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Monetary Policy and Macro-Prudential Regulation: The Risk-Sharing Paradigm*

Atif Mian
Princeton University

Abstract
How should monetary policy and macro-prudential regulation respond to the dangers of financial bubbles? I argue that bubbles - and their collapse - become a serious problem when there is inadequate risk-sharing. Neither monetary policy nor traditional macro-prudential regulation is designed to deal with this risk-sharing problem. Monetary policy has little hope of either accurately anticipating bubbles or dealing effectively with their consequences. Traditional approaches to macro-prudential regulation are unlikely to succeed as they are based on the false premise that risk can always be quantified up front. I propose considering "ex-ante flexible contracting" as a longer-term response to the financial stability question.

Resumen
¿Cómo deben responder la política monetaria y la regulación macroprudencial a los peligros de las burbujas financieras? Yo sostengo que las burbujas −y su colapso− se convierten en un problema grave cuando el reparto del riesgo es insuficiente. Ni la política monetaria ni la regulación macroprudencial tradicional están diseñadas para enfrentar este problema de reparto del riesgo. La política monetaria tiene pocas esperanzas de anticipar con precisión las burbujas o de abordar en forma eficaz sus consecuencias. Es poco probable que los enfoques tradicionales de la regulación macroprudencial tengan éxito, ya que se basan en la falsa premisa de que siempre es posible cuantificar el riesgo por adelantado. Propongo considerar "la contratación flexible ex-ante" como respuesta a largo plazo a la cuestión de la estabilidad financiera.

* Paper presented at the Central Bank of Chile 2012 Annual Conference, November 15-16, 2012. My discussion in this article is based on my joint work with Amir Sufi. I am also thankful to Virgiliu Midrigan for his comments and suggestions. The views and conclusions presented in this paper are exclusively those of the author and do not necessarily reflect the position of the Central Bank of Chile or its Board members.

1. INTRODUCTION

Economic history is replete with episodes of financial crises creating havoc for the real economy. These episodes typically have three important ingredients. First, there are large financial flows to finance a bubbling asset class such as sovereigns or housing with "safe" debt. Second, there is a sharp downward movement in the price of the asset that was being financed with debt. Third, there is no apparent "real shock" that one can point a figure at for the large drop in asset prices. In particular, there is no major production-side disruption such as the failure of a technology, political coup or breakout of large-scale disease. Yet the financial shocks translate into a deep and long economic recession. Why?

In this paper I argue that the fundamental reason for financial recessions is a failure of risk sharing. The workhorse macro model is based on a representative agent economy. Such models implicitly assume that households in the real world are able to shield themselves against large asset price movements. This is patently false in the data. As a result, aggregate demand and output will fall unless the economy is massively and quickly able to reallocate real consumption across households.

While financial shocks in the presence of high leverage necessitate the need to reallocate consumption across households, the real economy cannot move at the pace and frequency that a levered financial market demands. For example, relative prices cannot fluctuate as quickly as needed by the new financial reality; nominal wages can be stubbornly sticky; labor cannot be hired quickly by new sectors; and nominal interest rates cannot go negative. The slow pace of adjustment on the real side implies that the overall economy fails to reverse the real consequences of the risk sharing failure. Consequently, the economy goes into a decline.

This note discusses the evidence on the failure of risk sharing in the U.S. economy, and the role of policy in mitigating the effects of this failure. I discuss why traditional macro policy fails to limit financial excess *ex-ante*, and why it is naturally limited in its scope to deal with the consequences of financial excesses *ex-post*. Consequently, I argue that we need to design our financial system within a "risk-sharing paradigm" and provide some speculative suggestions in this regard.

My views in this paper are based on empirical work I have done with Amir Sufi and co-authors on the 2007-2008 U.S. financial crisis. My more prescriptive suggestions in this paper were mentioned in my written testimony to the U.S. Senate in October of 2011.

2. THE FAILURE TO SHARE RISK

An implicit but important assumption of typical representative agent macro models is that households are able to share idiosyncratic financial risks. In other words, the cross-sectional distribution of asset price shocks may be ignored.

This is an important assumption for two reasons. First, the bursting of debt-financed bubbles generates extreme cross-sectional variation in financial shocks that cannot be quantitatively ignored. Sections 1.1. and 1.2. illustrate this point using the build-up and then collapse of the U.S. housing market as an example.

Second, the inability of some households to protect themselves against extreme financial shocks translates into a sharp cut in their consumer demand. These cuts amplify the initial shock by triggering job layoffs on the production side. Aggregate demand fails to equal potential output supply due to standard and well-understood frictions including wage rigidity, debt deflation and the zero lower bound. I discuss evidence for these channels in section 1.3.

2.1 Debt and Bubbles

The original sin for finance-driven recessions is often some debt-financed bubble. In the context of the recent U.S. financial crisis, I show that the collapse in U.S. house prices was preceded by (a) an expansion in the supply of credit to the U.S. and (b) an increase in house prices that was de-coupled from traditional housing fundamentals.

The increase in household leverage from 2001 to 2007 was stunning by historical comparison - household debt doubled from $7 trillion to $14 trillion. The household debt to income ratio increased by more during these six years than the previous 45 years combined! In fact, the household debt to income ratio in 2007 was higher than at any point since 1929; the previous high in 1929 did not end well either.

Why did U.S. households borrow so much and in such a short span of time? The standard economic explanation for household borrowing is the permanent income hypothesis: households borrow against higher

expected income in an effort to smooth consumption. Does the permanent income hypothesis explain the rapid rise in U.S. household debt?

In Mian and Sufi (2009), we argue that the answer is no. For example, contrary to the permanent income hypothesis predictions, households with the largest increase in debt had the largest decline in income. In particular, mortgage credit growth and income growth were negatively correlated at the zip code level from 2002 to 2005, despite being positively correlated in every other time period back to 1990. Mortgage credit flowed into areas with declining incomes at a faster pace.

Instead, the increase in leverage can be explained by a relaxation in lending standards, or an expansion in securitization-driven mortgage credit supply. For example, the fraction of home purchase mortgages that were securitized by non-GSE institutions rose from 3% to almost 20% from 2002 to 2005, before collapsing completely by 2008. The non-GSE securitizations primarily targeted zip codes that had a large share of subprime borrowers. In these zip codes, mortgage denial rates dropped dramatically and debt to income ratios skyrocketed.

One consequence of the rapid increase in supply of mortgage credit was its impact on house prices. As credit became more easily available to households that were historically rationed out of the credit market, house prices began to rise. Moreover, the increase in house prices was not uniform across the U.S.; house price appreciated faster in areas that had difficult-to-build terrain, i.e. where housing supply was inelastic. While this mechanism does not explain all of the cross-sectional variation in house price growth across the U.S., it does explain a major proportion of it.[1]

The increase in house prices had a large impact on further encouraging the accumulation of debt by households. In Mian and Sufi (2011a), we focus on the feedback effect from house prices to household borrowing by analyzing individual level borrowing data on U.S. households that already owned their homes in 1997 before mortgage credit expanded. We find that existing homeowners borrowed 25 to 30 cents against the rising value of their home equity from 2002 to 2006.

The home equity-based borrowing channel is strongest for low credit quality borrowers, borrowers with high credit card utilization rate, and younger borrowers. Moreover, home-equity borrowing was not used to purchase new properties or to pay down expensive credit card balances, implying that the new debt was likely used for real outlays such as home improvement and consumption. Overall, we estimate that the home-equity based borrowing channel can explain 50% of the overall increase in debt among homeowners from 2002 to 2006.

In short, the massive increase in household leverage in the U.S. in the early 2000's was not driven by permanent income shocks but rather an expansion in the supply of credit to the U.S., which was, in turn, likely driven by the search for "safe debt" by Asian markets in the aftermath of the emerging market financial crises of the late 1990s. The increase in mortgage credit supply fueled a remarkable increase in house prices that was de-coupled from its traditional housing fundamentals such as household income. U.S. homeowners –particularly those with weaker credit scores– borrowed aggressively against the rising value of their houses. Consequently, the increase of 7 trillion dollars in household debt was concentrated among low credit score homeowners in inelastic housing supply areas that experienced high house price appreciation.

2. 2 The Cross-Sectional Distribution Of Net Wealth Shocks

Figure 1 shows the evolution of aggregate stock, bond and housing indices in the U.S. during recent years. While both stock and housing markets collapsed at the onset of the financial crisis, the recovery in the stock market was relatively robust. The collapse in the housing market was more permanent, and hence more damaging for anyone else exposed to this particular risk. What were the net cross-sectional consequences of the movement in asset prices shown in figure 1?

Mian, Rao and Sufi (2012) answer this question by constructing household balance sheets at the zip code level. The financial shock to net wealth at the household level depends on (a) the exposure of a household to each of the three asset classes, and (b) the amount of debt on the household's balance sheet. We use household borrowing data from Equifax, house price data from Core Logic, and stock and bond holding data imputed from tax returns – all at the zip code level – to construct change in zip code level housing net wealth from 2006 to 2009.

The result in figure 2 is striking. Households that experienced the largest decline in house prices also happened to have high levels of leverage and often did not have any financial cushion through stocks and bond holdings. This resulted in a sharp redistribution of net wealth across the U.S. from 2006 to 2009.

[1] In particular, cities in Arizona and Nevada are important outliers. See Mian and Sufi (2009, 2011a) for more details.

The bottom decile of U.S. zip codes, in terms of net wealth shock, lost close to 60% of their total wealth in 2006. The top decile, on the other hand, only suffered a loss of around 10%. This heterogeneity in net wealth destruction and its geographical concentration had important consequences for the real economy in terms of consumption and employment.

2.3 Net Wealth Shock and Real Outcomes

Figure 3 uses data from Mian, Rao and Sufi (2012) to show how consumption responded to the sharp decline in net wealth in some counties. It plots change in consumption –proxied by number of new automobiles sold– against the net wealth shock experienced by households in a county. There is a very robust pattern with households cutting back on their purchases of new automobiles a lot more if they are hit by a stronger net wealth shock. While figure 3 only shows results for automobile purchases, Mian, Rao and Sufi (2012) show that the same results hold true for broader measures of consumption as well.

The key point to take away from figure 3 is that households are unable to share financial risk. Full risk-sharing implies that idiosyncratic movements in house prices should have no impact on real consumption. Aggregate consumption might go up or down in response to various shocks, but cross-sectionally there should be no relationship between consumption change and financial shocks. The evidence in figure 3 strongly rejects the full insurance implication of typical representative agent models.

The fact that households with high exposure to housing shock and leverage cut back on their consumption, has drastic ripple effects throughout the economy via employment losses. The reason is that goods consumed in one part of the country are produced throughout the U.S. and abroad. For example, if Californians sharply reduce auto purchases because of excessive leverage and house price decline, the drop in auto purchases will likely reduce employment in Michigan and Ohio where auto parts are manufactured. At the same time, the non-tradable employment would only be impacted in areas where the initial consumption decline is located.

Thus, employment losses that are driven by a reduction in consumption due to net wealth shocks have a very specific prediction: the fall in tradable employment will be uniformly spread throughout the U.S., while the fall in non-tradable employment will be localized in precisely those counties that experienced the strongest decline in consumption. Mian and Sufi (2012) test this specific prediction using county level data on tradable and non-tradable employment.

Figure 4 presents the key result. There is a strong correlation between non-tradable job losses and net wealth shock experienced by a county, while the drop in tradable employment is uniform across the counties. The magnitude of the overall drop in employment due to the initial consumption decline can be estimated using the slope of the non-tradable employment change and net wealth shock relationship, and assuming that a similar relationship exists for the tradable sector (except when that cannot be detected cross-sectionally for reasons stated earlier). The quantitative calculation reveals a decline of almost 4 million jobs or 65% of total jobs lost due to the demand shock (see Mian and Sufi, 2012 for details).

3. THE EFFECTIVENESS OF MONETARY AND PRUDENTIAL POLICIES

In the event of a recession, monetary policy attempts to boost real activity by lowering nominal interest rates directly (both short term and long term via policy guidance and/or quantitative easing) and real interest rates indirectly through expected inflation. A large and impressive body of New Keynesian literature explains how monetary policy can be effective in a world with nominal rigidities. However, these models abstract away from the net wealth distributional issue discussed above.

In this section, I discuss whether or not monetary policy and related financial prudential regulations are effective when the source of real disturbances is a failure to share risk – as was the case in the 2007-2008 U.S. financial crisis. Policy can help in one of two ways. It can try to prevent the financial crisis in the first place by constraining debt (leverage) and bubbles. Alternatively, policy can react in the aftermath of a financial shock by muting any threatening real consequences.

3.1 Can Policy Makers Prevent Financial Shocks?

As discussed earlier, debt and asset bubbles are two key factors behind most financial crises. Consequently, a number of policy discussions are based on either preventing high levels of leverage through capital regulation, or coming up with ways to minimize the likelihood of asset bubbles.

Consider capital regulation that mandates a minimum capitalization ratio for financial intermediaries. Does such a requirement help prevent financial recessions? The recent U.S. experience illustrates why the answer is no. First, any attempt to impose a capital regulation creates a divide between the regulated and the unregulated (i.e. "shadow") banking systems. Since leverage is appealing for financial intermediaries, especially those interested in taking large risks, regulation increases the incentives to take intermediation towards the shadow part of the banking system. This is indeed what happened in the U.S.

Second, and more importantly, capital regulation presumes that the regulator has the ability to measure capital and risk appropriately, and also has the will to impose capital requirements when necessary. However, the ability of regulators to effectively manage capital requirements is questionable at best. Consider the practically negligible amount of capital that bank regulators allow banks to hold against the many "AAA" mortgage backed securities on the banks' balance sheets. It is apparent that the regulators have no special ability to measure the inherent risks embedded in financial assets. Regulators in Europe were equally caught off guard given the extremely low capital they allowed banks to hold against European periphery sovereign bonds.

The failure of capital requirements to discipline banks in the most recent financial crisis can be gauged from the fact that while there was significant variation in the risk-adjusted capital ratio used by bank regulators before the crisis, the capital ratio had as significant variation in the risk-adjusted capital ratio used by bank regulators before the crisis; the capital ratio had zero predictive power in explaining which banks were more likely to end up in trouble (Haldane, 2012). In fact, a simple unadjusted leverage ratio had better (i.e. positive) power for predicting which banks are more likely to end up in trouble. While regulators have shown no evidence of any ability to measure risk, their ability to impose tough capital requirements when needed is also questionable.

However, the third reason for the inadequacy of capital requirements and, in the context of the 2007-08 U.S. financial crisis, the most important, is the fact that the core problem in the most recent recession was leverage in U.S. household balance sheets. As explained in detail in section 1, it was leverage in U.S. household balance sheets coupled with the housing shock that led to the large cross-sectional shock to net wealth. Even if all the banks were perfectly well capitalized, household net wealth would have been seriously impaired in the aftermath of the housing collapse. In terms of the risk-sharing failure identified in section 1, the traditional focus on capital requirements in the banking sector does not offer much help.

3.2 Can Policy Clean Up Ex-post?

If prudential regulations are unable to limit the likelihood of financial crises ex-ante, can monetary policy ex-post help in minimizing the real consequences of crises? The evidence in section 1 shows that in order for monetary policy to be effective in limiting the real costs of financial crises, it must explicitly support households that have been most adversely impacted by the net wealth shock. I now discuss evidence in the aftermath of the U.S. financial crisis on the effectiveness of monetary policy.

3.2.1 Credit supply

An easing of monetary policy at the onset of a financial crisis may limit the damage done by the crisis by facilitating credit creation. Was this dimension of monetary policy helpful? The analysis in section I suggests that it is unlikely to be the case since the core problem was one of weak consumer demand due to impaired household balance sheets. There is significant evidence to suggest that monetary policy's role in increasing credit supply was unhelpful in the midst of the recent financial crisis.

First, despite the Fed lowering interest rates to zero, as well as quantitative easing, banks were unable to increase credit. Consequently, excess reserves held by the banking sector went from zero in 2009 to one and a half trillion dollars in 2011-2012. Banks had all the liquidity in the world and still could not find able borrowers.

Second, corporate firms were flush with cash and yet unwilling to make further investments. Kahle and Stulz (2012) show that there was no meaningful difference between bank-dependent and non bank-dependent firms in the rates of investment during the post-crisis period. In fact, bank-dependent firms were equally likely to hoard cash. The hesitancy of firms to invest, despite large cash holdings, suggests that credit supply was not the primary problem.

Finally, a large-scale survey by NFIB of firm managers shows that only about 5% of managers complained about financing problems. On the other hand, almost a third complained about poor sales or lack of demand in the midst of the recession. Both the bank and firm level evidence is consistent with the idea that weakness in consumer demand is the primary driver of recession.

3.2.2 Household credit

If the core problem is at household level, then perhaps monetary policy can help by making it easier for liquidity and credit constrained households to borrow. Is monetary policy effective in doing so in the midst of a crisis?

One of the ways through which monetary policy might favor indebted households is by lowering the carrying cost of their existing debts. In this way, lowering interest rates might act like a direct transfer in favor of debtors at the expense of creditors. This can be a useful policy given the results in section 1. Is monetary easing effective in transferring financial resources to the most indebted households?

Mian, Rao and Sufi (2012) show that the very factors that necessitate the need for a transfer from creditors to debtors also make it difficult for monetary policy to be effective. In particular, for monetary policy to be effective, one needs to lower the nominal debt burden of highly indebted homeowners. However, the same homeowners are most likely to be "under water" and hence, poor candidates for refinancing of existing mortgages.

We show that this is indeed the case. The sharp fall in mortgage interest rates as a result of monetary easing disproportionately helps prime borrowers who have significant equity in their homes. Refinancing rates are lowest for subprime borrowers with high loan to value ratios. Unfortunately, these are exactly the homeowners that are most in need of refinancing help. Thus, monetary policy is unable to work on the margins where it is most needed in the midst of a debt-overhang environment.

3.2.3 Default and bankruptcy

One direct way to help households cope with severe financial shocks is to allow them to default and clear their debt burdens. While this is clearly a mechanism that operates in the U.S., there are three main reasons why defaults are not sufficient to prevent the real costs associated with financial shocks.

First, defaults impose direct costs that add to the real burden of a financial crisis. In the case of housing debt, default leads to seizure of property and foreclosures. When the initial shock is wide in scope, as the 2007-2008 U.S. housing shock was, large-scale foreclosures are costly. Mian, Sufi and Trebbi (2011) show that foreclosures have strong negative externalities by significantly reducing the value of homes in the neighborhood of a foreclosed home. The house price effect of foreclosures also leads to a negative feedback effect on local consumption and investment.

Second, declaring default is costly from the individual perspective as well since it eliminates access to the credit markets, makes the homeowner lose his home, and may have additional emotional cost. In fact, a quarter of U.S. homeowners continue to pay back their mortgage loans despite being "under-water" on their properties. This fact suggests that the psychological and economic costs of declaring default are large enough to prevent millions of homeowners from using default to discharge their debts.

Third, the negative real effect of financial shocks start showing up well before a household is "under-water" and hence, a candidate for default. For example, a homeowner who loses most but not all of his equity in the home cannot use default to cushion the financial shock. At the same time, the financial shock will force this homeowner to cut back on his consumption, leading to the adverse real consequences mentioned earlier.

4. POLICY CHOICES WITHIN THE RISK SHARING PARADIGM

Section 1 showed that the source of real shocks on the consumption and employment side is the sharp change in net wealth experienced by highly indebted households. The inability of these households to insure themselves against such financial shocks ex-ante results in a high real cost for the overall economy as exemplified by the total loss in employment due to the reduction in consumer demand.

Section 2 discussed why monetary policy is not very effective in providing financial support to the households most severely hit by the net wealth shock. To put it differently, monetary policy fails to provide adequate insurance to these households. While I have focused on the limits of monetary policy in a financial recession, I do not intend to imply that monetary policy is completely useless. Clearly given the problems associated with household net wealth shocks, a loosening of monetary policy goes in the right direction. Philippon and Midrigan (2011) also argue that the easing of monetary policy helped improve the real economy. However, the focus of this paper is on the limits faced by monetary policy in practice, and what else can be done to improve the situation.

A more direct mechanism for improving the balance sheet position of those most adversely impacted by the housing crisis would be mortgage principal write downs. This would be the most direct manner in which transfers between credit and debtors can be made. While the government did try to initiate such schemes through programs such as HAMP, these programs have been largely ineffective.

The reason is that it is not in the lenders' private interest to write down debt that continues to be serviced on time. However, as the analysis above highlights, the collective consequences of such "individually rational" actions are quite unpleasant. If a large number of financially distressed homeowners cut back on consumption in order to protect their homes and continue paying their mortgages, the aggregate demand and employment consequences hurt everyone.

Unfortunately, the current deleveraging cycle in the U.S. is painfully slow. Despite more than three years since the start of this cycle, the amount of debt paid off or written down remains stubbornly small. Out of the 7 trillion dollars accumulated over 2001-2007, only about one trillion has been paid down or written off. U.S. household balance sheets remain highly levered by historical standards. The most recent monthly auto sales data also continue to show significant weakness in consumer demand among high leverage counties.

While the focus of my discussion has been the recent U.S. economic downturn, the relationship between high household leverage and long economic slumps is not limited to our current experience. In his seminal paper, Irving Fisher (1933) described the role that high household indebtedness and the process of deleveraging played in perpetuating the Great Depression. More recent empirical work by scholars such as Mishkin (1978), Olney (1999), and Eichengreen and Mitchener (2003) further supports this view of the Great Depression. Evidence from Japanese and European recessions (e.g. King 1994) also highlights problems associated with leverage.

Our collective experience from historical recessions, as well as the most recent global slump, points to a fundamental weakness in the modern financial system, its inability to distribute downside risk equitably and efficiently across the population. The tendency to rely too much on debt-financed economic activity implies that in the event of a negative economy-wide shock, most of the financial pain is pushed on a particular segment of the population (i.e. the borrowing class). As the recent U.S. experience reminds us, pushing most of the downside risk on one segment of the population is seriously damaging for the overall economy.

Going forward, in order to avoid deep economic slumps resulting from an over-leveraged household sector, we need to put contingencies in place that will automatically write down the value of outstanding debt if the overall economic environment is sufficiently negative. I refer to such contracts as "ex-ante flexible financial contracts." Surely there are complicated legal issues pertaining to mortgage debt restructuring. Similarly, any orderly mechanism of debt restructuring should minimize unwanted disruptions in the banking and financial system. These are difficult and complex problems but not impossible to address, and require collective regulatory and legislative action.

There is a lot to think through here before implementing a particular policy. However, it is feasible to re-design debt covenants by introducing contingencies for economic downturns. For example, mortgage principal can be automatically written down if the local house price index falls beyond a certain threshold. Since such contingencies are written on aggregate states of nature, they do not suffer from the standard moral hazard criticism. Lenders will obviously price in such contingencies before extending credit, but it is a price that benefits borrowers and the economy in the long run. If we had such contingencies present in the current mortgage contracts, we could have avoided the extreme economic pain due to the negative wealth shock –aggregate demand cycle.

Flexible debt contracts would not only make the crash less severe, but they would help prevent the bubble in the first place. The reliance on debt contracts gives investors a false sense of security. Because they have a senior claim on assets, they ignore issues such as fraud or poor lending practices that may artificially boost house prices. Historical examples abound in which lenders were lulled into complacency and, therefore, fueled a bubble with loose lending practices. Flexible debt contracts would force investors to explicitly consider the downside risks to lending and therefore make bubbles less likely.

It is important to recognize that government policy currently encourages the use of inflexible debt contracts through the mortgage and business interest tax deduction. All else being equal, government policy currently subsidizes the use of debt despite the overwhelming evidence that excessive debt levels are associated with severe subsequent recessions. At a minimum, governments need to move away from a system that encourages one specific financial instrument –straight debt– at the expense of others. The evidence presented in this note suggests that there are legitimate grounds for governments to do the opposite, i.e. subsidize more flexible financial contracts at the expense of traditional debt instrument.

There are obvious questions associated with such an idea. For example, why do such flexible mortgages not already exist? Is there a role of the government or the Federal Reserve to encourage their use? These are great questions, and there is a lot to investigate here. My primary goal on this note is to point out the direction in which I

believe we need to go. A number of details need to be spelled out, but it is clear –given the evidence– that we need to have better designed financial instruments to deal with economy-wide fluctuations in asset prices and expectations. The hope is that we move in that general direction.

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Figure 1

The figure plots return of stocks, bonds and U.S. housing over time.

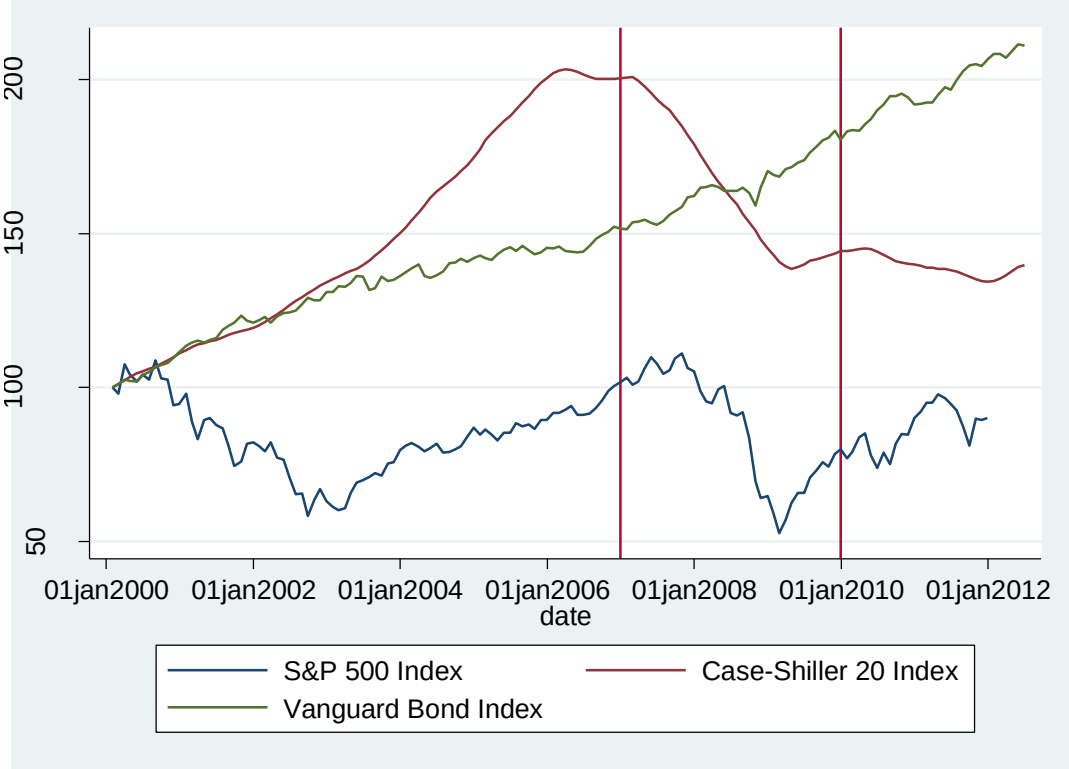


Figure 2

The figure plots distribution of net wealth shocks at the zip code level. Wealth is defined as the value of stocks, bonds and houses less liabilities for households at the zip code level.

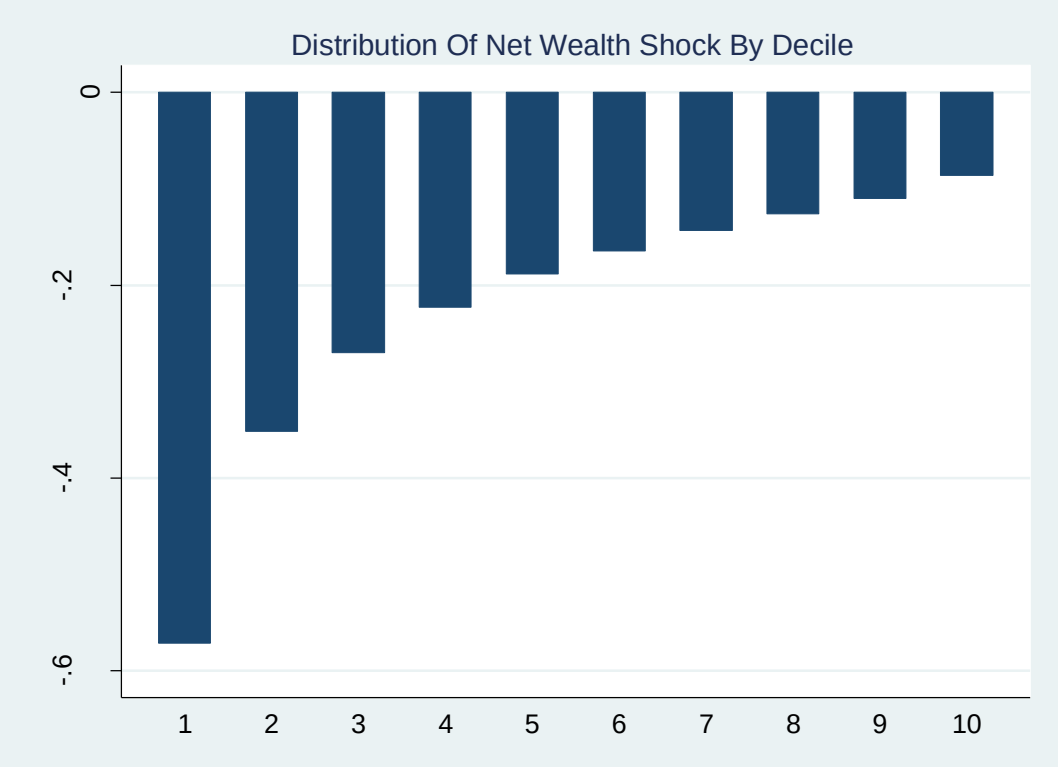


Figure 3

The figure plots the change in new automobile sales against change in household net worth from 2006 to 2009. The unit of observation is a county, and counties are weighted by their population size.

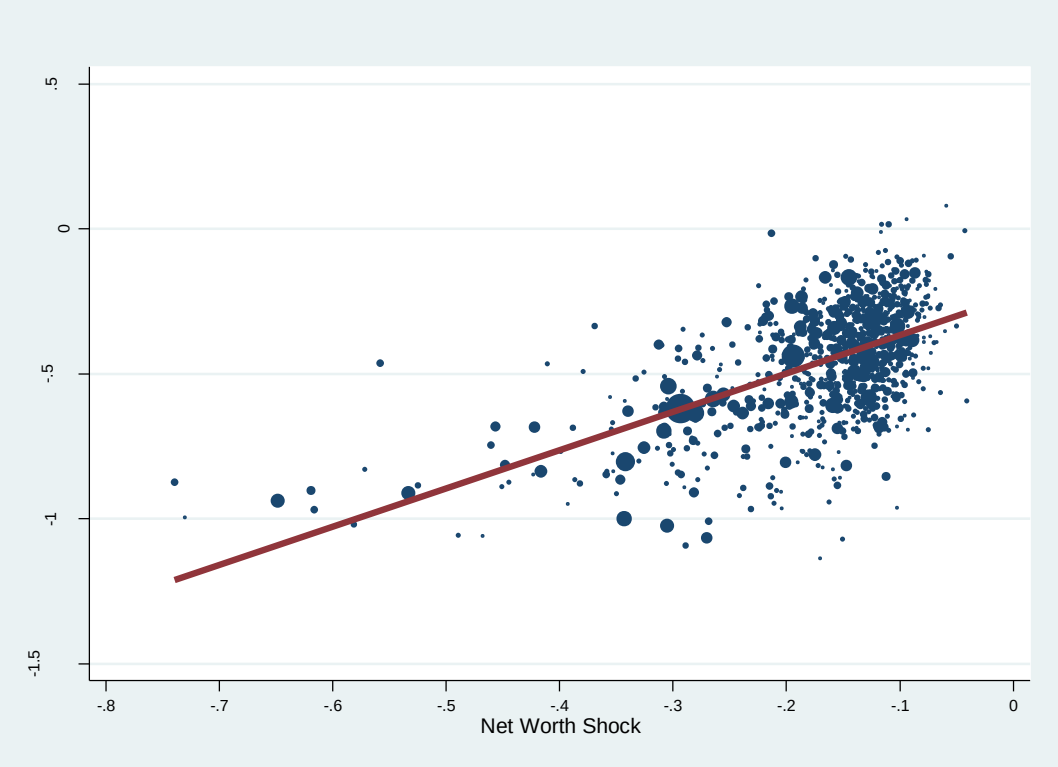
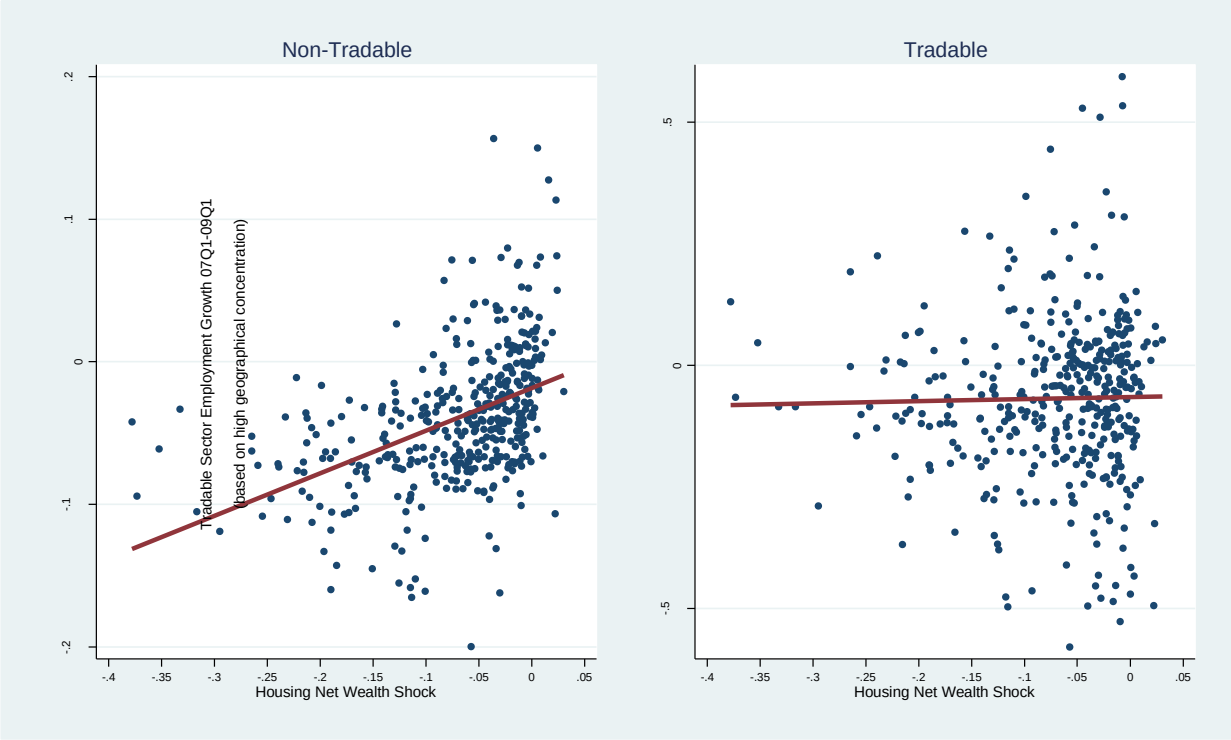


Figure 4

The left-hand panel plots change in non-tradable employment at the county level against the housing net wealth shock experienced by households in that county. The right-hand panel repeats this exercise for the tradable employment sector.



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