Regulating Banks in the Era of Fintech Shadow Banks

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Abstract

Intermediation in the lending market has undergone a dramatic shift from traditional banks to shadow banks, i.e., non-depository institutions that fall outside the scope of traditional banking regulation. I trace the growth of shadow banks to the increased regulatory burden faced by traditional banks and to the financial technology adopted by shadow banks. I argue that these factors explain changes in credit markets around the globe. Assessing financial stability in this new era involves understanding the business model of fintech shadow banks and traditional banks, the industrial organization of the credit market and the equilibrium interaction of intermediaries. I conclude by illustrating and emphasizing that a regulatory policy analysis requires the impact of the policy on banks and shadow banks to be analyzed side by side.

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I. Introduction

Financial regulation and supervision, in large part, concerns itself with traditional banks. This "banking centric" view works under the belief that well-functioning and stable banking system is critical for channeling funds from savers to users in any economy. Banks are believed to engage in maturity transformation, taking in funds, such as deposits, that are typically short term, to fund loans that are longer term. Regulatory policy is expected to generate outcomes based on these beliefs. For instance, when regulators raise the capital requirement to curtail risky lending, the expectation is that credit supply in the economy would contract, as banks would cut lending. I argue that policy analysis such as these give an increasingly incomplete picture and requires a serious rethink.

The reason that such policy analysis fails is that intermediation in the lending market has undergone a dramatic shift due to entry and growth of shadow banks (see Claessens et al. 2018). These nonbanks are not funded by depositors and therefore are not subject to traditional bank regulation. They also rely on technology and data analytics as being central to their business model (see BIS Annual Report 2019, Chapter III). Moreover, because they compete with banks on price and non-price dimensions in some markets and not in others, it is critical to understand the industrial organization of the credit market to better appreciate their equilibrium interaction. Thus, any regulatory policy analysis and expected outcomes now requires that the impact of the policy on banks and shadow banks be analyzed side by side.

In this paper I start by discussing the dramatic changes in the lending market due to growth of shadow banks (Section II). I argue that the growth of shadow banks can be traced to increased regulatory burden faced by traditional banks and to the technological changes adopted by shadow banks. I argue that these factors explain changes in credit markets around the globe (Section III). I then illustrate why assessing financial stability in this new era involves (i) understanding the business model of shadow banks, many of them fintech shadow banks, and traditional banks, (ii) the industrial organization of the credit market and (iii) the equilibrium

interaction of intermediaries (Section IV). I conclude by emphasizing these elements in the context of capital regulation and unconventional monetary policy changes, taking U.S as an example.

II. Intermediation in Lending Market: The Rise of Shadow Banks

United States:

General Trends

In the last decade, the consumer finance market has undergone a dramatic change. As a starting point consider the case of mortgage credit in the US. The residential mortgage market in the U.S. constitutes the world's largest consumer finance market. More than 50 million residential properties currently have mortgages outstanding with a combined debt of about $10 trillion. As can be observed, the share on shadow bank market share in residential mortgage origination has more than doubled from 2007 to 2017 as shown in Figure 1. A substantial portion of this growth is from online "Fintech" lenders that rely on technology. Using credit bureau data allows one to get a longer time series view. Shadow banks did increase their presence during the housing boom from 2001-2006. But their growth in the last decade is unprecedented. Figure 2 shows that a similar trend is visible in the US consumer personal loan market.

The growth of shadow banking has been visible beyond just consumer finance. Table 1 provides data across small business lending, leveraged lending (loans to non-investment grade businesses), and commercial real estate consumer lending. It also provides information on mortgage loan market (both origination and servicing), personal loans and student loans. As of 2015, the six key lending segments with $12 trillion loans outstanding, had around 40% of loans that were associated with shadow banks, with another 20% of the banking market estimated to be under threat back then. I now elaborate a few of these markets in some more detail.

Corporate Loan Market

The corporate lending market has seen a big change in the aftermath of the financial crisis. In particular, one has seen an increase in leveraged loans over the last decade. Leveraged loans are debt taken by firms with below investment grade credit ratings. Not surprisingly, as the name suggests, these loans are often granted to companies with a high leverage ratio. The market for

new leveraged loans in the US has increased by over 40% between 2013 and 2017, when a record high of $1.03 trillion were issued (Figure 3a). Much like other parts of the lending landscape, non-banks have accounted for a substantial portion of this increase, especially the most aggressive kinds. Prominent non-bank financial firms, such as Jefferies, Macquarie, KKR and Nomura have together claimed more than 10% of the whole market in 2017 (Figure 3b).

Regulators have closely watched the lending in this market by banks. For instance, in 2013, the Fed, OCC and FDIC issued guidance on what was acceptable leverage, restricting firms such as JPMorgan and BOA from participating in the riskiest deals.[2] This regulation constrained banks and allowed shadow banks to step in when banks retreated. In addition, the non-bank lenders tend to provide borrowers a greater choice of debt products, such as those with equity like features, than what banks have typically offered.

Incidentally, the rise of shadow banks is not just a phenomenon that is visible at the risky end of the corporate bond market. A syndicated loan, also known as a syndicated bank facility, is financing offered by a group of lenders – referred to as a syndicate – who work together to provide funds for a single borrower. Irani et al. (2018) studies the rise of shadow banking in the corporate syndicated loans market and show that shadow bank funding rose from about 20% in 1992 to 70% in 2014 (Figure 4). The study also finds that capital regulation on banks played an important role in the rise of nonbank funding: nonbanks stepped in for loans with higher capital requirements and at times when capital is scarce. While more non-bank funding may suggest that risks have shunned away from the banking sector, this risk might have moved to investors pension funds, mutual funds and insurance.

Shadow banks have also made headway in corporate loans for small and medium business enterprises. Small businesses make up almost 2/3rd of all new private-sector jobs, but typically have smaller needs. For instance, borrowing an amount of $100,000 is too small for big banks to bother with, but too large for a personal loan for most business owners. Online lenders like Kabbage have stepped into this untapped market. Many traditional banks deny customers with

[2] Several parts of this guidance have been reversed since 2017 after the Government Accountability Office found the guidance an overreach by regulators.

limited or no credit history as well as those with no credit history. Kabbage, instead, looks at credit score but also uses big-data on the health of business in its determination for approval. Its model considers company's sales, shipping costs, business software, cash flow information of suppliers and customers and activity on social media, including its online "reputation". With this data and its analysis, they obtain a better picture of business health. The assessment of alternative factors beyond the facades of credit history can often supplement those with limited credit history or mitigate concerns about those with questionable credit. In addition, fully automated lending solution from online lenders removes the age-old hurdle of normal business hours, offering companies 24/7 access to working capital online. Data science and technology-based solutions have thus simplified arduous financial processes and expanded the market.

Personal Loans Market

As noted earlier, shadow banks have made significant headways in personal loan market. As of 2017, shadow banks account for more than half of the total personal loan market. New lenders, such as peer-to-peer (P2P) lenders like publicly-traded Lending Club and private companies like Prosper, have grown significantly and contributed to this increase. Unlike a bank loan funded by deposits, P2P lenders have used technology and social network information to connect investors to borrowers. Moreover, increased regulatory and supervision costs on banks seem to have played a role in growth of shadow banks. For instance, Tang (2018) exploits a regulatory change that caused banks to tighten their personal loan lending criteria[3] and finds that regions with more affected banks witnessed a significantly sharper LendingClub market share increase.[4]

Student Loan Market

Between 2004 and 2017, the total volume of outstanding student debt in the US has more than quadrupled to surpass $1.3 trillion, making it the second largest debt market next only to

[3] In 2010, the Financial Accounting Standards Board (FASB) implemented a new regulation (FAS 166/167) that required banks to consolidate securitized off–balance sheet assets onto their balance sheets and, starting in the first quarter of 2011, to include them in their risk-weighted assets. In aggregate, this caused banks to consolidate more than $600 billion of assets in 2011, over 80% of which were revolving consumer loans.

[4] Appendix (Figure A1) shows that P2P application and origination volumes increased significantly in treated counties after 2010Q4, in terms of both the total loan amount and the number of loans. According to the study, per thousand inhabitants in treated counties, an average of 0.07 more applications were made for an additional $1,108; this figure represents a 25% increase in the number of applications and a 39% increase in their respective dollar amounts.

residential mortgage market (Figure 5). Shadow banks have created significant inroads in the refinancing student loan market. The idea of student loan refinancing is simple: when students initially take out their loans, they have weak credit scores and little to no income, but after they graduate, both their credit history and their income should be stronger, making them eligible for more favorable interest rates and terms. $25 billion in student loans have been refinanced between 2012 and 2018, which is shown in Table 2. SoFi, a fintech shadow bank, is the clear market leader. Moreover, Fintech lenders in general (marked in red) account for the bulk of the refinancing market.

After the financial crisis, interest rates offered by the government decreased substantially, making it hard for mainstream banks such as Bank of America, Citigroup and JP Morgan to compete. Additionally, federal government, being the dominant player in the market, set interest rates on student loans without regard to risk profile of the borrower (i.e., borrowers were offered a "pooled" rate). Thus, any comparative advantage that banks might have in terms of risk assessment is blunted. Moreover, regulatory requirements on banks also precludes them from picking and choosing segments of consumers they might want to target. Instead banks are "encouraged" to lend more broadly in regions where they have physical locations.

Fintech firms do not come under the same regulatory structure and therefore have more flexibility to take advantage of the opportunity in this market. SoFi led the charge by targeting the high end of this market. It targeted low-risk graduates who have good credit histories and decent income potential, referred to as Henrys: "high earners, not rich yet". SoFi offered personalized low interest rates to these graduates, luring them away from federal programs. In addition, using data science and analytics it has been able to provide additional services, such and investment and tax planning as well as "career coaching", to its consumers.

Other Markets:

Shadow banking in Europe

Similar to the US market, there is a general trend of rising shadow banks in EU as well in Figure 6 (see also Figure A2). The EU shadow banking system stood at €42.3 trillion at the end of 2017, nearly doubled from €26 trillion one decade ago. This measure of shadow banking is broader than

what I have discussed in the context of U.S. and includes all financial sector entities, except banks, insurance corporations, pension funds and CCPs. A significant portion of assets held within the EU shadow banking system is concentrated in a few countries that function as international financial centers. Investment funds represent about one-third of the total assets of the shadow banking system, while entities that come under the category of other financial institutions account for the remainder.

Interconnectedness, in the form of wholesale funding provided to euro area banks by entities included in the shadow banking sector, has increased, following a period of contraction (see Figure A3). In 2017, wholesale funding provided to euro area banks by such entities grew by 2% compared with end-2016, reaching €2.2 trillion and marking the highest rate of growth since 2012, the year data were first available. The increase primarily reflects growth in money market funds (MMFs) and other investment fund holdings of bank debt securities.

Much like in the US, regulation seems as an important factor that has contributed to rise of shadow banking the EU. On regulatory side are rules that have put pressure on banks by opening up European banking to more competition, tightening rules on trading, and boosting capital requirements. In contrast to the U.S. – and despite complaints from customers -- European retail banking has been remarkably unscathed by technology-driven disruption (there have been exceptions such as Klarna, Kreditech or Atom bank). One reason the incumbents have proved so resilient is that fintech firms lack the customer-transaction information they need to provide many financial services. This is likely to change in the future. In particular, open banking directives or data sharing plans between banks and fintech firms at the explicit consent of the customers are slowly being implemented. It sets terms of engagement between banks, which have had a monopoly on customers' account data and a tight grip on payments, and others. This is likely to have a huge impact on the landscape of lending market in Europe, much like it did in the U.S.

Shadow banking in China

Estimates from various sources (e.g., Moody's) suggest that the shadow baking sector is about a third of all banking assets is China (see Figure 7). According to the Financial Stability Board, China's shadow banking has grown by more than 30% per year over the last three years compared with

10% growth in the rest of the world. In terms of composition, a large bulk of shadow banking involves wealth management products (WMP) which has grown rapidly in the last five years. This growth outside the banking supervision has been attributed in part to regulation (Hachem 2018).

The picture on China shadow banking would be incomplete without touching on the rapid growth of fintech firms that have relied on technology. The quintessential example here is the Yu'ebao provided by Alibaba Group (see Figure A4). Yu'ebao, as a money market fund, has removed the entry barriers that bar most small investors from getting returns higher than bank deposits. Thanks to the absence of barriers, one can invest as little as 0.1 yuan, which would be unimaginable for conventional funds that retail through bank branches. Yu'ebao retails through PayPal-like Alipay of Alibaba. Alipay, the payment tool of choice for hundreds of millions of online shoppers who use Alibaba's online marketplace Taobao, functions as a virtual wallet and provides an entry point for many investors of Yu'ebao.

Another important aspect contributing to the rise of China's fintech firms is the Fintech credit scoring using digital footprints. For example, Sesame Credit in China, run by Alibaba affiliate Ant Financial, is the leading Chinese "social credit" rating firm with 520 million users. Sesame Credit gives users a score based on five dimensions of information: personal information, payment ability, credit history, social networks and online behavior. Together with Tencent, who has also pioneered a credit score, these fintech firms have exploited high mobile penetration in China and opened online markets for a large unbanked population in China (see Figure 8).

III. Why the Rise of Shadow Banks?

As was evident in the discussion of various markets in the U.S. and outside, the growth of shadow banks and fintech lenders in lending landscape has been attributed to two main factors – increased regulation on the financial sector, especially in the aftermath of great recession and breakthrough in technology related to big data and data analytics. I will now summarize the arguments under these categories, reminding us of the earlier discussions on these aspects when we touched on various lending markets.

Regulatory burden

The broad idea here is that in the aftermath of the crisis, tightened regulation, increased supervision and heavy fines and penalties prompted banks to cut risky lending, invest in more liquid assets and maintain higher equity capital. As a result, banks were reluctant to lend to less-than-stellar credit users. Shadow banks, operating in a relatively lightly regulated environment seized the opportunity and have filled the pent-up consumer demand.

This observational is not just anecdotal and is backed by empirical analysis. For instance, Buchak et al. (2018a) exploit regional variation in different types of regulatory and supervision pressure faced by banks engaged in mortgage lending over the period 2008 to 2016. The regulatory and supervisory actions they consider include regulatory capital raising, implementation of Basel III with respect to mortgage servicing rights, lawsuits arising from conduct prior and during to the crisis, and changes in supervisory agency monitoring the lender. They find that shadow banks increased their market share across regions during this time period (see Figure 9). However, banks retreated mortgage lending more in regions where regulatory and supervisory pressure on banks was higher. And, these regions were also where shadow bank activity was the highest.[5]

This type of analysis – that regulatory pressure on banks leading to growth of shadow banks -- is evident beyond just mortgage market in the U.S. For instance, see Irani et al. (2018) for corporate loan market in the U.S. and Halchem (2018) for shadow banking related to WMPs in China.

Technology improvement

The argument here has been that improvements in technology have allowed fintech firms to provide banking services in ways that is different from traditional banks. Broadly, improvements in technology have allowed some fintech firms to provide the same services cheaply. Other fintech firms have leveraged on technology and improvements in data science to create new markets by

[5] For instance, as one indicator, the average tier 1 risk-based capital ratio of US banks rose by roughly 5% from 22% in 2008 to 28% in 2016. Some counties witnessed a larger build-up of bank capital than other counties due to poorer capitalization of banks present in that market. Buchak et al. (2018a) find that counties where bank capital grows the most saw greater shadow bank market share and lending growth (see Appendix Figure A5).

expanding the pool of borrowers that they have provided services to. This has involved attracting consumers to banking services by using mobile phones and convenience apps as an entry point. For instance, consumer to consumer payment apps such as PayPal and Venmo, have attracted millennials due to ease of transacting on the phone and have eventually moved to providing deposit like services.[6]

Data science has also been shaping the lending market, opening previously closed doors to credit-constraint consumers with limited or tarnished credit history. In the past, underwriters had only a few ways to assess risk of borrowers, which meant many people were either turned away or charged a higher interest rate when not enough was known about their credit worthiness. With big-data and AI, fintech lenders are able to use different information, such as their digital footprint on social media, in the underwriting process to evaluate borrowers' default likelihood. This has allowed both credible borrowers to pay a lower interest rate as well as opened doors for many unbanked. Another new market that has been made possible due to technology and data science is "peer-to-peer" lending. This breaks away from the conventional investor-borrower framework, drawing resources from large number of ordinary people to fund others with financial needs. Consumers can participate on both sides of the market as investors or as borrowers.

Finally, fintechs have leveraged on technology and data science to provide new services to existing set of customers. In particular, they have been able to offer "convenience" to consumers who might have high willingness to pay for such services. For example, Venmo offers payment ability to consumers through their mobile phones who want to make payments to other consumers swiftly without having to go through a cumbersome process of writing and cashing checks or wiring money through banks. Similarly, Quicken Loans, climbed to become the largest US residential mortgage lender by 2017 through the use of its convenient "Rocket Mortgage" product that enables a full online application process and allows consumer to provide all "relevant" information quickly. This innovation brings significant convenience to potential customers and increases their satisfaction and overall efficiency. Buchak et al (2018a) show that all this translates

[6] Similarly, fintech firms such as Robinhood and Wealthfront have given all investors access to commission-free stock trading through mobile apps.

into Quicken being able to substantially cut down the time it takes to originate and sell the loans relative to traditional lenders. In addition, Fuster et al. (2018) show that fintech lenders process mortgage applications faster and adjust supply more elastically than other lenders in response to mortgage demand shocks, which suggests that technological innovation may have improved the efficiency of financial intermediation in the mortgage market

Buchak et al. (2018a) also emphasize that Quicken uses technology to employ different data than traditional lenders in their interest rate setting process.[7] This allows them to find consumers with similar default risk as those offered loan by traditional banks. Strikingly, however, Quicken's customers are charged an interest rate premium for providing convenience (see Figure 10).

IV. A Proposal for Financial Regulation

I have discussed extensively that shadow banking and in particular fintech lenders have grown substantially as we look at the lending landscape across banking products. I have also argued that regulation on banks and technological improvements are likely two most important factors behind this growth. How should regulatory policy targeted towards financial stability be designed in such an environment?

Following the spirit of the famous Lucas critique, I argue that such an endeavor needs to (i) understand the business model of fintech shadow banks and traditional banks, (ii) the industrial organization of the credit market and (iii) the equilibrium interaction of intermediaries. Doing these can help give a sense of what activities will migrate between banks and shadow banks in response to different policies. It will also allow quantitative assessment of how much this migration will be and why. All of these elements are critical in predicting policy responses accurately.

Let me next illustrate the importance of these steps through an example of U.S. mortgage market where data availability allows us to delve deeper into these issues.

[7] For instance, traditional hard information variables such as credit scores explain more of the interest rate variation for traditional lenders than they do for fintech lenders. Moreover, fintech lenders have a higher presence in refinancing market, where obtaining credit information about consumers is easier to obtain.

Illustration: US Mortgage Market

Business Model

As noted earlier in Figure 1, the growth of shadow banks in this market in the last decade is unprecedented. To understand the respective positions of traditional banks and shadow banks in the mortgage market, one needs to get into their business models and the structure of the mortgage market.

Traditional banks take deposits and use those funds to make loans, including mortgages. At the same time, they are heavily regulated and subject to strict requirements to hold capital against the loans they keep on their balance sheets. In the mortgage market, they have a choice: They can sell mortgages to the GSEs, collecting an origination fee and, in some cases, a fee for servicing the mortgages. Or they can hold mortgages on their balance sheets, collecting interest and principal until the loans are paid off, but taking the risk that borrowers will default. The better capitalized they are, the greater their capacity to keep mortgages.

By contrast, shadow banks don't take deposits and are lightly regulated. They generally don't have the balance sheet capacity to keep the mortgages they originate. Their business model is "originate-to-distribute", that is, to make mortgages and sell them to the GSEs. An easy way to see this is to compare the loans sold to GSEs by traditional banks versus shadow banks. In Figure 11, one can see that shadow banks sell virtually all their loans to GSEs while traditional banks only partially do so. Finally, given the business model of fintech shadow banks, as noted earlier, they are more active in refinancing market, where they are better able to exploit their comparative advantage with data.

Industrial Organization

While the U.S. residential mortgage market constitutes the world's largest consumer finance market, its structure is very unique and reflects the special role the federal government plays in promoting home loans. To make mortgages more widely available, Congress created Fannie Mae and Freddie Mac, private government-sponsored enterprises (GSEs) that buy home loans from lenders and package them as mortgage-backed securities (MBS) for sale to investors,

guaranteeing payment if borrowers default. However, the GSEs only buy loans up to a limit, called conforming limit, that has varied over time and by geography. Mortgages above that are classified as jumbo loans and are not eligible for purchase by the GSEs. Before the financial crisis, these loans could be sold to private investors, including investment banks such as Lehman Brothers. However, the market for selling these loans has evaporated since the crisis. Instead, jumbo mortgages are usually held by lenders on their balance sheets.

This structure and different business models have had an important implication on where the growth of shadow banking sector has been. In particular, banks have lost a significant share to shadow banks in the confirming loans market. Shadow banks can compete with traditional banks in this part of the market because GSEs are available as buyers for loans they want to sell – given their "originate to sell" business model. However, this is not true in the jumbo loans market where, as noted earlier, the market for "selling" the loans is non-existent. Figure 12 is a graph showing the evolution of bank market share in both the conforming loan market and jumbo loan market since 2007. One can see that bank share in the jumbo loan market remained relatively stable and only began to decrease slightly over the last five years.

Figure 13 reconfirms this fact by looking at the data more finely. The left-hand graph shows the bank market shares in the total residential mortgage market, binned by percentage of the conforming limit.[8] Where GSE financing is available, banks have a much lower share. The right-hand side graph shows a similar fact. When loans are below the conforming limit, the percentage of balance sheet financing is small. However, once GSE financing is removed from the picture, we see that most loans are retained on the balance sheet and banks appear to have a significant advantage.

Finally, there is an interesting interaction of these patterns with the financial health of traditional banks. Figure 14 focuses only on traditional banks and shows that the retention of loans on bank balance sheet and the market share of banks in a market segment co-vary with bank capitalization, holding regulation constant. The left-hand side plots binned capital ratios vs. amount of loans

[8] Note that conforming limit is usually regional-specific and grew from $417,000 in 2006 to $453,100 in 2018 for a one-unit, single family dwelling in a low-cost area, and from $625,000 to $679,650 for same type in a high cost area.

retained on bank balance sheet, controlling for time fixed effect. The right-hand side looks at the same pattern but this time uses within-bank difference by taking out the bank fixed effect in addition to time fixed effect. As is evident, the cross-sectional variation suggests that well-capitalized banks hold more loans on their balance sheet. We therefore see that traditional banks alter their business model – between selling and retaining loans on the balance sheet -- as their capitalization improves. These facts reinforce the claim that understanding the industrial organization of the market and business models of banks and shadow banks is critical to gain insight on what activities from traditional banks move to shadow banks.

Equilibrium Interaction

Doing quantitative policy evaluation requires one to take the information on different business models and industrial organization of lending and embed these in a framework where we can study this equilibrium. I will describe briefly one such framework that is formalized in Buchak et al. (2018a and 2018b)

We model supply side by considering different type of lenders who compete for mortgage borrowers, i.e. we consider traditional banks, non-fintech shadow banks and fintech shadow banks. Following our discussion, these lenders differ on several dimensions: regulatory burden faced by traditional banks, origination costs due to different funding structure and operations, and product quality (for instance, convenience). Traditional banks have advantage over shadow banks due to lower funding costs (deposits) but they also face regulatory costs. On the demand side borrowers choose mortgages from the three types of lenders to maximize utility, which depends on mortgage interest rate and non-price attributes such as convenience/quality.

Equilibrium pricing by each lender and the markups are determined endogenously as lenders try to maximize their profits given demand side. The business model considerations are important because shadow banks sell all the loans they originate while traditional banks decide whether to sell or retain the loans on their balance sheet. This choice of traditional banks depends, among other things, on their funding costs – which are a function of their financial health. It also depends on the industrial organization discussed earlier, with shadow banks competing on price and non-price attributes with traditional banks in some segments (conforming market) but not in others.

In Buchak et al we are able to exploit the joint movements of banks' market share and relative pricing to estimate important parameters of this model. I would like to talk about two parameters in the model that explain interesting patterns related to share of shadow banks and fintech shadow banks over time. These govern regulatory burden on banks and product quality (e.g., convenience) of fintech shadow banks.

By assessing changes in market share and differences in relative pricing of traditional banks relative to shadow banks one is able to get insights on the regulatory burden faced by banks. For instance, one might imagine that the increase in market share of shadow banks relative to traditional banks might be due to their lower prices (due to differences in funding costs). However, all else equal, one finds no differences in prices between banks and shadow banks. The increasing regulatory burden on banks over time can, instead, explain the pattern of increasing shadow bank share without directly mediating through prices (see Figure A6).[9]

Similarly, one can successfully explain the rise of fintech market share through the higher product quality these lenders offer. For instance, one might imagine that the increase in market share of fintech shadow banks relative to non-fintech shadow banks might be due to their lower prices. However, all else equal, one finds that prices of fintech shadow banks are in-fact higher than those of non-fintech shadow banks. The increasing product quality by fintech shadow banks over time can, instead, explain the pattern of increasing fintech shadow bank share, without directly mediating through prices (see Figure A8 and A9).

Using the model, one can isolate how much of the increase in market share of shadow banks was due to regulatory burden on banks and how much was due to improvement in technology that allowed for various aspects such as improved product quality.[10] Our estimates suggest that regulation accounts for roughly 2/3rd of the growth while technology accounts for roughly 1/3rd.

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[9] Interestingly, the time series change of bank regulatory constraint lines up well with policy changes. The graph shows that after 2011, the regulation burden became especially acute after 2011. This timing is in consonance with to a number of policies targeted at curbing bank mortgage issuance, such as Implementation of Dodd Frank Act, the establishment of CFPB and news rules on MSR etc. (See Figure A7).

[10] As a baseline scenario, we estimate the change in market share of banks when we take regulatory burden of traditional banks and freeze it at the level of 2008 and assume that no technological progress has taken place. Next, we allow regulatory burden to change following the previously estimated pattern, while holding constant the

Counterfactual Policy Analysis

Regulation and technology played a crucial role in the shadow bank market penetration in the mortgage lending market. These factors have driven the equilibrium interaction between traditional and shadow banks. Shadow banks strategically compete more in markets where they have a technological advantage and where traditional banks are hampered by regulatory burden. Shadow banks also compete with traditional banks in markets where they are able to operate their "originate to distribute" model. Finally, banks exploit their comparative advantage of "balance sheet capacity" by deciding whether to finance loans themselves or by following an "originate to distribute" model like shadow banks. Therefore, financial regulation needs to understand the business model of fintech shadow banks and traditional banks, the industrial organization of the credit market and the equilibrium interaction of intermediaries. This *integrated view* of financial intermediation is important for understanding policy responses on aspects such as financial stability. I will illustrate this by discussing their importance in the context of two important policy levers used in recent times.

Changes to Bank Capital Requirements

As one illustration, consider the effects of changing bank capital requirements on risk inside the traditional banking system (loans retained on bank balance sheet) as well as overall lending in the economy. We examined such an experiment in Buchak et al. (2018b) where we used the integrated model of intermediation as discussed above.

Raising capital requirement blunts comparative advantage of traditional banks and they shift from balance sheet lending to originate-to-distribute. Since selling of mortgages is only available for conforming loans, this change shifts lending of banks from the jumbo to the conforming market and lowers the share of mortgages retained on bank balance sheets. If one measures success of the policy based on risk retained on bank balance sheet, one might conclude that that risk has down in the financial system. However, this would be an erroneous conclusion.

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technology progress. This counterfactual helps explain the contribution of regulation. Third, we let technological improvement evolve according to the estimated pattern, while holding fixed regulation burden at the year of 2008. This counterfactual helps explain the relative contribution of technology.

Considering bank behavior alone overstates the reduction in overall mortgage volume for two reasons. As noted, tightening of capital requirements forces banks to move from loan retention to adopting the originate to distribute model of shadow banks. In addition, the comparative advantage of traditional banks relative to shadow banks goes down. As a result, significant lending activity also migrates from traditional banks to shadow banks. Here we illustrate the point assuming capital requirement increases from 6% to 7.5%. The policy counterfactual result is illustrated in Table 3. We see a significant decrease in bank's balance sheet lending. However, most of the reduction is compensated by (1) banks moving from originating and holding to instead selling to GSEs (on conforming mortgage side) and (2) shadow banking increasing lending volume. As a result, total lending decreases only by a modest $13 billion.[11]

A more general aggregate lending volume change in response to changes in capital requirements for traditional banks is illustrated in Figure 15. As can be seen, an integrated view that considers behavior of both banks and shadow banks side by side, reveals a quantitatively large *dampened* effect of the policy relative to one that only focuses on effects of the policy on traditional banks.

QE Monetary Policy

In another illustration consider how unconventional monetary policy might impact risk inside the traditional banking system as well as overall lending in the economy. The Federal Reserve policy of buying mortgage-backed securities under a quantitative easing program tends to push down mortgage interest rates for loans sold to GSEs, raising conforming lending volumes significantly. For example, if quantitative easing were to trim MBS interest rates 0.1 percentage point, this would impact both traditional banks and shadow banks (see Table 4).

Lower cost of selling leads to significant increase in originate-to-distribute lending for traditional banks, as funding loans using balance sheet becomes less lucrative. Not surprisingly, for shadow banks that are reliant on selling to GSEs, a lower cost leads to a significant increase in their lending. However, because the GSEs don't buy jumbo loans, this market is left relatively unaffected (except through pricing decisions of traditional banks that operate in both conforming and jumbo

[11] Since shadow banks would become more dominant, higher capital requirements would also move mortgage credit risk off bank balance sheets to the GSEs and indirectly to the U.S. Treasury.

markets). Thus, focusing only on banks, which operate significantly on the jumbo side as well, would understate the true impact of the policy. It would miss the substantial effects of the policy on shadow banks. A more general aggregate lending volume change in response to changes in unconventional monetary policy of the form considered is illustrated in Figure 16. As can be seen, an integrated view that considers behavior of both banks and shadow banks side by side, reveals a quantitatively large *amplified* effect of the policy relative to one that only focuses on effects of the policy on traditional banks

Overall, the two illustrations show that focusing only on the banks might result in amplified or dampened effect on outcome variables -- such as aggregate risky lending in the economy – depending on the policy. In the context discussed above, focusing only on banks may overstate the true response to policies that impact funding of traditional banks directly. In contrast, focusing only on banks may understate the true response to policies that impact funding in the secondary market.

V. Conclusion

Intermediation in the lending market has undergone a dramatic shift from traditional banks to shadow banks, i.e., non-depository institutions that fall outside the scope of traditional banking regulation. I trace the growth of shadow banks to the increased regulatory burden faced by traditional banks and to the financial technology adopted by shadow banks. I argue that these factors explain changes in credit markets around the globe. Assessing financial stability in this new era involves understanding the business model of fintech shadow banks and traditional banks, the industrial organization of the credit market and the equilibrium interaction of intermediaries. I emphasize that a regulatory policy analysis requires the impact of the policy on banks and shadow banks to be analyzed side by side.

Importantly, while the detailed illustration focused on the U.S. mortgage market, the lessons that emerge might be quite general. For instance, consider the case of shadow banks in China. A policy change, such as tightened monetary policy again demands an "integrated view of financial intermediation". Presence of a large shadow banking sector is likely to play an important role as

financial capital might flow to WMPs and internet finance products (see BIS Annual Report 2019, Chapter III). However, understanding the net effect of such a policy would require an equilibrium model of the kind I discussed since a large chunk of resources from internet finance products are reinvested with banks.

I conclude with a few elements that have been missing from the discussion but might be quite important as well. In work in progress with my collaborators we examine the sources of shadow bank funding. We find that their funding is largely through short term bank loans. Consequently, the risk in the traditional banking sector that is assessed just based on consumer credit that remains on bank balance sheet is incomplete for another reason. A more complete integrated view of the type I am advocating would need to consider the fact that banks might be, in large part, financing shadow banks.

In addition, while research has assessed the nature of risky lending done by shadow banks and traditional banks, most of this work has been during a low default environment. Moreover, there is an interesting interaction between shadow banks and traditional banks based on changes in monetary policy following the work of Drechsler et al. (2019) and Kairong (2019) that is outside what I have discussed. How the changes in monetary policy or macroeconomic conditions might impact the nature of risky lending extended by shadow banks and traditional banks through various channels remains a fruitful area of investigation.

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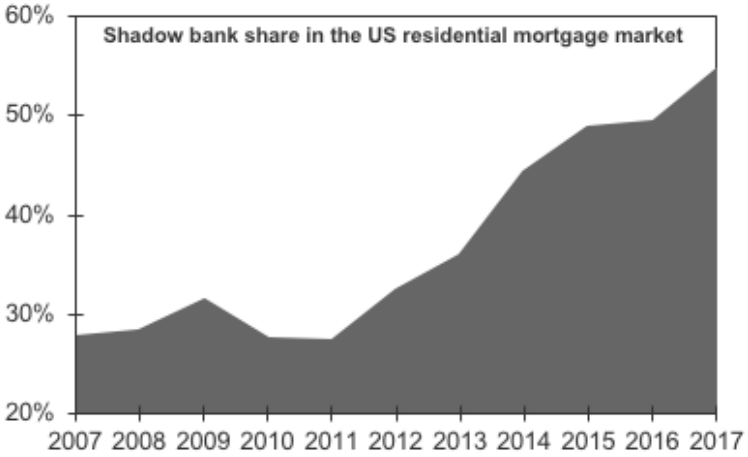
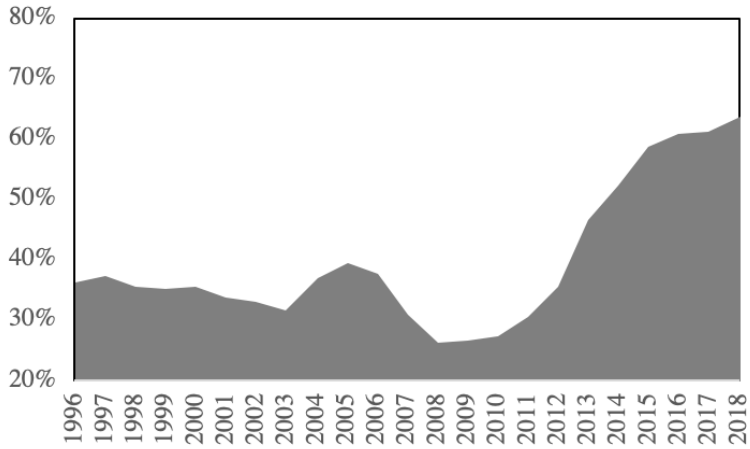
Figure 1: Shadow banks in the U.S. residential mortgage market

These figures show the shadow bank origination shares in the U.S. residential mortgage market. Panel (a) shows shadow bank origination shares as a fraction of total originations for all mortgages in HMDA between 2007 and 2017. The method used to construct this figure is based on Buchak et al. (2018a). Panel (b) shows the same plot for a longer time period. This data comes from a large credit bureau.



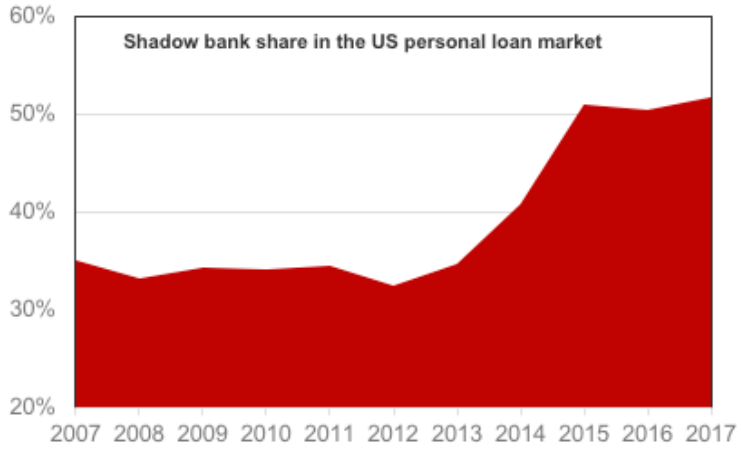
(a): Mortgage market



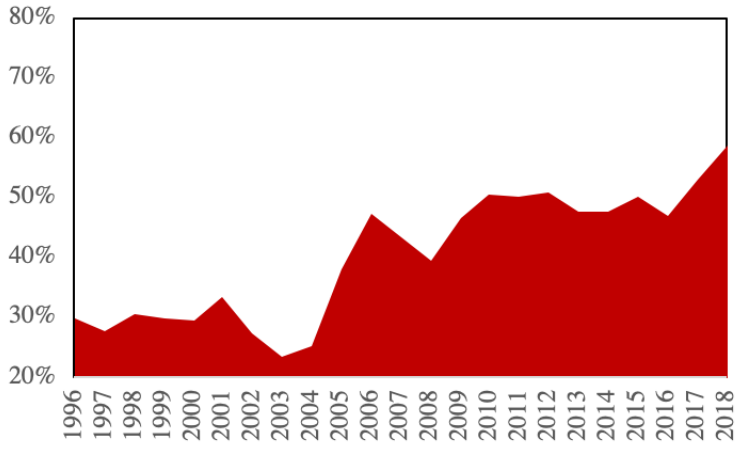
(b): Mortgage market (longer time series)

Figure 2: Shadow banks in U.S. personal loan market

These figures show the shadow bank origination shares in the personal loan market in the U.S. Both panels show shadow bank issuance shares as a fraction of total personal loans. The plot this share for different time periods. The data comes from two (different) large credit bureaus.



(a): Personal loan market



(b): Personal loan market (longer time series)

Figure 3a: Leveraged loan market in the U.S.

This figure shows the U.S. institutional leveraged loans issued per year from 2008 to 2018. The unit is in trillion dollars. Leveraged loan is defined as debt from companies with below investment grade credit ratings. Regulators slowed the leveraged loan growth after 2013 but the rules were loosened in 2017. Data are from Bloomberg Report.

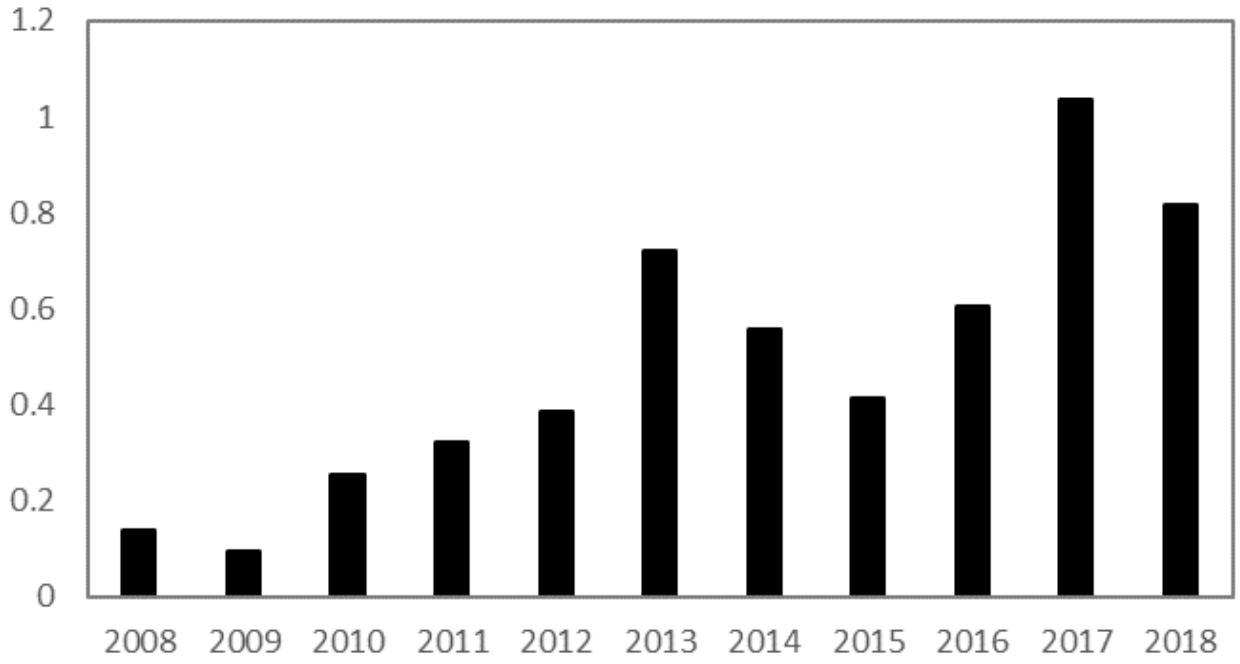


Figure 3b: Market share of selected non-banks in Leveraged loan market in the U.S.

This figure shows the leveraged loan market share for selected nonbanks in year 2013 and 2018. Within the five years' window, nonbanks' share of leveraged loan has more than doubled on average, and more deals are done outside of regulators' view. Data are from Bloomberg Report.

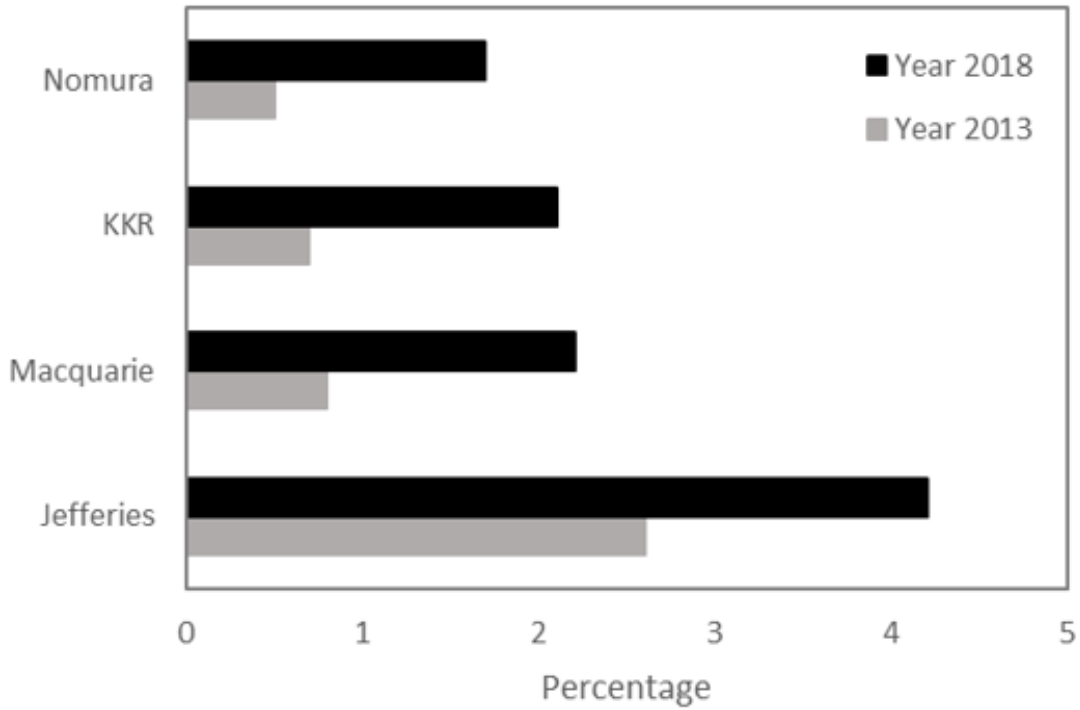


Figure 4: Composition of nonbank funding of syndicated term loans

This figure shows the nonbank share of U.S. syndicated term loans by entity type between year 1992 and 2014. Composition of funding by lender type. DEO and FEO stand for other domestic and foreign entity, respectively. The categories in the figure refer to groups of financial firms and, to ensure confidentiality, data for no individual firm is disclosed. Source: Irani et al. (2018).

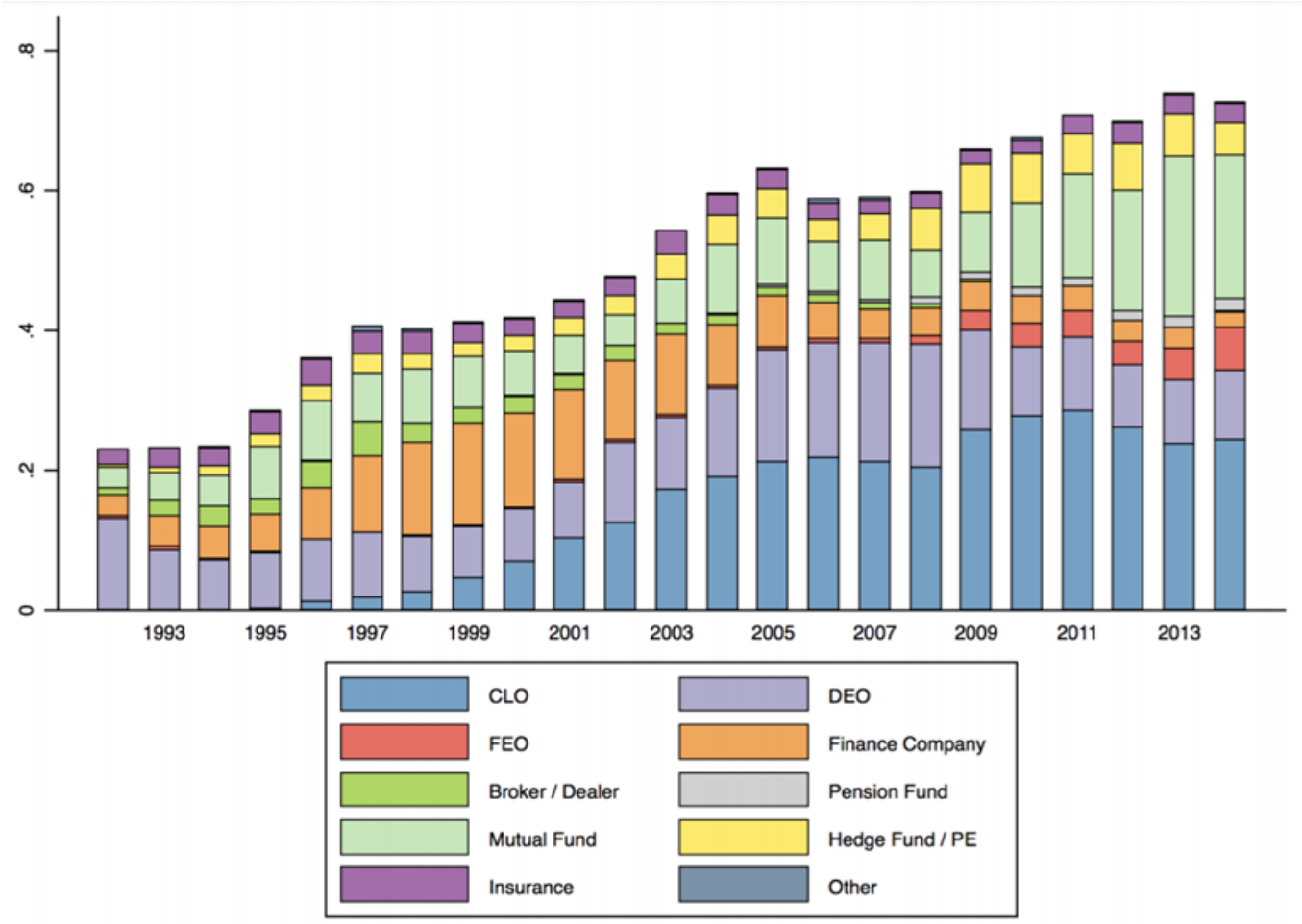


Figure 5: US. student loan market

This figure shows the size of US student loans between year 2004 and 2017. The unit is in trillion dollars. Data are from Looney and Yannelis (2015) and extended by author.

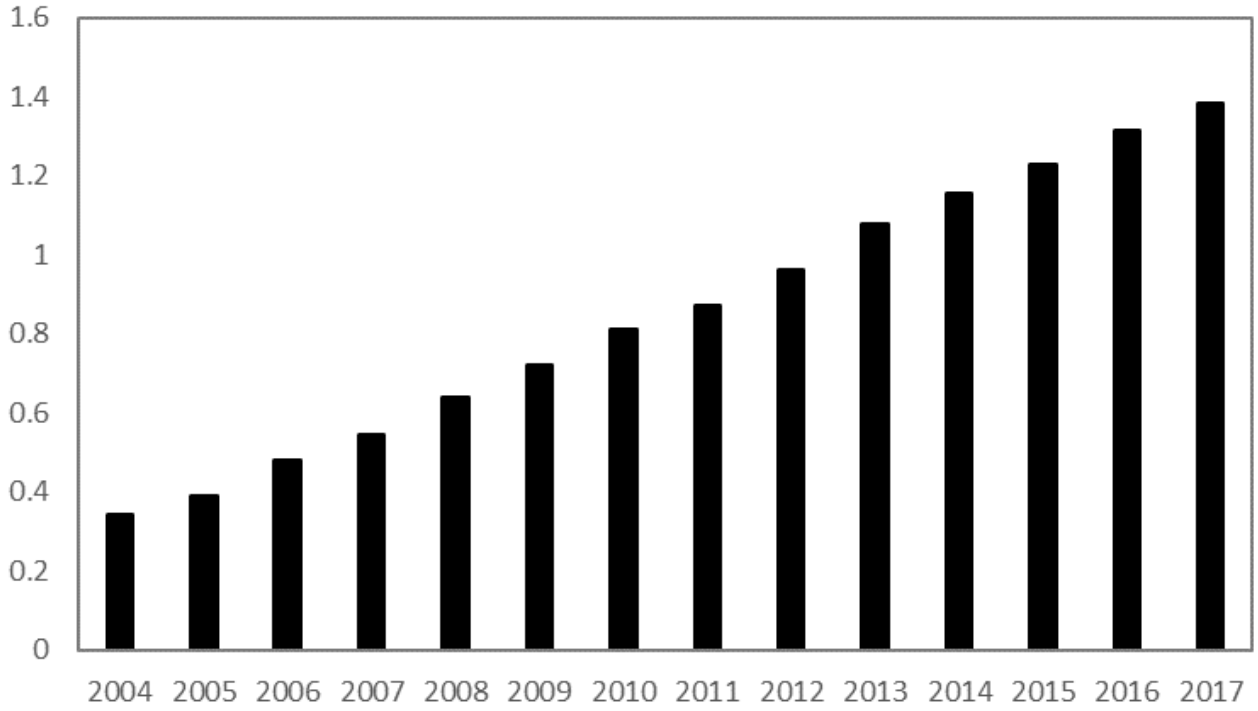


Figure 6: Shadow banking in EU

This figure shows the shadow banking system breakdown in EU. Data for the total other financial institutions (OFI) are sourced from financial accounts statistics; data on investment funds and MMFs are based on ECB monetary statistics. Data are from Central Bank of Ireland, De Nederlandsche Bank, Nationale Bank van Belgie/Banque Nationale de Belgique and ECB report calculations.

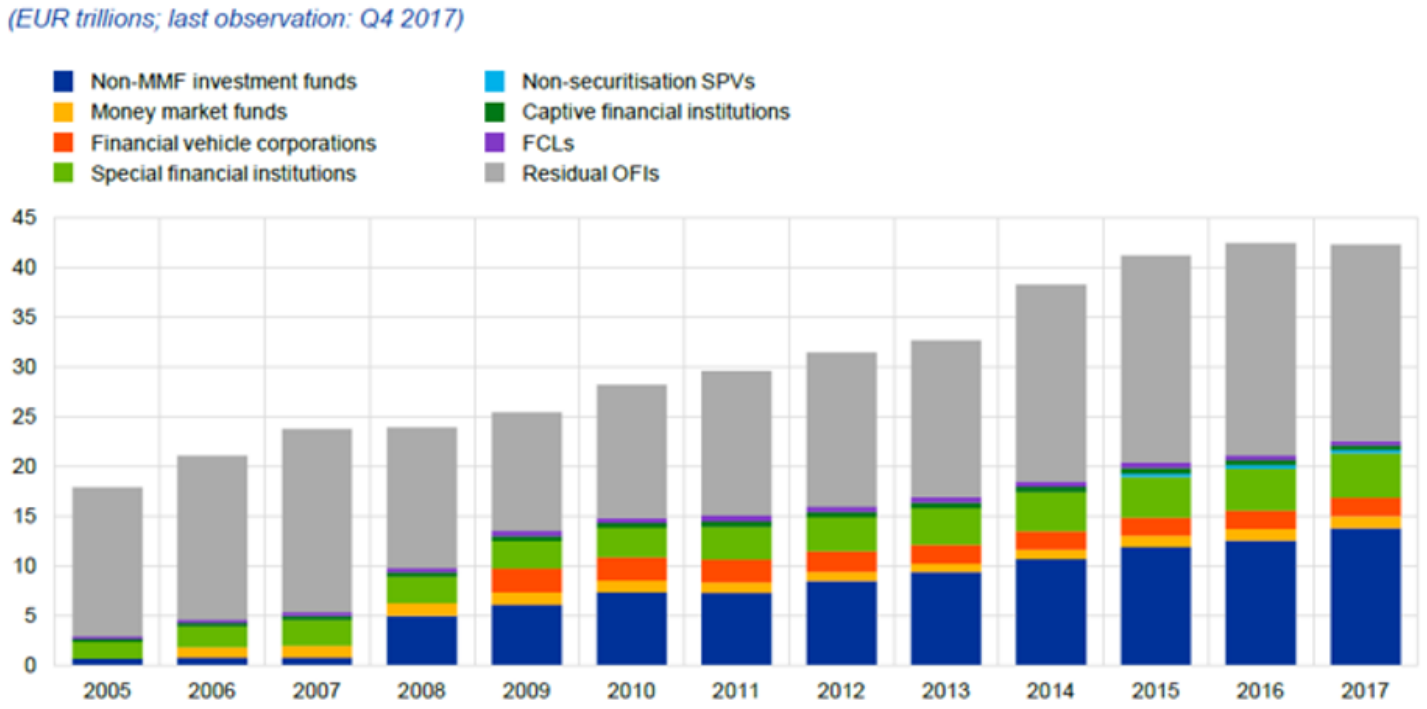


Figure 7: Total shadow banking growth in China

This figure shows the total shadow banking growth in China from year 2012 to 2016. Note that 2016 data is only for the first half of the year. Data are from CaixaBank Research, based on data from People's Bank of China (PBOC), Moody's, China Trustee Association and China's Wealth Management Registration System.

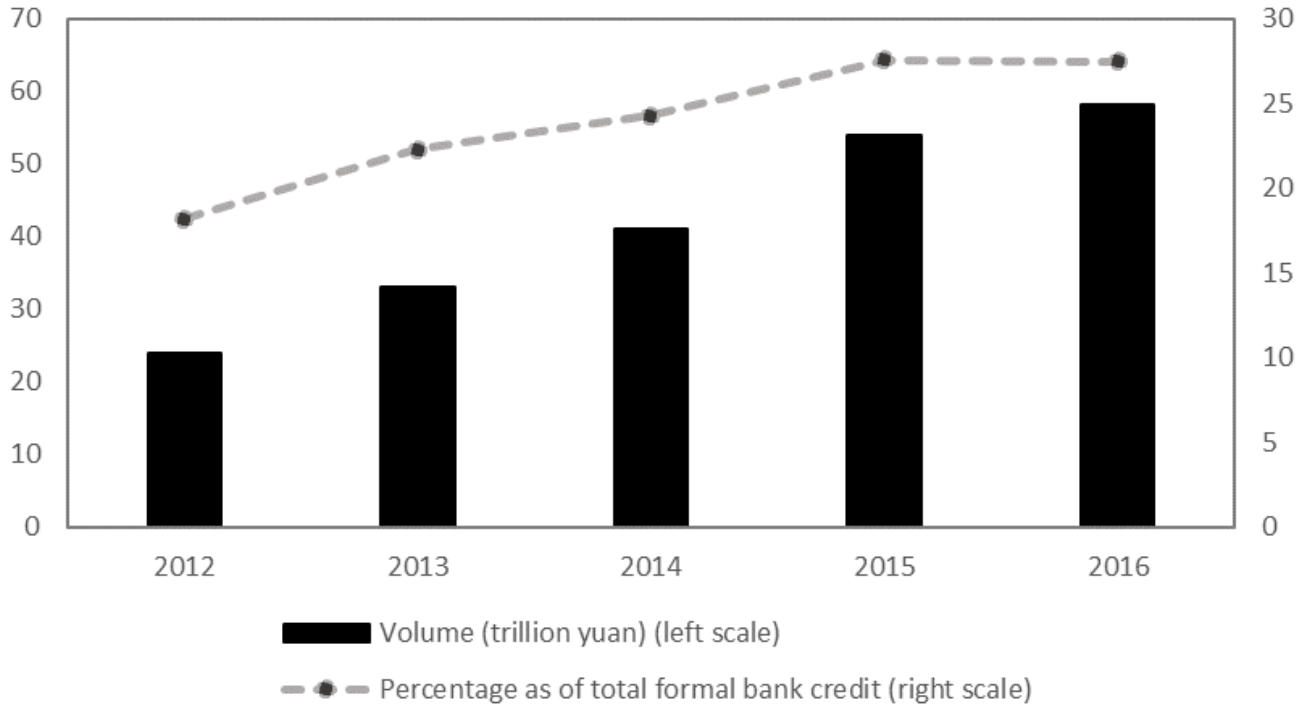


Figure 8: Alibaba “Ali-pay” and Tencent’s market share in online payment market 2017Q1

This figure shows the online payment market share composition as of first quarter of 2017. Data are from iResearch Consulting Group.

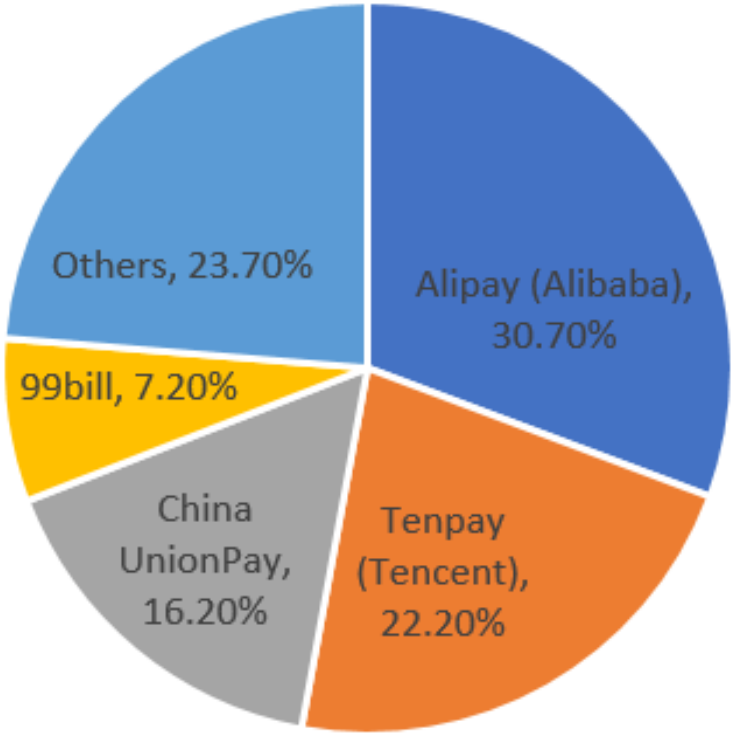
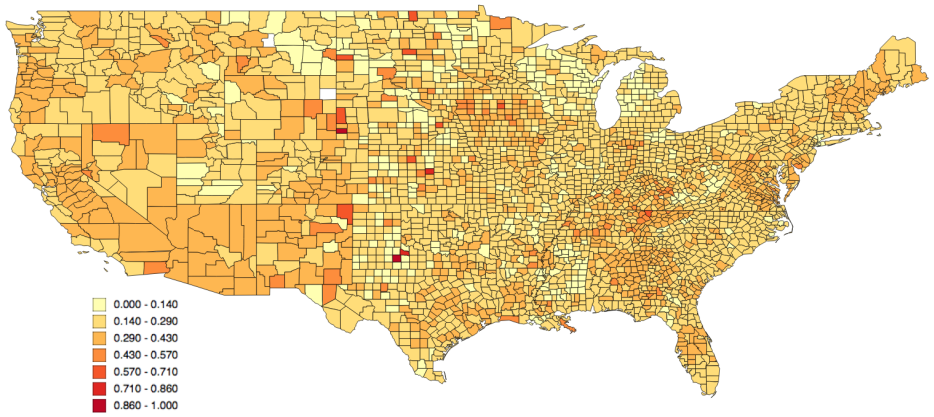
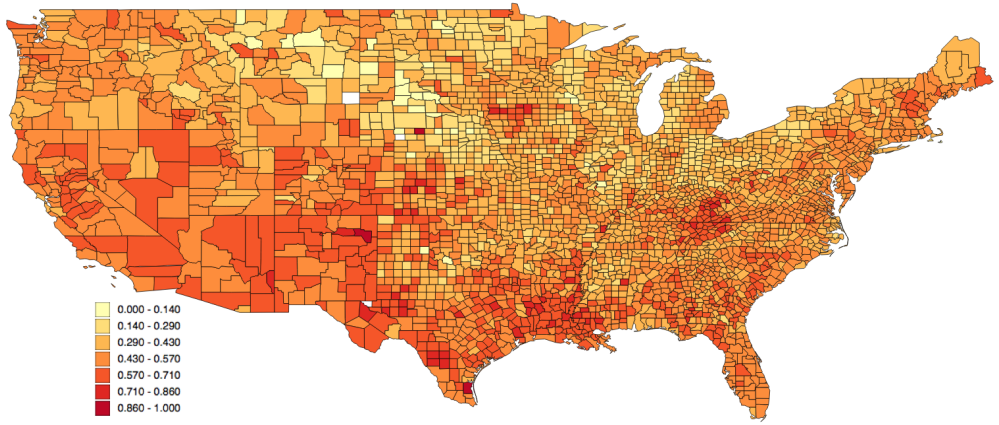


Figure 9: County level shadow bank market share (2008 vs. 2015)

These figures show the regional shadow banking penetration between 2008 and 2015. Panel (a) shows the county-level percentage of mortgages originated by shadow bank lenders as of 2008. Panel (b) shows the county-level percentage of mortgages originated by shadow bank lenders as of 2015. Calculations are based on HMDA data and follow method outlined in Buchak et al. (2018a).



(a): Year 2008



(b): Year 2015

Figure 10: Willingness to pay to Fintech shadow banks vs. Traditional banks

This figure shows mortgage rates for Fintech shadow bank (Quicken) and Traditional banks over time. The sample period is from 2010 to 2015 with quarterly observations. The red solid line indicates mortgage rates for Fintech lender, and the black dash line indicates mortgage rates for traditional banks. The method used here follows Buchak et al. (2018a).

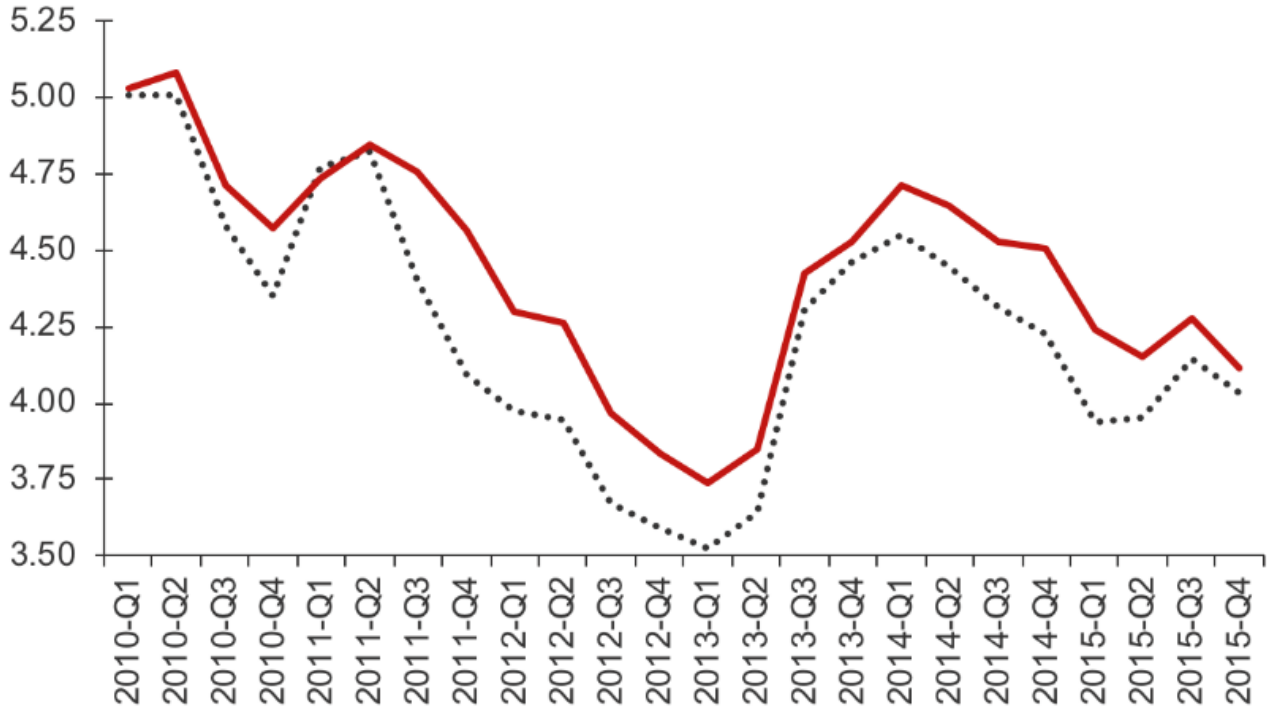
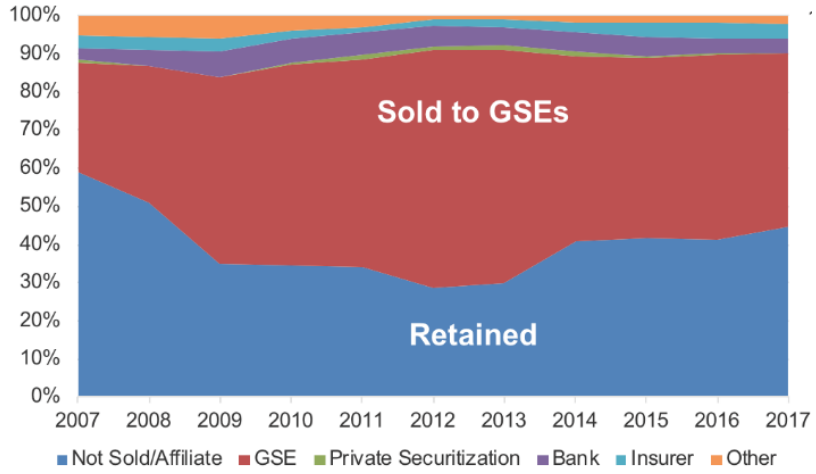
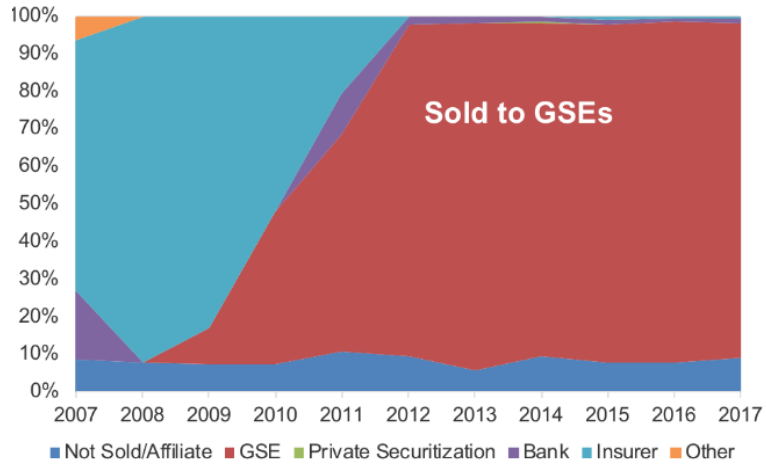


Figure 11: Disposition of mortgages among Traditional Banks and fintech Shadow Banks

These figures show the disposition of loans among traditional banks and fintech shadow banks, in particular, the percentage of originated loans by originator type sold to various entities within the calendar year of origination (including loans not sold). Panel (a) shows the buyer composition of traditional bank originations; Panel (b) shows the buyer composition of all fintech shadow bank originations. Loans categorized as "not sold" are not sold within the calendar year of origination, although they may be sold some time later. The GSE category pools Fannie Mae, Freddie Mac, Ginnie Mae, and Farmer Mac. Calculations are based on HMDA data and follow method outlined in Buchak et al (2018a).



(a): Banks



(b): Fintech Shadow banks

Figure 12: Bank market share on jumbo and conforming loan

This figure shows bank market share (by dollars originated) in the confirming (solid) and jumbo (dash) markets. Conforming loans are defined as "conventional" (non-FHA) in HMDA with loan amounts below the conforming loan limit as discussed in Buchak et al. (2018b). As figure shows, the decline in bank market share is not uniform across different segments in the mortgage market. It is largely driven by the conforming market where GSEs buy loans of pre-specified characteristics from traditional banks and shadow banks.

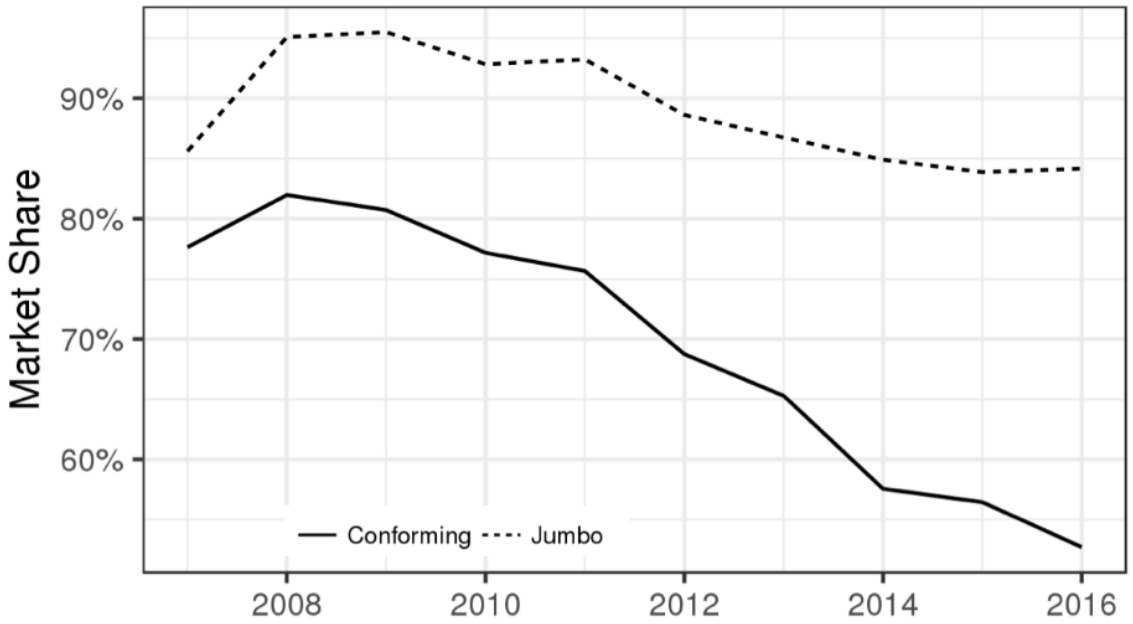
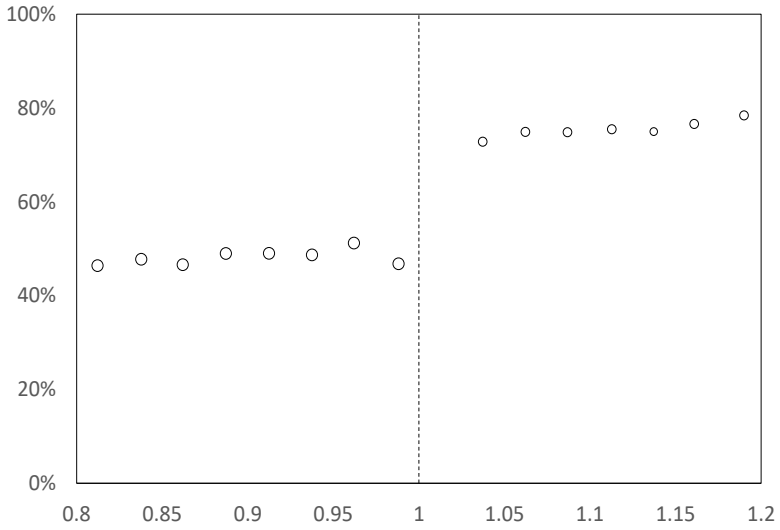
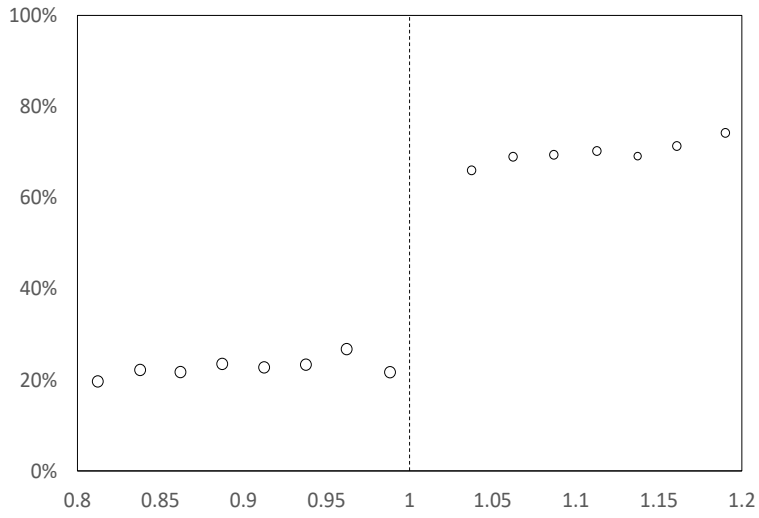


Figure 13: Bank market share and bank balance sheet financing of loans

These figures show the bank market share and bank balance sheet financing of mortgages in the US. Panel (a) shows the percentage of originations that are done by banks around the conforming loan limit. Panel (b) shows the percentage of mortgage originations retained on balance sheet by the loan amount divided by the conforming loan limit in the county-year of origination. The cutoff is at 1, shown by a dotted vertical lone. Loan sizes are binned as a proportion of the conforming loan limit in 0.05 buckets, i.e., 0.91-0.95, 0.96-1.00, 1.01-1.05, and so on. Data are from HMDA and span 2007 to 2017 following method in Buchak et al. (2018b).



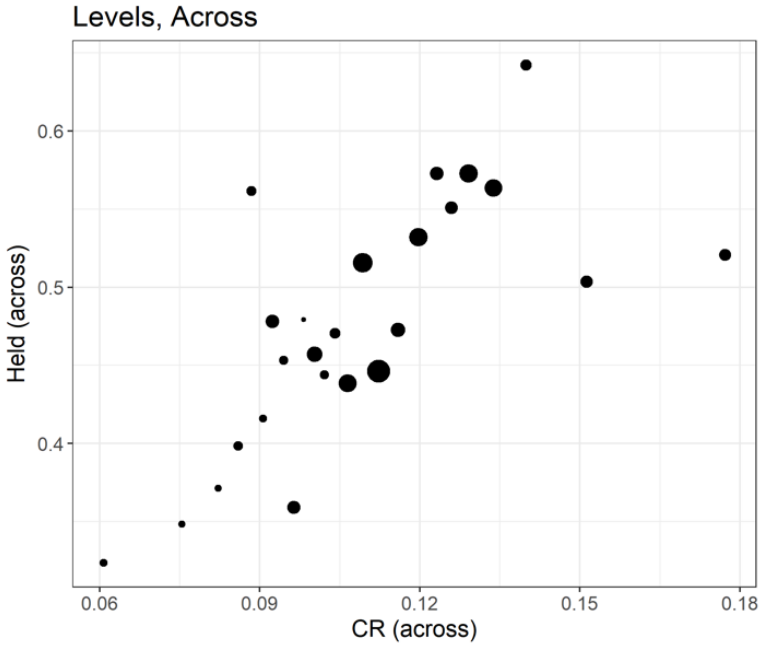
(a): Bank market share around conforming limit



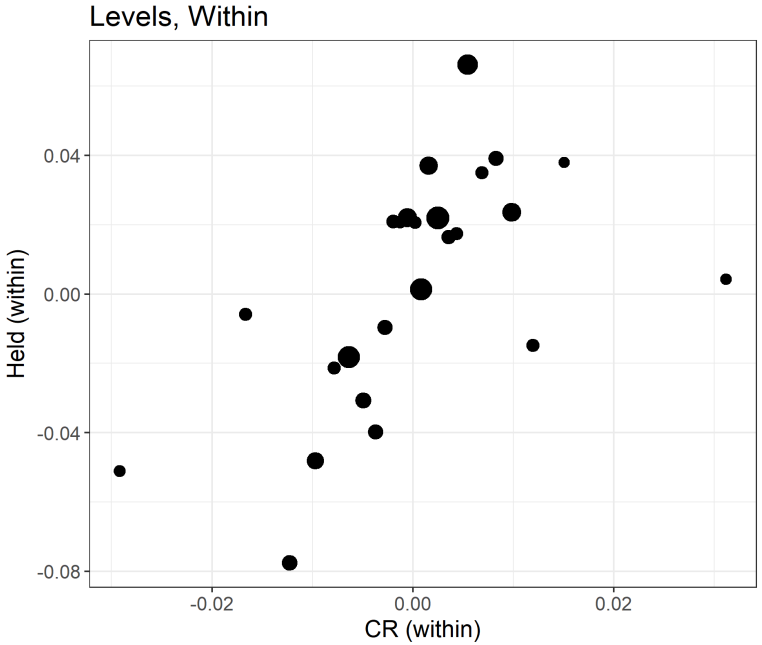
(b): Share of loans on balance sheet around conforming limit

Figure 14: Bank capitalization and balance sheet retention

This figure shows binned scatterplots (25 equal-sized bins) of bank percent of loans retained on balance sheet versus bank capital ratios. All bins are residualized taking out the effect of bank controls. Panel (a) is across banks by taking out time fixed effect; Panel (b) is within banks by taking out bank fixed effect.



(a): Across banks, levels



(b): Within banks, levels

Figure 15: Counterfactual Analysis

Lending Response to Changes in Capital Requirements of Traditional Banks

This figure shows the aggregate mortgage origination volume (in $ billions) across various bank capital ratio requirements (in %) based on the model calibrations described in the text. The model follows Buchak et al. (2018b). The blue line is the mortgage origination by banks only, while the black line is the mortgage origination by banks and shadow banks together.

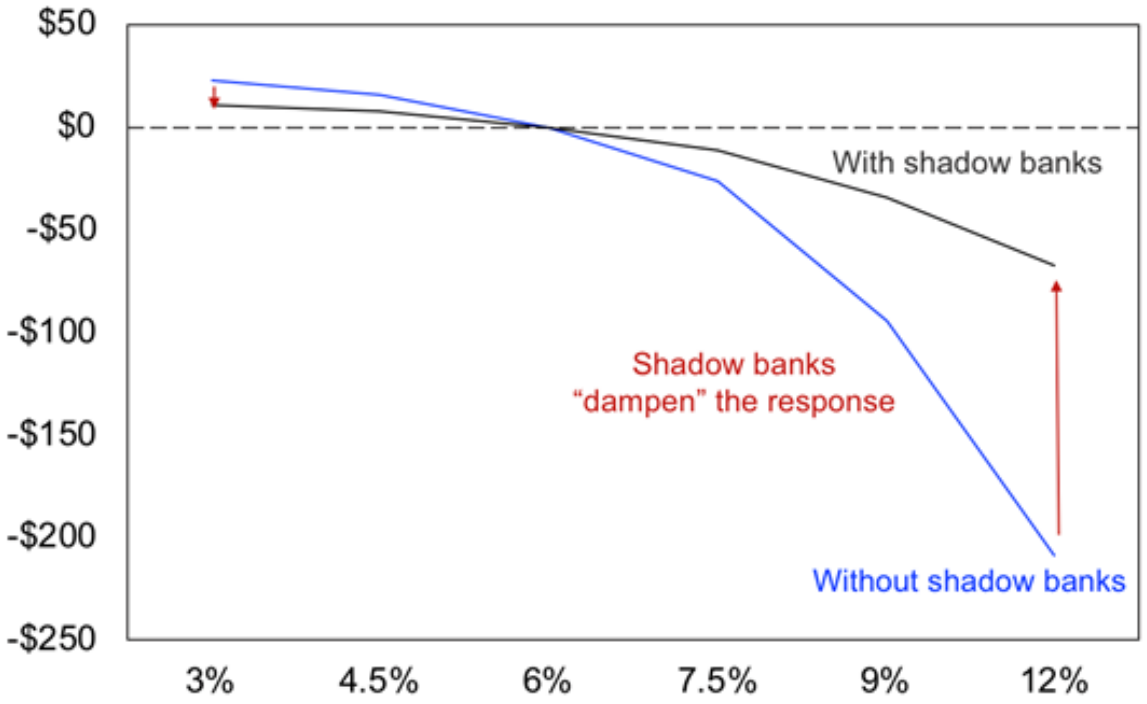


Figure 16: Counterfactual analysis

Lending Response to Changes in GSE financing costs

This figure shows aggregate mortgage origination volume (in $ billions) across various changes to the GSE financing costs relative to the baseline (in basis points) based on the model calibrations described in the text. The model follows Buchak et al. (2018b). The blue line is the mortgage origination by banks only, while the black line is the mortgage origination by banks and shadow banks together.

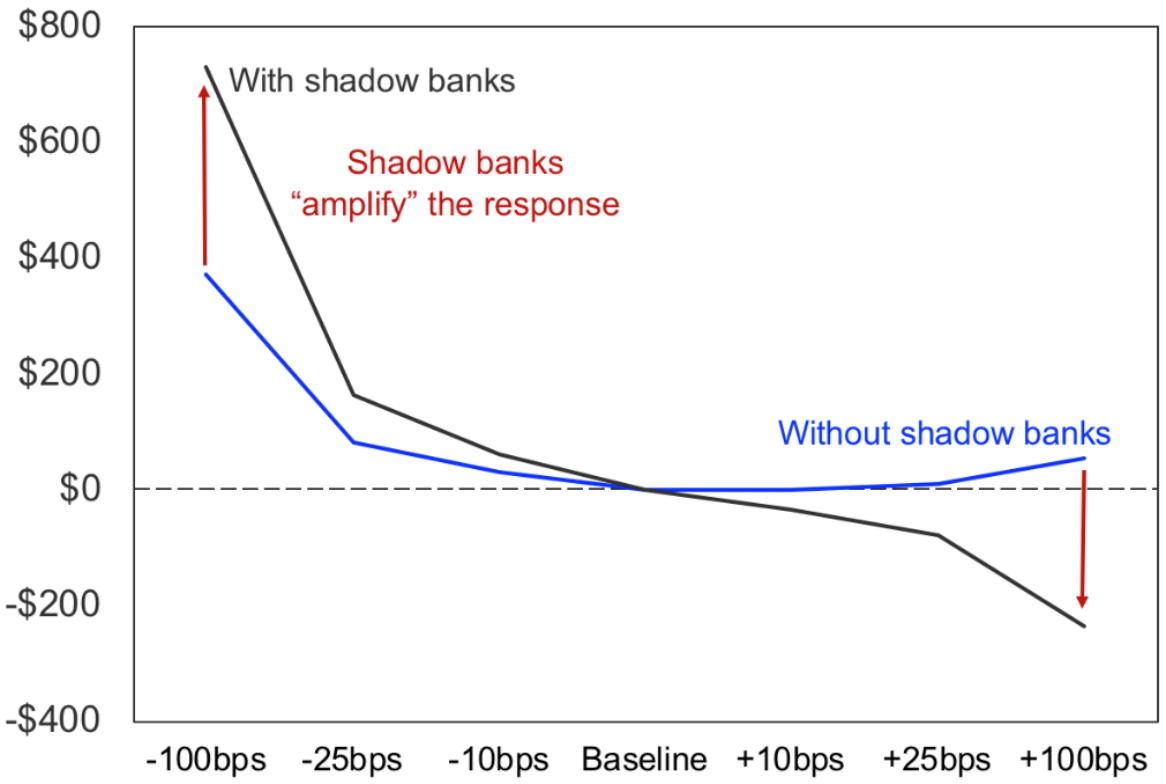


Table 1: Shadow banks across different markets in the U.S.

This table shows the breakdown of banks and shadow banks market size in different markets: unsecured personal loans, small business loans, leveraged loans, student loans, residential mortgage loans and commercial real estate loans. The fourth column presents estimates of how much of the lending as of 2015 is done by traditional banks. The fifth column presents estimates of how much of the lending by traditional banks is at risk by shadow banks. Data are based on Goldman Sachs Global Investment Research.

Type	Market size	Market type	% inside banking system	% in banking system at risk	Select disruptors / new entrants	Competitive advantage
Unsecured personal loan	$843bn	Loans O/S	81	31	Lending Club, Prosper	Regulatory, technology
Small business loan	$186bn	Loans O/S	95	100	On Deck, Kabbage	Technology (time, convenience)
Leveraged lending	$832bn	Loans O/S	7	34	Alternative AM, BDCs	Regulatory
Student lending	$1,222bn	Loans O/S	5	100	SoFi, Earnest, CommonBond	Regulatory, technology, convenience
Mortgage origination	$1,169bn	Annual Vol	58	100	Quicken, PFSI, Freedom	Regulatory, convenience
Mortgage servicing	$6,589bn	Loans O/S	73	6	OCN, NSM, WAC	Regulatory, cost
CRE lending	$2,354bn	Loans O/S	56	9	Commercial REITS, alternative lenders	Regulatory, market dislocation
Total	$13,195bn	/	59	20	/	/

Table 2: Student loan refinance market between 2012 and 2018

This table shows the student loan refinance market size and various players' share between 2012 and 2018. Data sample ends in Jan 2018. Source: Citizens Bank, Lendkey, College Ave, others estimated from public data.

Lender	Amt Originated $bn	# of Borrowers	Avg. Loan Size
SoFi	$15	185,000	$81,081
Citizens Bank	$3.3	57,772	$57,121
DRB	$2.8	24,000	$116,667
Earnest	$1.3	17,000	$76,471
CommonBond	$1.3	19,000	$68,421
Lendkey	$0.7	14,000	$50,000
College Ave	$0.2	4,000	$50,000
others	$0.4	10,000	$40,000
Total	$25	330,772	$75,581

Table 3: Counterfactual analysis:

Change in Lending in response to change in capital requirement faced by traditional banks from 6% to 7.5%

This table shows the change in mortgage origination volume (in $ billions) by banks and shadow banks when capital requirement increases from 6% to 7.5% based on the model calibrations described in the text. The table further breaks down the mortgage volume change into jumbo and conforming loan volume change. Data are based on calculations in Buchak et al. (2018b).

Lender	Loan Type	Financing Source	Change
Total	-	-	-$13b
Bank	Jumbo	Balance Sheet	-$38b
Bank	Conforming	Balance Sheet	-$204b
Bank	Conforming	GSE	+$215b
Shadow Bank	Conforming	GSE	+$14b

Table 4: Counterfactual analysis

Change in Lending in response to decrease in GSE financing cost by 10 bps

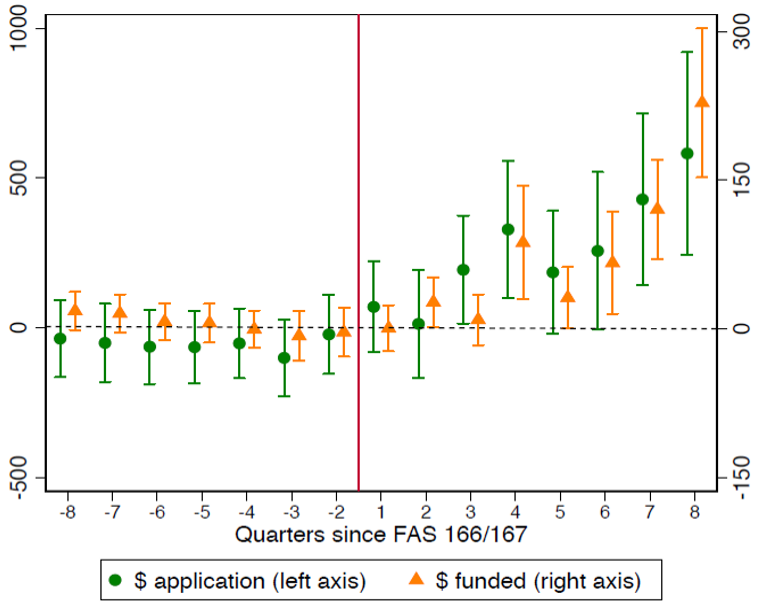
This table shows the change in mortgage origination volume (in $ billions) by banks and shadow banks when GSE financing cost decreases by 10 bps based on the model calibrations described in the text. The table further breaks down the mortgage volume change into jumbo and conforming loan volume change. Data are based on calculations in Buchak et al (2018b).

Lender	Loan Type	Financing Source	Change
Total	-	-	+$61b
Bank	Jumbo	Balance Sheet	-$4b
Bank	Conforming	Balance Sheet	-$357b
Bank	Conforming	GSE	+$389b
Shadow Bank	Conforming	GSE	+$33b

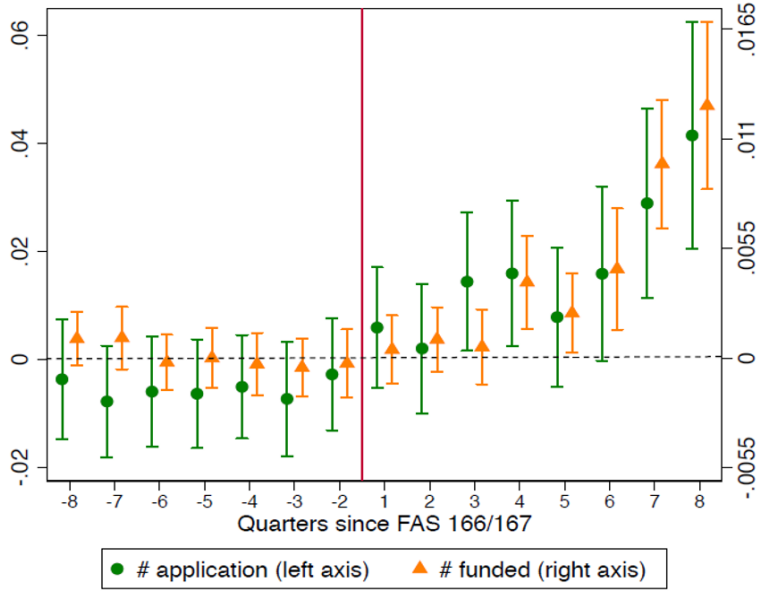
Appendix

Figure A1: LendingClub penetration in different markets

This figure reports the effects of FAS 166/167 on local P2P application volume and origination volume as obtained from estimation using the quarterly data. The P2P lending volume is measured in dollars per thousand inhabitants in Panel (a) and by the number of loans per thousand inhabitants in Panel (b). Quarter t=-1 signifies the last quarter of 2010 and is used as the reference point. Error bars mark the 95% confidence intervals. Standard errors are clustered at the county level. Source: Tang (2018).



(a): Dollar amount



(b): Number of loans

Figure A2: Size of shadow banking system in EU and euro area

This figure shows the size of shadow banking system in EU and euro area. The continuous lines indicate annual growth rates based on changes in outstanding amounts. The dotted lines indicate annual growth rates based on transactions – i.e. excluding the impact of FX and other revaluations and statistical reclassifications. Data are from ECB report.

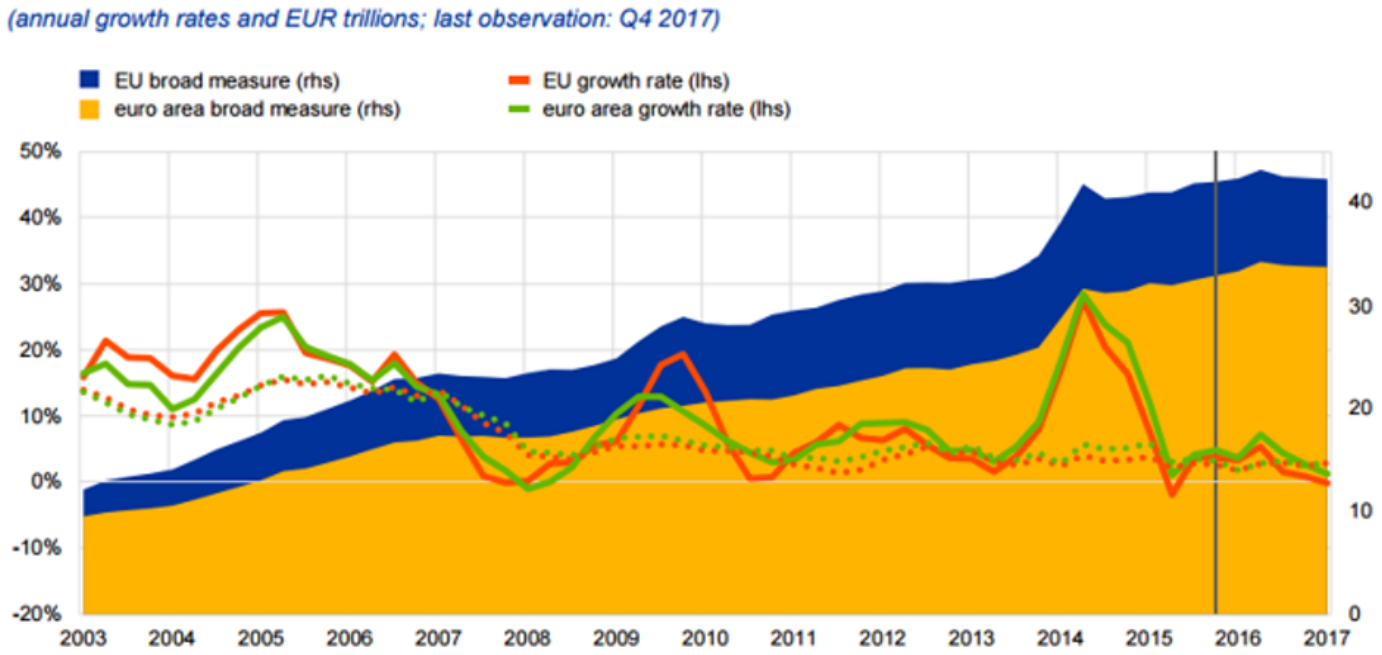


Figure A3: Funding to European banks provided by shadow banking entities

This figure shows the wholesale funding to European banks provided by shadow banking entities. The wholesale funding measure is the sum of: MFI funding arising from securitization; Investment funds (IF), money market fund (MMF) and other financial institutions (OFI) deposits at euro area MFIs; and IF, MMF and OFI holdings of debt securities issued by euro area MFIs. "Resid OFIs" reflects the difference between the total financial sector and the known sub-sectors within the statistical financial accounts (i.e. assets from the banking sector, insurance companies, pension funds, FVCs, investment funds and MMFs). Data are from ECB and ESMA calculations.

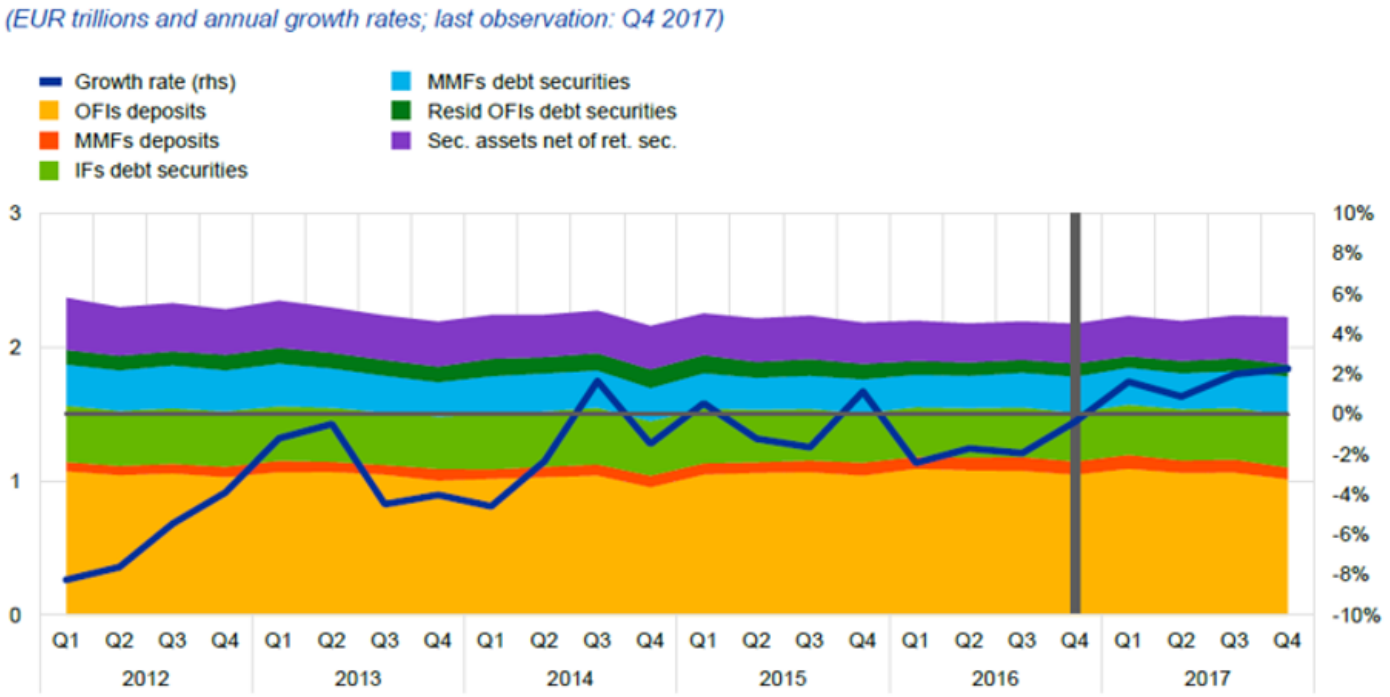


Figure A4: Alibaba Yu'ebao Balance in billion RMB

This figure shows the balance of Alibaba Yu'ebao over from 2013 Q3 to 2016 Q4. Yu'ebao is an investment product of Alibaba's payment affiliate Ant Financial that invests in money market mutual funds. Data are from Alibaba Group.

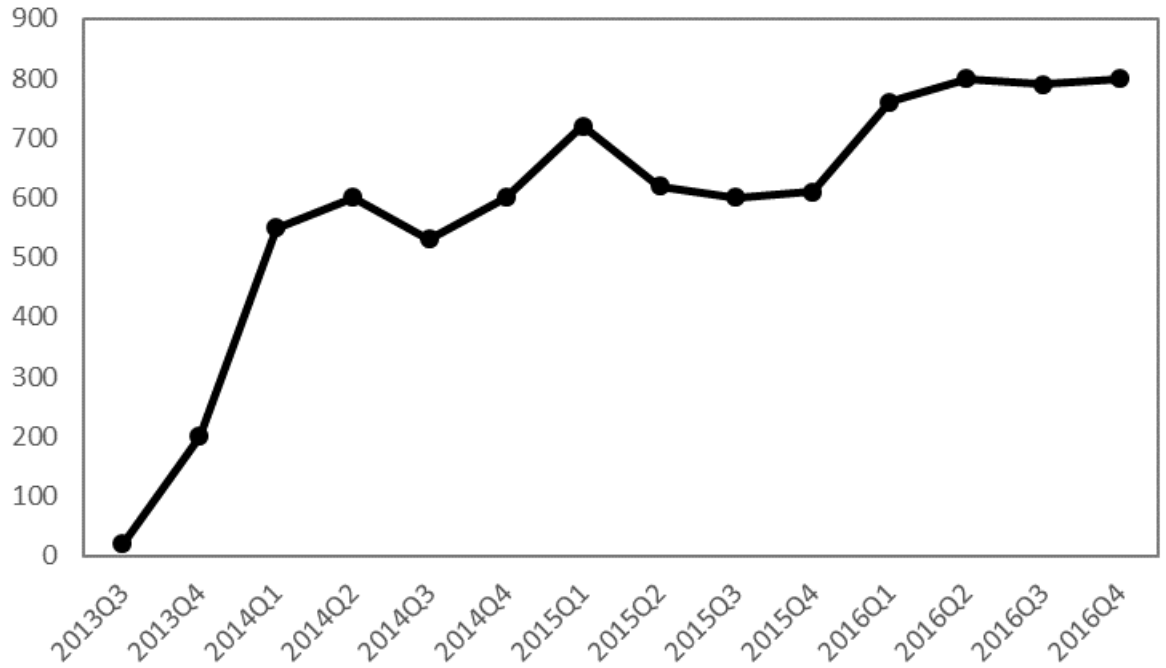


Figure A5: County level change of capital ratio vs. shadow bank growth

This figure shows binned scatterplots (in 25 bins) of growth in shadow bank market share versus regulatory exposure to capital requirement. The size of the points represents the number of originations falling into the bin. Best fit lines, along with 95% confidence intervals are shown along with the bins. The method follows Buchak et al. (2018a).

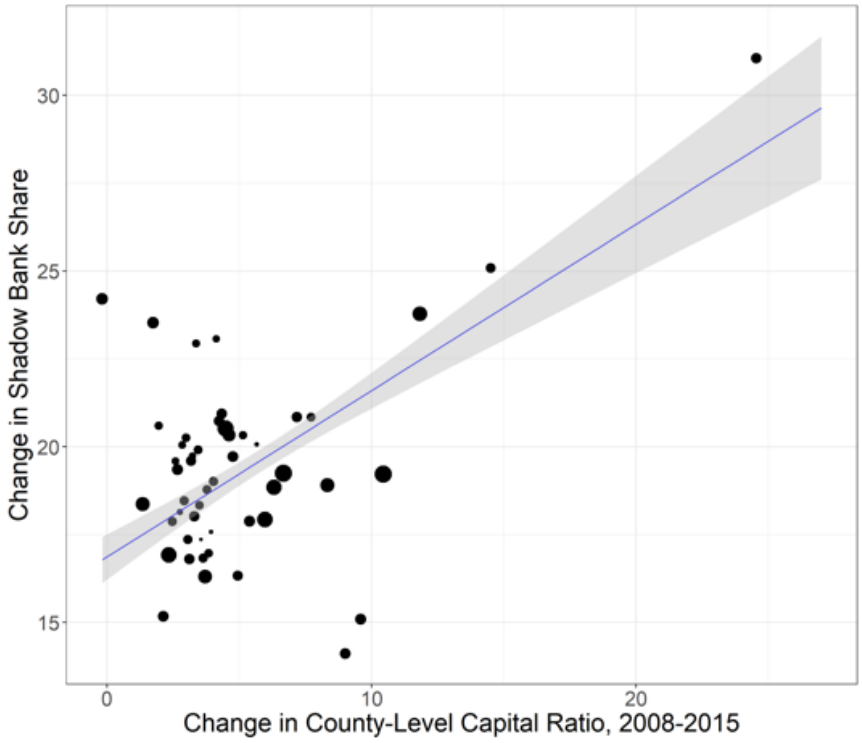
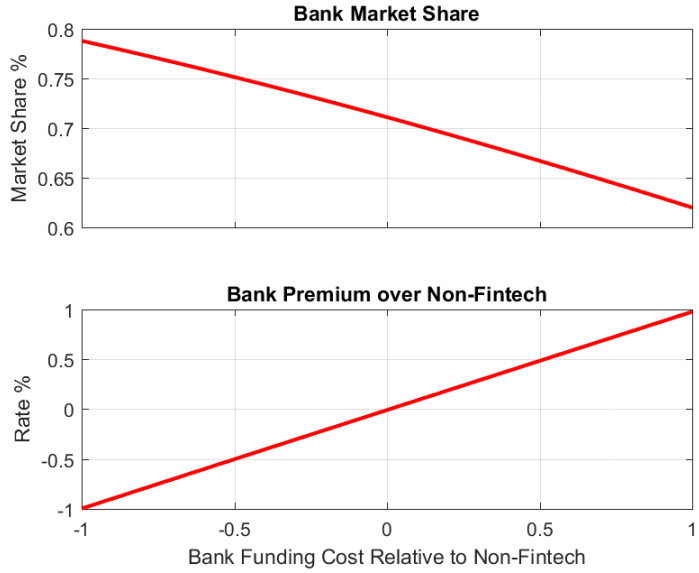
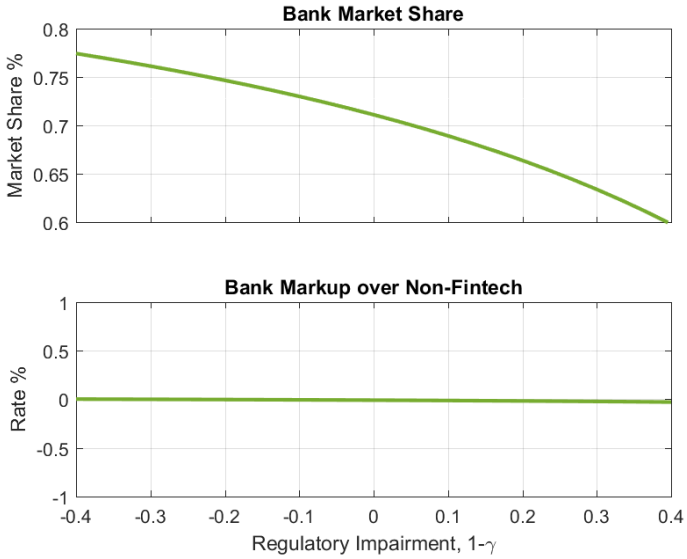


Figure A6: Comparative statics on funding cost channel and regulation burden channel

These figures show the comparative statics of traditional bank market share and traditional bank mortgage rate premium relative to shadow banks. Panel (a) shows what the model in Buchak et al. (2018a) predicts should occur as the bank funding cost relative to shadow banks is changed. Panel (b) does a similar exercise changing the regulatory burden faced by traditional banks in Buchak et al. (2018a) instead.



(a): Funding cost channel



(b): Regulatory burden channel

Figure A7: Calibration of regulatory burden faced by traditional banks

This figure shows the evolution of regulatory burden face by traditional banks relative to 2008 implied by Buchak et al. (2018a) model calibration. A higher value of the parameter implies a lower regulatory burden level.

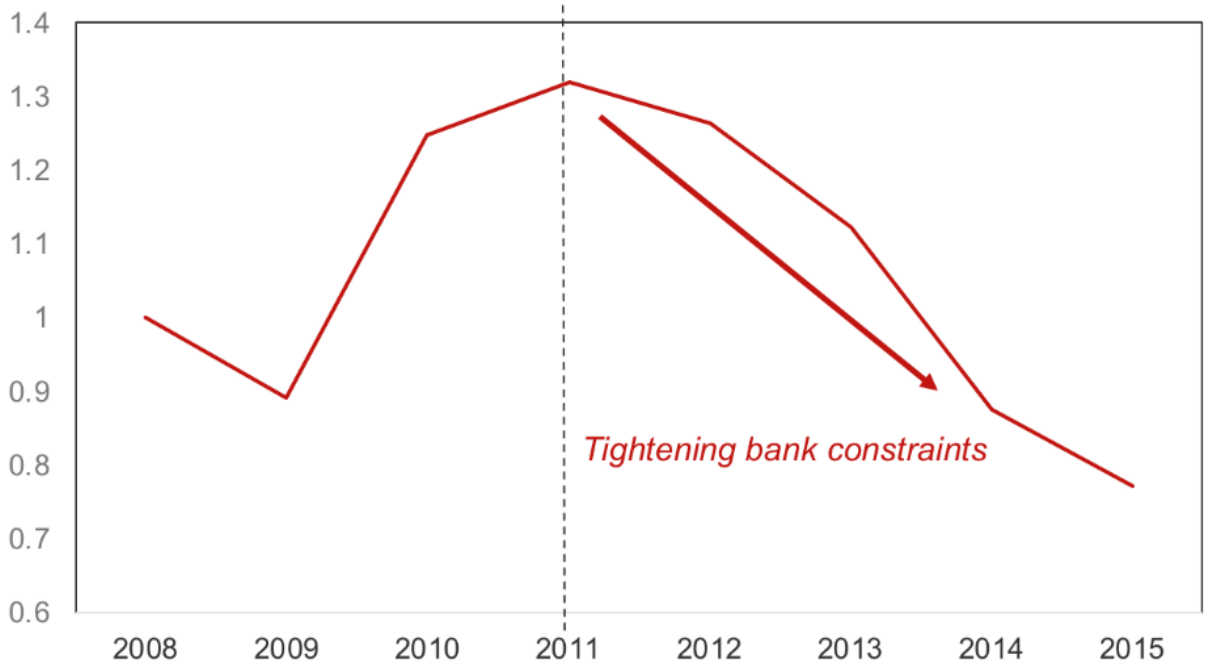
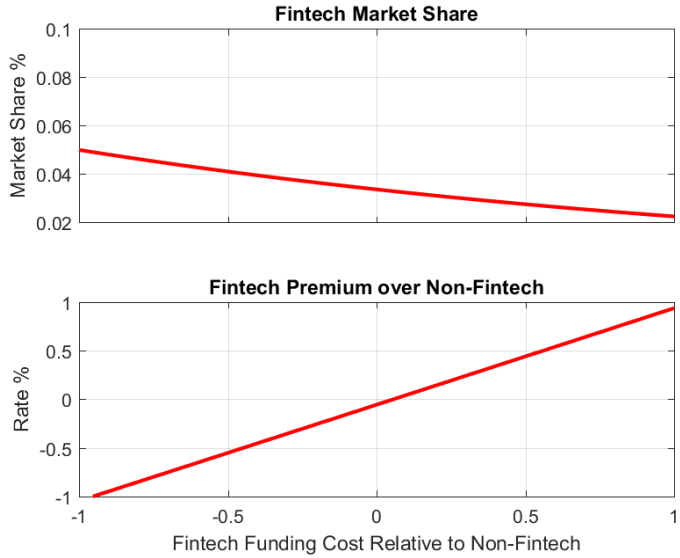
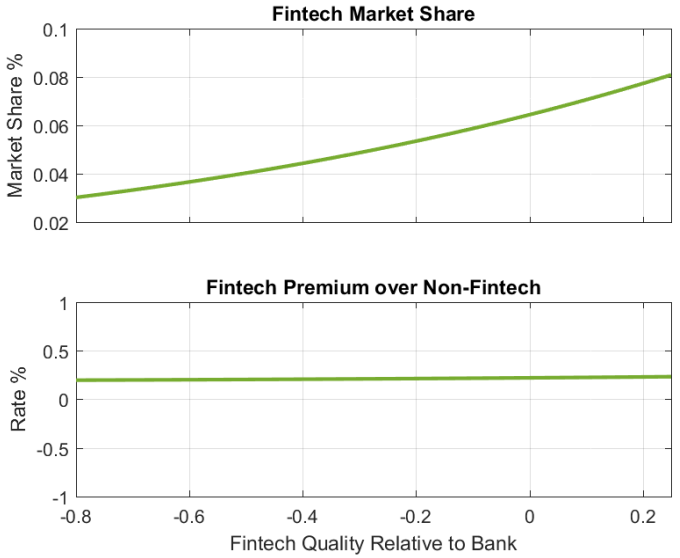


Figure A8: Comparative statics on funding cost channel and technology/quality channel

These figures show the comparative statics of fintech shadow bank market share and fintech shadow bank mortgage rate premium relative to non-fintech shadow banks. Panel (a) shows what the model in Buchak et al. (2018a) predicts should occur as the fintech shadow bank funding cost relative to non-fintech shadow banks is changed. Panel (b) does a similar exercise changing the fintech shadow bank product quality relative to traditional lenders in Buchak et al. (2018a) instead.



(a): Funding cost channel



(b): Technology channel

Figure A9: Calibration of Fintech lender product quality

This figure shows lender quality characteristics for Fintech and non-Fintech shadow banks relative to traditional bank based on Buchak et al (2018a) model calibration. A higher value of the parameter implies a higher product quality.