might help to reveal why some firms saved more internal cash than others. Indeed, armed with these detail data, it may even be possible to understand why there is a break in many of the cash-stock series around the time of the 2001 recession. Also, further analysis of the detailed cash-stock data may help in understanding the depth and duration of the Great Recession to the extent that it is related to a constrained credit environment. It also seems worthwhile to better understand the role of working capital and inventory investment along the lines of the analysis in this paper. Given that detailed information exists about the composition of the stock of cash, it might also be interesting to evaluate the age of different components and their role in hoarding behavior. It should also be possible to derive a new measure of financial flexibility by using a Herfindahl concentration index on the sources of funds that constitute the stock of cash to see how this compares with other measures put forth in the literature, such as those of Arslan, Florackis, and Ozkan (2010). Finally, it might be profitable to use quantile regression analysis to determine precisely which firms fared best and worst over the Great Recession and to study their relative financial characteristics.

Affective Decision Making: A Theory of Optimism Bias

by Anat Bracha and Donald J. Brown

complete text: <http://www.bostonfed.org/economic/wp/wp2010/wp1016.htm>

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Motivation for the Research

Many decisions such as working on a project, getting a flu shot, or buying insurance require an estimate of probabilities of future events: the chances of a project's success, of falling sick, or of being involved in an accident. In assessing these probabilities, decision makers tend toward optimism bias, defined as the tendency to overestimate the likelihood of favorable future outcomes and underestimate the likelihood of unfavorable future outcomes

Optimism bias translates into both microeconomic and macroeconomic activity. For example, CEOs who are optimistic regarding their firm's future performance are more sensitive to investment cash flow and this distorts their investment decisions (Malmendier and Tate 2005); optimistic CEOs are also 65 percent more likely to complete mergers, to overpay for those target companies, and to undertake value-destroying mergers (Malmendier and Tate 2008). On the macroeconomic level, Robert Shiller (2000, 2005) makes the case that irrational exuberance contributes to generating bubbles in financial markets, where irrational exuberance is "wishful thinking on the part of investors that blinds us to the truth of our situation." Shiller points out several psychological and cultural factors that affect individuals' beliefs and consequently the investment behavior that leads to real macro-level effects. Many of these factors can be summarized as optimistically biased beliefs.

Yet optimism bias is inconsistent with the independence of decision weights and payoffs found in models of choice under risk, such as expected utility, subjective expected utility, and prospect theory.

Research Approach

To explain the evidence suggesting that agents are optimistically biased, the authors suggest an alternative model of risky choice where decision weights—labeled affective or perceived risk—are endogenized. More specifically, the authors consider two systems of reasoning: the rational process and the emotional process. The rational process decides on an action, while the emotional process forms a perception of risk and in doing so is optimistically biased. The two processes interact to yield a decision. This interaction is modeled as a simultaneous-move intrapersonal potential game, and consistency between the two processes, which represents the agent's choice, is the equilibrium outcome realized as a pure strategy Nash equilibrium of the game.

This novel formulation of optimism bias, by employing a simultaneous choice of action and beliefs where the tradeoff is accomplished through a game, may be viewed as a model of the specialization and integration of brain activity considered in recent neuroscience studies (for instance, Reisberg 2001; Gray, Braver, and Raichle 2002; Camerer, Loewenstein, and Prelec 2004; Pessoa 2008). This model is also consistent with the psychology literature that draws a distinction between analytical and intuitive, or deliberate and emotional, processing (Chaiken and Trope 1999).

Formally, the rational process coincides with the expected utility model, where for a given risk perception (meaning the affective probability distribution), the rational process chooses an action to maximize expected utility. The emotional process forms a risk perception by selecting an optimal risk perception that balances two contradictory impulses: (1) affective motivation and (2) a taste for accuracy. This is a definition of motivated reasoning, a psychological mechanism where emotional goals motivate an agent's beliefs (see Kunda 1990), and is a source of psychological biases, such as optimism bias. Affective motivation is the desire to hold a favorable personal risk perception—optimism—and in the model it is captured by the expected utility term. The desire for accuracy is

modeled as a mental cost the agent incurs for holding beliefs in lieu of her base rate probabilities, given her desire for favorable risk beliefs. The base rate probabilities are the beliefs that minimize the mental cost function of the emotional process, that is, the risk perception that is easiest and least costly to justify. In many instances, one can think of the baseline probabilities as the empirical, relative frequencies of the states of nature.

As an application of affective decision making, the authors present an example of the demand for insurance in a world with two states of the world: a bad state and a good state. The relevant probability distribution in insurance markets is personal risk; hence, the demand for insurance may depend on optimism bias. Affective choice in insurance markets is defined as the insurance level and risk perception that constitute a pure strategy Nash equilibrium of the affective decision making (ADM) intrapersonal potential game.

The authors show that the ADM intrapersonal game is a potential game, where a (potential) function of a penalized subjective expected utility (SEU) form characterizes the entire game. This property has the natural interpretation of the utility function of the composite agent or the integration of the two systems, and the authors use it to derive the axiomatic foundation of ADM potential maximizers.

Key Findings

- The emotional process leads to exaggerated choices relative to the standard expected utility model—agents will buy too much or too little insurance.
- Choices are subject to framing “context” effects—if the agents are manipulated to think first of risk, they will generally buy less insurance than if their attention is manipulated to think first of insurance.
- Report and choice tasks are different—reported risk will tend to be lower than the risk implied in the actual action (insurance) taken.
- Consistent with consumer research, the ADM model shows that campaigns intended to educate consumers on the magnitude of their potential loss may backfire. That is, these campaigns may lead consumers to purchase less, rather than more, insurance. Hence, the ADM model suggests that the failure of the expected utility model to explain some datasets may be due to systematic affective biases.
- There is a relationship between risk and ambiguity, and the ADM model has an alternative interpretation as ambiguity-seeking behavior. The authors draw a distinction between endogenous and exogenous ambiguity. Endogenous ambiguity is generated by the agent in a skewed manner. If the individual is optimistic, then the generated endogenous ambiguity would be favorable to her; therefore, in this case being optimistic is being ambiguity-seeking. In this sense, attitudes toward ambiguity are equivalent to holding optimistic attitudes. In contrast, uncertain or ambiguous situations are instances of exogenous ambiguity, meaning ambiguity that is imposed on the individual. Using this distinction between endogenous and exogenous ambiguity and existing studies, we would expect to find ambiguity-seeking à la ADM in endogenously ambiguous situations, while we would expect ambiguity-aversion in exogenously ambiguous situations.

Implications

The ADM model proposed by the authors reconciles some of the discrepancies between actual decision making under risk and standard models of choice under risk, such as expected utility, subjective expected utility, and prospect theory. The ADM model offers a more complex and nuanced interpretation of decision making under risk where decisions are product of two processes, an approach that is consistent with recent literature from the fields of psychology and neuroscience.

The Financial Structure of Startup Firms: The Role of Assets, Information, and Entrepreneur Characteristics

by Paroma Sanyal and Catherine L. Mann

complete text: <http://www.bostonfed.org/economic/wp/wp2010/wp1017.htm>

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Motivation for the Research

Financial structure is central to a firm's business strategy and has important implications for firm behavior, yet little is known about the financial structure of startup firms. Theoretical research and most empirical investigations have focused on large established firms, which can tap an array of financial sources, such as stock equity or commercial paper, a scenario quite different from the situation facing small firms. Most empirical research on small firms has focused on ongoing firms despite recent research revealing the importance of startups for economic vibrancy and job creation. (Haltiwanger, Jarmin, and Miranda 2010; Kane 2010; Stangler 2010). During times of financial crisis, such as 2008–2010, it is difficult to determine whether credit conditions affect startup activity without having a benchmark assessment of the financial structure of startup firms during more normal credit conditions. The question addressed by this paper is whether the relative importance of internal funds, external debt, and external equity that comes from established-firm theory plays out for startups, which have different asset and information characteristics as well as different available financial resources. The paper's contribution arises from the fact that the research is based on the Kauffman Firm Survey (KFS) dataset, which tracks a panel of 5,000 businesses from year of initiation in 2004. These data enable the authors to compare the financial structures of firms at inception with the structures predicted by the theories of established firms and with the findings of empirical investigations of ongoing small firms.

Research Approach

In extensions of Modigliani-Miller (1958), theoretical analyses of large established firms have addressed how the degree of asset specificity (asset value at bankruptcy) and information opacity (alignment of manager and shareholder interests) influences governance and financial structure. Established-firm theory finds that, on the one hand, firms with highly specific assets (low liquidation value at bankruptcy) should have a higher proportion of equity relative to debt, since stockholders in principle can exercise greater control over the operations of the firm, whereas debtholders cannot appropriate the highly specific assets. On the other hand, under conditions of information opacity about managers' activities, after first using internal resources the firm then should use bank debt, which disciplines management, and only lastly turn to external equity for financing, since ensuring the alignment of interests between managers and shareholders is more difficult.

Previous research points out that in the case of startups there are no ongoing operations and no track record by which to judge the firm. This information opacity makes external financing more difficult to obtain at the nascent stages. A startup's potential external equity investors (such as angel or venture capital) may have limited information about the founder (unless s/he is a serial entrepreneur) and about the prospects for the enterprise and may therefore demand a high ownership stake for a given financial outlay. From the standpoint of the owner-founder, internal finance is preferred, followed by external debt such as bank financing, and only lastly would the founder use external equity, which is expensive in terms of ownership stake.

These general predictions based on information opacity are qualified by the characteristics of the assets of most startups. In small startups the entrepreneur provides not only managerial expertise, but also financial and human capital to the firm. Such specific human capital may not be easily

transferable to alternative uses, which compounds the information opacity. The “inalienable” nature of the entrepreneur’s human capital exacerbates the tension between the owner and debtholders because the owner can threaten to walk away. Therefore, firms with a high degree of asset specificity should be financed primarily by the entrepreneur’s own resources, followed by external equity such as venture capital, and last by external debt.

Insights gleaned from theory suggest that startups would use internal funds first, followed by external resources, with predictions on the external debt-equity mix unclear and dependent on the relative importance of asset specificity and information opacity. However, despite this theoretical preference for internal finance, Berger and Udell (2003) reveals the importance of debt financing for young firms in the United States, including high-growth startups. Therefore, in practice, internal resource constraints faced by the entrepreneur mean that startups may have to rely primarily on external financing of one sort or another.

Outside the issues of asset specificity, information opacity, and financial constraints, substantial empirical work focuses on the relationship between financial structure and entrepreneur characteristics such as education, strategic alliances and networks, and experience of the founding team.

Ninety-eight percent of the 5,000 businesses tracked by the KFS have fewer than 25 employees. Each business has a unique identification number, and the original survey posed more than 1,400 questions to each firm in the survey, including detailed questions on financial structure, owner and founder characteristics, business and innovation activity, and location. The authors of this paper examine the firms in 2004, their founding year, considering these entrepreneurial characteristics in conjunction with financial structure. With regard to race and gender, the authors examine whether the financial structure of firms owned by African-Americans and women differs from that of other startups, and, specifically, whether these firms have less external funding.

The authors use multinomial logit applied to the KFS dataset to examine the financial structure of startups, looking first at internal debt or equity versus external debt or equity. They then look into the type of external debt, via a six-way decomposition of startups’ financial structure. To do this, they take owner equity to be the base financial resource, with the other five sources being (1) internal debt and equity (that is, equity owned by family, and loans from friends, family, and employees, (2) external debt in the form of a bank loan, (3) external debt in the form of a personal or business credit card, (4) other external debt, such as loans from the government and other businesses, and (5) equity from venture capitalists, angel investors, and other sources.

Key Findings

- Startups with more physical assets or those where the entrepreneurs have other similar businesses are more likely than other startups to use external debt in the financial structure, since these assets have a high liquidation value.
- Startups with human capital embodied in the entrepreneur or with intellectual property assets have a lower probability of using debt, consistent with the higher asset specificity and lower collateral value of these assets.
- Startups characterized as small, unincorporated, solo, first-time, or home-office-based are more likely to be financed by self, family and friends, and importantly through credit cards, as these startups have both highly specific assets and information opacity.
- More educated founders and nonAfrican-American founders are more likely than other startups to be financed by external sources.
- Controlling for other attributes of the startup, the financial structure of women-owned startups does not differ from that of other startups.

- High-tech startups' financial structure differs significantly from the financial structure of startups in other business sectors.

Implications

Consistent with theoretical underpinnings based on asset specificity, the findings show that startups with more tangible assets as potential collateral are more likely to use external debt in their financial structure, since these assets have a high liquidation value. Entrepreneurs with other businesses as collateral are less likely to give up control to external equity investors. On the other hand, all else being equal, startups with higher human capital embodied in the entrepreneur or more intellectual property assets have a lower probability of using debt than other startups, consistent with the higher asset specificity and lower collateral value of these assets.

In terms of information opacity, startups located in the entrepreneur's home are the most opaque and their financial structure is dominated by credit card debt. Team-run startups are less likely to use debt financing, particularly credit cards and other external loans, and, consistent with their greater personal resources and available information, more likely to have internal and external equity in their financial structure. Serial entrepreneurs are equally likely to finance their businesses using their own resources, bank loans, or external equity, since more information is available about these entrepreneurs, which mitigates the information opacity problem.

In terms of owner attributes, some—but importantly not all—of the findings mirror the research on ongoing small businesses. Educated entrepreneurs are more likely to use debt financing. African-American entrepreneurs are more likely to use their own resources to finance their business and are less likely to use credit card or nonbank debt. An important finding is that the financial structure of women-owned startups does not differ from that of male-owned startups, controlling for many other attributes. Regional factors and local conditions relate to the financial structure of startups. Areas with better-educated resident populations may have greater personal resources to finance startups using internal debt. Startups in innovative states and states with higher venture capital activity have a greater probability of having external equity in their financial structure. Startups in larger states have a higher probability of having bank loans in their financial structure.

Some of the biggest differences in the financial structure of high-tech startups and startups in other sectors can be traced to the relationship between financial structure and race, citizenship, and business knowledge.

Public Policy Briefs

b-10-3

Evidence of a Credit Crunch? Results from the 2010 Survey of First District Banks

by Jihye Jeon, Judit Montoriol-Garriga, Robert K. Triest, and J. Christina Wang

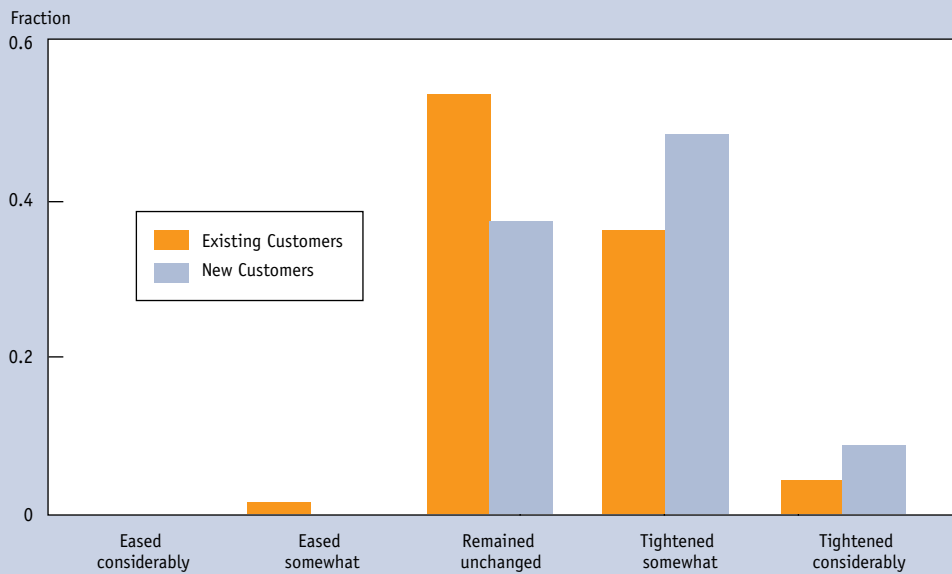
complete text: <http://www.bostonfed.org/economic/ppb/2010/ppb103.htm>

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Motivation for the Research

Restricted access to credit, especially decreased availability of bank credit to small businesses, is often cited as a potentially important factor in amplifying the effects of the recent recession and contributing to the weakness of the subsequent expansion. In an effort to gather first-hand data to help assess how the supply of, and demand for, bank credit changed in the period following the financial crisis,

Change In Underwriting Standards for Business Lines of Credit since August 1980



Sources: Authors' Calculations.

the Research Department and Financial Institution Relations and Outreach (FIRO) group of the Federal Reserve Bank of Boston cooperated to conduct a survey of First District community banks in May 2010. The survey was designed (1) to assess how much community banks were willing and able to lend to local businesses that were formerly customers of large banks but had lost access to credit in the aftermath of the financial crisis and (2) to understand the role of Small Business Administration (SBA) lending in promoting business lending by community banks in New England.

Research Approach

The survey questionnaire was sent to 268 banks; of these, 135 responded. The response rate for qualitative questions was far higher than the response rate for quantitative questions. At least one of the qualitative questions was answered by 124 banks and 121 banks answered all of the qualitative questions. In contrast, 84 banks answered one or more of the quantitative questions and only 44 banks answered all of the quantitative questions.

Key Findings

- The survey responses provide some evidence that lending standards for commercial loans have tightened moderately at community banks since late 2008, with the tightening being more severe for new customers than for those that already had a relationship with the respondent bank. The survey also reveals that expansions of several SBA guarantee programs since the crisis have ameliorated possible credit constraints on small businesses.
- More than 40 percent of respondents reported that the amount of new originations remained essentially unchanged during 2008:Q4. On the other hand, more banks (slightly over 40 percent) reported that origination volume decreased than reported that originations increased (16 percent).
- Business loan applications from new customers decreased less than overall applications, suggesting that businesses that had relied on large commercial banks for credit may have turned instead to community banks for credit as the large banks cut back on lending because of the serious capital constraint stemming from subprime-induced balance sheet losses.

- Of the banks that responded to the survey, the vast majority (78 percent) indicated that they participate in one or more of the SBA programs. Slightly over one-third of these banks (35 percent) were SBA-preferred lenders. On average, banks increased business lending by \$11.23 million as a result of the availability of SBA programs. As expected, this average increase was larger for SBA-preferred lenders (\$22.69 million) than for nonpreferred lenders (\$4.49 million). The median values are somewhat lower, given the skewness of the distribution. Overall, these results suggest that the SBA programs were somewhat effective at promoting business lending among community banks in New England, especially among the SBA-preferred lenders.

Implications

Although tighter lending standards for new customers than for existing customers makes sense at any given time, it is less obvious why underwriting standards for new customers should have been tightened more than for existing customers during the last two years. One possibility is that the community banks believed that the information asymmetry problem with regard to firms that used to but were no longer able to borrow from large banks had become more severe, since larger banks are likely to shed their most problematic customers. Another possible reason is that community banks wanted to slow the growth of their assets in the face of a rather uncertain economic outlook, while protecting their investment in relationships with existing customers.

The community banks generally did not report that balance sheet problems impeded their ability to lend. In contrast, many large commercial banks suffered graver losses during the financial crisis due to their greater exposure to subprime-based assets and as a result were more likely to be forced to raise their capital ratio by restricting lending. To the extent that some larger banks restricted lending as a result of balance sheet problems, the survey responses suggest that the customers of these large banks who were denied additional credit also would have faced a difficult time in obtaining credit from the community banks.

Information gathered through this survey suggests that New England community banks have tightened their loan underwriting standards, especially for new customers, since the onset of the financial crisis. Nevertheless, deteriorating borrower qualifications and reduced demand for loans have also clearly played a role in the contraction of bank credit.

The persistence of tighter standards is consistent with similar indications from the Senior Loan Officer Opinion Survey (SLOOS) of tighter lending standards at both large and small banks. The survey data suggest that businesses that were turned away from large banks would generally have found it difficult to get credit at community banks. Overall, community banks do not appear to have been able or willing to offset the contraction in the credit supply stemming from the actions of large banks. On the other hand, the survey responses provide some evidence in support of the efficacy of SBA lending programs in boosting the supply of credit to small businesses. This suggests that further expansion of the SBA programs could potentially be effective in increasing the supply of credit to small businesses, all else being equal. More data and analysis of this issue should prove useful.

Multimedia

The Great Recession (video presentation)

by Christopher L. Foote

complete video: <http://www.bostonfed.org/videos/index.htm>

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This four-part video presentation examines the Great Recession, paying particular attention to New England. A senior Boston Fed economist analyzes the recession from four perspectives: (1)

the expansion and bursting of the housing bubble; (2) the consequences of the recession for output, employment, and inflation; (3) the fiscal and monetary policy response to the recession; and (4) the Great Recession in the context of longer-term trends in the labor market. The presentation reflects his independent views as a researcher and does not represent official views or policies of the Federal Reserve System.

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