INTERNATIONAL REAL ESTATE REVIEW

2025 Vol. 28 No. 3: pp. 255 - 328

The Unforeseen Impact: IPOs and Worsening Performance in Local Residential Mortgage Markets

Jing Yang*
California State University at Fullerton, Email: jyang@fullerton.edu

Xin Rong Li
Actuaries Unlimited, Inc. Email: xinrong.grace@gmail.com

Erin Liu
Massachusetts Institute of Technology, Email: erinliu@mit.edu

This study examines the potential linkages between corporate public listing activities and performance of local residential mortgage markets with the use of a dataset of 1,100 initial public offerings (IPOs) in the United States (U.S.) from 2000 to 2018. While the existing literature suggests that IPOs may generate positive spillover effects, such as stimulating local businesses and housing markets, we find an unexpected negative correlation between long-term IPO activity and the average performance (particularly foreclosure rates and 90-day delinquency rates) of local mortgage loans. We explore several potential explanations for this relationship and find little evidence to support the hypothesis that it is driven by the post-IPO rising housing costs, exit of wealthier borrowers from the mortgage market due to welfare changes, or cashing out of home equity by local residents to finance their increased stock market participation. However, we do find that IPO activity is positively associated with the local loan-to-household ratio and median original loan-to-value (OLTV) ratio. Additionally, the negative correlation between IPO size and loan performance is stronger when excluding metropolitan statistical areas (MSAs) that are home to the headquarters of the largest mortgage lenders with nationwide operations. The relationship remains after we control for degree of banking restrictions on household loans. Our findings suggest a

*Corresponding author.
DOI: https://doi.org/10.53383/100405

potential counter-cyclical shift in lending quality, similar to trends identified in the banking literature, where lenders may relax lending standards or reduce the quality of borrower assessments during business upswings following IPOs.

Keywords

Initial public offering, Mortgage, Capital market, Counter-cyclical

1. Introduction

The initial public offering (IPO) and residential mortgage markets are both vital components in the capital markets, which cater to the needs of business entities and households, respectively. Regions that witness active IPOs frequently undergo surges in housing prices, business expansions, and overall economic improvements. These are all influential to the dynamics of the mortgage loan markets. Nevertheless, academic studies that address the direct and/or indirect interplays between these two capital markets are scarce, which might be attributed to the inherent division across two fields – corporate finance and residential mortgage. Connecting these two domains presents a unique intersection that has yet to receive scholarly exploration.

Our study addresses this research gap by investigating the potential linkages between long-term IPO activity and the performance of local residential mortgage markets. Using a dataset of 1,100 IPOs in the United States (U.S.) from 2000 to 2018, we find evidence that after a notable increase in local long-term IPO activity, mortgage market health indicators tend to decline. Specifically, foreclosure and 90-day delinquency rates increase, with most of these effects concentrated in the period of 2010–2018. We explore several potential channels for this negative relationship between IPO activity and mortgage performance and find that the most likely mechanism is a decline in lending standards that coincides with improved economic conditions following surges in local IPO activity.

The existing literature has explored the connections between public listing activities and local economic indicators, including employment and revenue growth, and business establishments (such as Kenney et al. (2012), Babina et al. (2017), Borisov et al. (2021) and Cornaggia et al. (2024)). Although there are some inconsistencies in the findings, the majority of these studies show a positive association of IPOs with the growth of local business and employment. More recently, several papers have shed light on the relationships between IPO activities and local housing market characteristics, particularly housing price movements. These include the works of Butler et al. (2019), Nguyen et al.

(2022), and Hartman-Glaser et al. (2023). Most of them reveal associations between IPOs and the escalation of housing prices.

In spite of these studies, there has been a notable absence of research that examines the connections between public listing markets and local mortgage loan markets to the best of our knowledge. In fact, even research that links stock markets to mortgage markets is quite scarce. Among the sporadic studies, Titman and Tsyplakov (2010) observe that commercial mortgage loans originated by institutions experiencing significant stock underperformance just before loan originations tend to have higher default rates compared to other commercial mortgage loans with similar characteristics. They argue that these underperforming originators may have less incentive to meticulously assess the credit risk of prospective borrowers. Additionally, Chen and Stafford (2016) find that families who are facing mortgage payment difficulties are more inclined to exit the stock market, and mortgage-related challenges act as a deterrent, thus preventing households from entering the stock market as new participants. Our paper seeks to fill the research gap by undertaking a pioneering investigation into the relationships between IPO activities and local residential mortgage market performance (with a focus on the local foreclosure rate and 90-day delinquency rate). Furthermore, we explore the potential mechanisms that contribute to the formation of these relationships.

Mortgage loan performance is a pivotal aspect of any mortgage market, and the risk of underperformance in residential mortgages has been widely examined in the real estate and mortgage literature.[1] Jones and Sirmans (2015) provide a comprehensive review of the mortgage literature and summarize a range of factors that influence mortgage underperformance. These include loan characteristics (such as initial and current loan-to-values (LTVs), loan amount, and probability of negative equity), trigger events (like unemployment and divorce rates), borrower characteristics (credit score, payment-to-income ratio, age, etc.), local housing market conditions (house price appreciation and volatility), and the broader macroeconomic conditions (interest rate spreads and volatility).

Mortgage underperformance was notably exemplified during the subprime crisis, marked by a surge in defaults and foreclosures. Research has identified a strong correlation between this crisis and the widespread use of risky

[1] Mortgage underperformance, particularly in the form of foreclosures, proves not only financially burdensome for homeowners and lenders (Rohe et al., 2002; Focardi, 2002) but also triggers a cascade of consequences for local households and the economy at large. These repercussions include diminished capital expenditure investments in residential properties (Li, 2016), negative spillovers that affect neighborhood stability and community well-being (Baxter and Lauria, 2000; Lin et al., 2009), impacts on the corresponding property values of neighborhoods (Immergluck and Smith, 2006), increased local tax delinquencies (Simons et al., 1998), and changes in the effective interest rates received by lenders (Kahn and Yavas, 1994).

alternative mortgage products, such as interest-only loans and negative amortization loans (LaCour-Little and Yang, 2010). Additionally, the relaxation of underwriting standards, including reduced loan documentation requirements, has been linked to the rise in mortgage underperformance (Courchane et al. , 2015; LaCour-Little and Yang, 2013), particularly during the *easy loan period* from 2000 to 2007, which led to the subprime crisis.[2] All of these credit supply-side factors can impact mortgage loan performance by influencing key borrower metrics such as credit score, income, payment-to-income ratio, initial LTV, and other performance determinants outlined by Jones and Sirmans (2015).

IPO activities may exert influence on local residential mortgage loan performance through multiple channels, including the housing price, wealth, stock market and business channels. Most of these channels may lead to nuanced outcomes as detailed in the following:

(1) The housing price channel is related to the positive impact of IPOs on local housing price appreciation, a key determinant of mortgage performance highlighted by Jones and Sirmans (2015). This impact is well-documented in the literature and supported in our study, as we will elaborate later. The effects through this channel are multifaceted. On the one hand, rising housing prices can improve mortgage loan performance by reducing the incentive of borrowers to default through equity-driven strategies (LaCour-Little and Yang, 2010) or lowering the risk of productivity drops among borrowers (Bernstein et al., 2021), a phenomenon that we term the *equity appreciation effect*. On the other hand, Ong et al. (2006) and Eriksen et al. (2013) suggest that premiums paid on home purchases above fair market value can increase mortgage loan costs for borrowers, thus raising foreclosure risks and worsening loan performance – a dynamic that we term the *cost inflation effect*. However, our findings contradict this latter effect: housing price appreciation appears to mitigate, rather than exacerbate, local mortgage underperformance. [3]

(2) The wealth channel pertains to the wealth changes experienced by IPO stockholders, who often experience positive wealth shocks after selling their shares in the secondary market, particularly following lock-up expiration dates. These wealth gains stimulate additional demand for local housing, driving up

[2] Studies also find other causes for mortgage underperformance, including insufficient participation in government mortgage programs (Passmore and Sherlund, 2021), information disadvantage of geographically diversified lenders and their corresponding difficulty in screening borrowers (Loutskina and Strahan, 2011), house purchase price premium paid on top of the fair market value (Ong et al., 2006), and the impatience of investors in selling houses (Fisher and Lambie-Hanson, 2012).

[3] One possible justification is that the cost inflation effect is based on two key assumptions when local housing prices rise: (1) for behavioral reasons, homebuyers suddenly struggle to determine which homes they can afford, and (2) the proceeds from homes sold do not match the costs of homes purchased, particularly since many buyers are not first-time homeowners. However, both of these assumptions are questionable.

prices (Hartman-Glaser et al., 2023; Nguyen et al., 2022), thereby reducing strategic default risk – a component of the *equity appreciation effect* within the housing price channel. Moreover, these wealth shocks lower financially-driven default risks among wealthier borrowers, which is an effect that we term the *wealth shock effect*. Positive wealth shocks can increase borrower income and lower the payment-to-income ratio, both of which are key mortgage performance determinants summarized in Jones and Sirmans (2015).

However, wealthier IPO stockholders may reduce their financial dependence on mortgages, thus potentially lowering the average quality of mortgage borrowers – a phenomenon we call the *rich retreat effect*. As found in studies such as Amromin et al. (2007), a significant portion of households choose to prepay or reduce their mortgage debt when they have increased cash and willingly forego the tax-saving benefits of mortgage loans due to their aversion to carrying debt. Of course, this does not apply to all households or individuals. For instance, some affluent individuals do not necessarily withdraw from mortgage markets after experiencing wealth shocks. A report titled *Zuckerberg's 1% Mortgage: Why Does a Billionaire Need a Loan?* published by CNBC on July 18, 2012,[4] shows that wealthy individuals may still opt for mortgages rather than cash purchases and may also invest in second homes or investment properties. In line with this, as we will show later, the proportion of mortgage loans for non-owner-occupied properties (typically owned by wealthy investors) tends to increase, rather than decrease, following local IPO activity, opposite to the prediction from the *rich retreat effect*.

(3) In terms of the stock market channel, a recent study by Jiang et al. (2024) finds that increased local IPO activity boosts stock market participation. If IPOs trigger a market frenzy, individuals may excessively extract home equity or borrow aggressively, thus potentially leading to poor mortgage performance – a phenomenon we refer to as the *cash out effect*. This aligns with the finding in Mian and Sufi (2011) who find that borrowing against rising home equity accounts for a significant portion of the increase in U.S. household leverage from 2002 to 2006 and the subsequent rise in defaults from 2006 to 2008. This effect can lead to a high original loan-to-value ratio (OLTV) or a high current LTV ratio, which are both key factors in mortgage underperformance, as highlighted by Jones and Sirmans (2015). However, our study finds no evidence that supports this effect: long-term stock market performance influences neither mortgage market performance nor the IPO-mortgage performance relationship.

(4) The business channel is associated with the impacts of IPOs on local mortgage markets through their broader positive effects on local business

[4] See July 18, 2012 article titled *Zuckerberg's 1% Mortgage: Why Does a Billionaire Need a Loan?* by Schuyler Velasco (of the Christian Science Monitor) on *CNBC* website, available at Zuckerberg's 1% Mortgage: Why Does a Billionaire Need a Loan? (cnbc.com).

growth, as documented in the existing literature.[5] Increased local business activity and corresponding employment growth often improve the financial situations of local borrowers, thus reducing defaults and foreclosures – a dynamic that we term the *business booming effect*. This effect can result in higher borrower incomes and lower unemployment rates, both of which are major drivers for better mortgage performance, as identified by Jones and Sirmans (2015).

However, economic booms and flourishing loan markets can paradoxically lead to poorer loan performance due to countercyclical information production and lending standard changes from lenders. Research shows that during economic downturns, banks tend to invest more in information acquisition, enforce stricter lending standards, and spend more time on loan origination – practices that enhance the predictability of default. In contrast, during economic booms, banks may relax their standards to remain competitive or become overly optimistic about new lending opportunities, a phenomenon we term the *counter-cyclical lending quality effect*.[6] This effect can lead to higher initial LTV ratios as well as lowering the credit scores and income of borrowers, all of which are factors that contribute to mortgage underperformance, as summarized by Jones and Sirmans (2015).

In summary, IPOs, which often occur during economic booms and further fuel local business and housing markets, may paradoxically lead to worsened local mortgage market performance through these complex channels.

Our research also contributes to the line of studies on the relationships between public firms and the location of their headquarters. While firms that go public

[5] For example, see Kenney et al. (2012), Butler et al. (2019), and Borisov et al. (2021). However, Babina et al. (2017) and Cornaggia et al. (2024) report that IPOs may lead to a decline in local employment and business establishments. This can happen when *wealthier* employees of IPO firms leave or when these firms crowd out other local businesses. Nonetheless, our analysis, presented later in our paper, supports a generally positive relationship between IPO activities and local GMP growth. It is important to note that this relationship could also be due to the opposite causality. For instance, Gao et al. (2013) find that venture capital funds are more likely to exit financed firms via IPOs during economic booms, while they tend to favor mergers and acquisitions during downturns. To show the impact of IPOs on mortgage loan performance beyond local business cycles, our loan performance analyses do account for local economic conditions, as detailed later in the paper.

[6] This line of research includes studies by Howes and Weitzner (2023), Rodano et al. (2018), Dell'Ariccia et al. (2012), Lisowski et al. (2017), Becker et al. (2020), Dell'Ariccia and Marquez (2006), Kraft and Jankov (2005), Fahlenbrach et al. (2018), Zurek (2022), and others. Interestingly, Goetzmann et al. (2012) report that housing price appreciation, which typically occurs during economic booms, also leads to an increase in loan applications and subprime loan approval rates from lenders. This aligns with the *counter-cyclical lending quality effect*, which suggests that the business channel is intertwined with the housing price channel.

may expand their businesses across MSAs, states, or even countries, they retain a notable influence on the investment portfolio choices of investors and households at their headquarters, who are inclined to own and trade local stocks (see, for example, Pirinsky and Wang (2006) and Branikas et al. (2020)). On the other hand, headquarter locations also influence the decisions of public firms, such as capital structure choices (Gao et al., 2011). Additionally, companies in certain industries tend to cluster geographically to leverage the positive externalities of proximity (Marshall, 1980; Hartman-Glaser et al., 2023). Our study contributes to this evidence by showing how IPOs impact residential mortgage market performance in the MSAs of their headquarters.

In this study, we investigate the potential effects of IPO activities on local residential mortgage market performance through the various channels discussed above and determine whether the overall positive impacts of IPOs outweigh or are overshadowed by their negative effects on local mortgage market performance. Using a comprehensive sample of 1,100 U.S. IPOs from 2000 to 2018, we find a generally negative association between long-term IPO activities and local mortgage market performance, particularly when the latter is assessed by using local foreclosure rates or 90-day delinquency rates.

This unexpected association is not simply a byproduct of concurrent booming housing markets, as it persists when isolating influences from local housing price movements. Additionally, it is unlikely to be driven by welfare changes associated with IPOs, as indicated by the observed increase in the local non-owner-occupied loan ratio following IPOs. Furthermore, it is not likely due to the cashing out of local residents of their home equity to finance increased stock market participation triggered by IPOs either, given that long-term stock market returns show no impacts on mortgage underperformances after we control for local IPO activity. Interestingly, we find IPO variables positively correlated with the local mortgage loan-to-household ratio and the median OLTV. Moreover, the negative correlation between IPO size and mortgage performance is generally stronger when excluding MSAs that host national leading lenders, and these lenders operate on a nationwide scale and are less likely to be influenced by local events. Finally, we find that the relation remains after we control for degree of banking restrictions on household loans. These findings suggest a potential *counter-cyclical* change in lending quality after IPOs, similar to trends identified in the banking literature, where lenders adopt more lenient lending standards or produce lower-quality borrower information during economic booms.

We analyze the relationships between IPO activities and local mortgage loan market performance not only over the full sample period from 2000 to 2018 but also across various sub-periods, including the easy loan, recession, and rebound periods. This approach helps to mitigate the potential influences of changes in mortgage regulations across different periods on our results. Additionally, for each of these samples, we control for MSA, year, and quarter fixed effects to

further minimize disturbances that arise from potential cross-area or cross-time variations in mortgage policies or regulations, as we will elaborate on later.

The subsequent sections of the paper are structured as follows: we introduce our data sources, research hypotheses, and methodologies in the upcoming section. Following that, the third section presents the descriptive statistics, while the fourth section unfolds our primary regression results. Finally, the paper concludes in the fifth section.

2. Data, Hypotheses and Methodologies

2.1 Data

This empirical study uses data from various sources. At the MSA level, we employ: (1) residential mortgage market data from CoreLogic; (2) quarterly housing price indices from the Federal Housing Finance Agency (FHFA); and (3) economic variables from Moody's Analytics. At the IPO/firm level, we use: (1) IPO data from the Kenney-Patton database, Securities Data Company (SDC), and Jay Ritter's IPO Data website, and (2) company information from COMPUSTAT. At the national level, we use: (1) Federal Reserve Economic Data, and (2) stock market data.

One of our primary databases, the CoreLogic Market Trend database, provides quarterly mortgage market information at the MSA-level. This includes details such as the total mortgage loan count, count of loans with special performance statuses (including foreclosures, pre-foreclosures, 90-day delinquencies, real estate owned (REO), and auction), count of non-owner occupancy loans, and MSA-median OLTV (that is, original LTV ratio) of mortgage loans. The database covers 39 MSAs across the U.S., including major urban areas like New York-Jersey City-White Plains (NY-NJ), Los Angeles-Long Beach-Glendale (CA), Chicago-Naperville-Arlington Heights (IL), Boston (MA) and San Francisco – Redwood City – South San Francisco (CA), among others. Unfortunately, due to data limitations, the mortgage market data do not cover three important IPO hosting cities: San Jose, Houston and Philadelphia.

Following Nguyen et al. (2022), we compile IPO data from different sources, with a primary focus on the emerging and growing IPO database built by Martin Kenney and Donald Patton. This comprehensive database offers detailed information for each IPO, including the business address, offering price, and number of shares publicly offered, and outstanding post-offering. We then incorporate additional information about the offering dates by referring to Jay Ritter's IPO, and the COMPUSTAT North America and SDC Platinum Global New Issues databases. These result in an IPO-level dataset that comprises 1,100 IPOs listed in the U.S. during 2000 to 2018 from firms headquartered in the 39 MSAs covered by the CoreLogic Market Trend Database.

Next, we consolidate IPO information at the MSA level and integrate it into our mortgage market dataset. Specifically, for each MSA in every quarter, we measure the IPO activities of firms headquartered within the MSA by the total number of IPOs issued, and their total value (referred to as IPO size). We calculate the value of each IPO by multiplying the IPO price by the total number of shares outstanding after the offering.

As in Nguyen et al. (2022), our analyses are based on scale-adjusted IPO variables, which are raw IPO variables divided by the population of the MSA in the current quarter, to control for the size of the local economy. Given our main interest in the effects of long-term IPO activity on local residential mortgage loan performance, we focus on local long-term scale adjusted IPO variables, including accumulated scaled-adjusted number of IPOs and IPO size (value) for IPOs that occur in each MSA during the most recent 5, 7, 10 and 12 years to explore issues including if IPOs affect the loan origination qualities of the lenders. Our mortgage market performance data at the MSA-level do not provide average loan age information, so we use these various time windows to match the different possible average loan ages, as such that these IPO variables can be comprehensive enough to reflect the loan IPO activity at loan origination times.

Furthermore, in our regressions that examine local mortgage market performance and other mortgage market characteristics, we include the MSA unemployment rate and/or population growth rate to account for local economic fluctuations. More importantly, we incorporate the Gross Metropolitan Product (GMP) growth rate into the regressions. This not only helps to control for local economic conditions but also allows us to segregate any IPO-specific impacts on mortgage market performance from the impacts of the general business booms.

Additionally, we include three variables in the mortgage market regressions to account for capital market conditions: (1) mortgage rate (30-year) – the average loan rate for 30-year fixed-rate mortgages in the U.S., not seasonally adjusted; (2) yield curve slope – the ratio of the 10-year Treasury bond rate to the 2-year Treasury note rate; and (3) S&P 500 return – the annualized change rate of the S&P 500 index. In regressions that involve variables that are not directly related to the mortgage market (such as the annual GMP growth rate), we replace the 30-year mortgage rate with the 3-month T-bill rate to control for the level of interest rates. The information on the mortgage rate, yield curve slope and T-bill rate comes from the Federal Reserve Economic Data.

Note that in testing the *cash out effect* of IPOs via the stock market channel in affecting loan performance, we include the long-term S&P 500 return in the mortgage performance regressions. Moreover, in the tests related to mortgage lending (for instance, the regression for local loan-to-household ratio and the OLTV ratio) as well as in a robustness test of our main result, we also control for the long-term average bank tightening rate. The bank tightening rate is the

net percentage of U.S. domestic banks tightening standard on household loans, weighted by the outstanding loan balances of banks (not seasonally adjusted), and the data also come from the Federal Reserve Economic Data. This will help us to determine whether the roles of IPOs (in affecting lending qualities) remain after we control for standard changes in the lending of the national banking sector.

2.2 Hypotheses and Methodologies

As previously mentioned, our study aims to investigate the potential correlations between long-term IPO activities and the performances of mortgage loan markets in areas that host the headquarters of IPO firms. Moreover, we seek to elucidate the underlying mechanisms that drive these correlations.

To start our analysis, we develop regressions in which each MSA mortgage market performance variable is regressed on a specific scaled IPO variable measured over a particular term. This regression is carried out while incorporating controls for proxies for local economic dynamics, such as the GMP growth rate, and the MSA-level unemployment rate and/or population growth rate. By including these proxies, we aim to ensure that any observed effects of long-term IPO activities in the regression results are not confounded by concurrent local economic changes. The sign and significance of the coefficient associated with the scale-adjusted IPO variable in the regression serve as a means to test the various hypothesized channels and/or effects mentioned earlier. Denoting i as the MSA indicator, our regression model is expressed as follows:

$$M_{i,q} = \alpha + \beta I_{i,t} + \sum_{k=1}^{K} \gamma_k F_{i,k,q} + \sum_{j=1}^{J} \theta_j C_{j,q} + \delta_{i,q} \quad (1)$$

where q is the quarter index; $M_{i,q}$ is the mortgage market performance variable of the i-th MSA at quarter q; $I_{i,t}$ is one of the local long-term IPO variables mentioned earlier for the i-th MSA during time window t, and t is the most recent 5, 7, 10 or 12 years (that is, quarter q-19, q-27, q-39 or q-47, respectively, to the current quarter); $F_{i,k,q}$ is the k-th local economic variable of the i-th MSA, with $k = 1, 2, \ldots K$; and $C_{j,q}$ is the j-th national capital market variables, with $j = 1, 2, \ldots J$. In addition, α is a constant, β, γ_k and θ_j are coefficients, and $\delta_{i,q}$ is the error term. The coefficient of the scaled local IPO activity measurement, β, indicates an association between local IPO activities and mortgage loan market performance through a specific channel and/or effect. To deal with the possible heteroskedasticity and/or auto-correlations in our dataset, we use generalized least squares (GLS) estimation to calculate the coefficients. In addition, to account for any potential correlation in observations within the same MSA or that during the same quarter, we adjust the standard errors with two-way clustering by MSA and quarter count. This results in a total

of 39 MSA clusters, as well as 76 quarter clusters accounted for across our 19-year sample period. Furthermore, we incorporate MSA, year, and quarter fixed effects into our model, to mitigate potential influences from cross-time and/or cross-area differences in national and/or local mortgage sector regulations on our results.[7] The regression model is structured to test the following hypothesis:

[Hypothesis 1: for IPO-loan performance relationship] The degree of local long-term IPO activity, measured by various long-term IPO variables, exacerbates mortgage market underperformance, as shown in the mortgage market underperformance regression following Equation (1).

When mortgage market performance is assessed by using underperformance variables such as the foreclosure and 90-day delinquency rates, Hypothesis 1 predicts that the coefficient β for the local IPO variable will be positive. As we show later, this prediction is supported by the majority of the IPO variables that we examine, thus indicating that Hypothesis 1 is generally confirmed by our data. Building on this, we also develop several extended hypotheses to test the potential channels that may explain the positive relationship between IPO activities and local mortgage underperformance: the housing price, wealth, stock market and business channels.

The housing price channel is via the influence of the IPO on local housing price movements. We will explore whether the relationships between long-term IPOs and mortgage performance primarily stem from the influences of IPO activities on local housing markets, particularly housing prices, rather than through the direct effects on the local mortgage market itself. Studies such as Nguyen et al. (2022) have identified a positive correlation between IPOs and local housing price growth, which is also supported by our data as we will report later. Correspondingly, as mentioned earlier, while rising housing prices may diminish the incentive for equity-driven strategic defaults on mortgages, and/or increase the work productivity of borrowers and hence their ability to pay mortgages (*equity appreciation effect*), they could also elevate financial-driven default risks due to increased housing costs (*cost inflation effect*). The latter may drive a positive relation between IPOs (which positively affect local housing price growth) and local mortgage underperformances.

[7] To mitigate the potential confounding effect of local economic changes on IPO activities, several studies, such as Borisov et al. (2021) and Cornaggia et al. (2024), investigate the impact of IPOs on local economic growth by comparing firms that successfully completed IPOs with those that withdrew. Similarly, Bernstein (2015) employs this method to analyze the effects of IPOs on the innovation strategies of firms. Other research, such as Butler et al. (2019) and Nguyen et al. (2022), employ a matching-sample approach based on zip code or MSA characteristics to compare local economic changes in areas with IPOs to similar areas without IPOs. However, due to limitations in our data on IPO withdrawals and the small sample size (only 39 MSAs), we are unable to perform comparable analyses. Instead, we address this issue by including local economic variables, along with MSA, year, and quarter fixed effects, in our regressions.

To test this channel, we design a two-stage regression method. In the first stage, we regress a variable of the local mortgage market performance on the rate of change in local housing prices:

$$M_{i,q} = \mu + \theta R_{i,q} + \epsilon_{i,q} \quad (2)$$

where q is still the quarter index; $M_{i,q}$ is the i-th variable of the mortgage market performance of the MSA at quarter q; and $R_{i,q}$ is the i-th annualized change rate of the MSA housing price, measured by the year-over-year rate of change of the FHFA HPI Indice for this MSA at quarter q. Additionally, μ is a constant, θ is a coefficient, and $\epsilon_{i,q}$ is the error term. Once more, we employ GLS estimation to derive the coefficients, and control for MSA, year and quarter fixed effects, and our standard errors are adjusted with two-way clustering by MSA and quarter count. In the second stage, we re-estimate the regression outlined in Equation (1). However, the dependent variable in this stage is now the residual obtained from the first-stage regression. This residual reflects the separation of the mortgage performance from the influence of local housing price changes. This two-stage regression method is employed to test the following hypothesis:

[Hypothesis 2: for housing price channel] The results that show the worsening of mortgage underperformance with increasing local long-term IPO activity as shown in the single-stage regression in Equation (1) and predicted by Hypothesis 1, are further supported in the two-stage regressions.

The results that support Hypothesis 1 might reflect the influence of IPOs on mortgage performance through their effect on housing prices, if local housing prices increase after the issuance of IPOs, and the cost inflation effect dominates the equity appreciation effect. However, if the positive relations between IPOs and local mortgage market underperformance persist or even increase after controlling for housing price changes in the two-stage regressions, this would suggest a potential impact of the IPOs on the mortgage markets outside of the housing price channel.

Next, we investigate whether the findings for Hypothesis 1 are driven by the alternate wealth channel. As previously mentioned, wealth effects can have dual consequences. On the one hand, owners of IPO stocks may experience positive wealth shocks when selling their IPO stocks in the secondary market post lock-up expiration, thereby reducing their financially-driven defaults (*wealth shock effect*). On the other hand, after the lock-up periods expire, IPO stock owners may have fewer financial needs and rely less on the mortgage markets. This reduced dependence might negatively impact the average quality of mortgage loan borrowers and, consequently, overall loan market performance (*rich retreat effect*). If the effect of the latter outweighs that of the former, and this predominantly explains why IPOs are associated with the worsened performance of the mortgage market as posited in Hypothesis 1, then the findings can be largely attributed to the indirect effect of IPOs on loan

performance via their impact on the wealth of local residents. To test this, we propose a method that involves estimating a regression similar to Equation (1) but with the dependent variable as the fraction of non-owner occupancy loans in local residential mortgage loans. We analyze both the immediate and long-term effects of IPOs on this fraction by influencing the wealth of borrowers, and test the following hypothesis:

[Hypothesis 3: for wealth channel] The fraction of non-owner occupancy loans in the mortgage market increases with the level of local IPO activity, as indicated by various (short-term and long-term) local IPO variables.

This regression helps us to analyze the relations between the proportion of non-owner occupancy loans in mortgage portfolios and local IPO activity levels. If the results align with the predictions of Hypothesis 3, then this suggests that the positive correlation between IPOs and mortgage market underperformance (consistent with Hypothesis 1) is unlikely to be primarily driven by wealth effects. These non-owner occupancy loans are more likely to be taken by wealthier borrowers, whose presence among borrowers is unlikely to increase the overall default risk in the local mortgage market. Therefore, if their proportion in mortgage portfolios eventually increases rather than decrease following IPOs, the wealth changes should not be attributed to the negative IPO – mortgage performance relations predicted by Hypothesis 1.

We then assess whether the positive relationship between local long-term IPO activity and mortgage market underperformance, as stated in Hypothesis 1, is driven by another alternative stock market channel. As previously noted, increased local IPO activity has been shown to enhance stock market participation, thus potentially triggering a *cash out effect*. In this scenario, households may take on excessive debt through initial mortgage originations or refinancings to finance stock market investments, which results in poorer loan performance. If this effect exists, the risk of mortgage market underperformance is higher when the stock market is stronger at the time of loan origination or refinancing.

Accordingly, we re-estimate the loan underperformance regression based on Equation (1) and incorporate the long-term annualized S&P 500 index return over a period of time (e.g., the recent 5, 7, 10 or 12 years) that aligns with the term used for the long-term IPO variables. Since we are incorporating this long-term stock market return into the regression, we replace a previously included but correlated variable – the annualized S&P 500 index return measured in the current quarter. If the long-term stock market return variable does not have a positive impact in this regression, the cash-out effect is unlikely to hold. Conversely, even if it does have a positive impact, but the IPO variables remain significant in the regression, this suggests that the cash-out effect may not be the sole explanation for the influence of IPOs on the local mortgage loan performance. Accordingly, we test the following hypothesis:

[Hypothesis 4: for stock market channel] The finding that mortgage underperformance worsens with increasing local long-term IPO activity, as shown in the regression in Equation (1) and predicted by Hypothesis 1, persists even after we control for the long-term stock market return, which does not exhibit a significantly positive effect in the regression.

Finally, we investigate whether the finding for Hypothesis 1 is driven by factors related to the business channel. As discussed earlier, IPOs can improve local mortgage performance by stimulating local business growth, thereby enhancing the financial conditions of local borrowers (*business booming effect*). However, they could also lead to relaxed lending standards, which may worsen mortgage performance (*counter-cyclical lending quality effect*). If the latter effect outweighs the former, it could explain the positive association between IPOs and local mortgage underperformance.

Our residential mortgage market data at the MSA-level include the total number of mortgage loans, total number of households, MSA median OLTV ratio, and other relevant variables. Unfortunately, due to data limitations, we lack information on average loan ages which could have otherwise helped us to track the corresponding average origination time of loans existing in an MSA during each quarter. With this constraint, we develop four tests to indirectly evaluate the possible impacts of IPO activity on mortgage lending quality or ease of lending. In the first test, we use the ratio between total mortgage loan number to household number, that is, the loan to household ratio, to reflect the degree of lending expansion, which can be related to ease of lending. We develop a regression model similar to Equation (1), but with the loan-to-household ratio as the dependent variable. We want to examine if IPO activity can exert immediate and long-term effects on this ratio by testing the following hypothesis:

[Hypothesis 5-1: for the counter-cyclical lending quality effect of the business channel] The MSA loan-to-household ratio increases with the amount of local IPO activity, as reflected by various (short-term and long-term) local IPO variables.

Since our CoreLogic mortgage loan market data start from 2000, this test can help to explore if IPOs lead to increased ease of loan origination since 2000 but cannot show the quality in the relations between IPO and loan origination before 2000, even though a significant portion of the loans in our data might have been originated before 2000, especially those included in the easy loan period. As a result, this test is more relevant for the study of IPO effects on the performance of loans that existed in the recession and rebound periods.

In our second indirect test on the counter-cyclical lending quality effect, we examine the relationship between long-term IPO activities and median OLTV of local loans. We assume that if this effect is present and dominant, IPO activities at the loan origination time may lead to larger OLTV ratios. We

develop a regression model similar to Equation (1), but with the MSA median OLTV ratio as the dependent variable, and test the following hypothesis:

[Hypothesis 5-2: for the counter-cyclical lending quality effect of the business channel] The MSA median OLTV increases with degree of local IPO activity, as reflected by local long-term IPO variables.

To further investigate the same effect, we also conduct a third indirect test by excluding data observations from MSAs where the largest national residential mortgage lenders are headquartered. These lenders operate nationwide and are, therefore, theoretically less influenced by local business events including IPOs in the cities of their headquarters. If lenders influence the positive relations between IPO activities and local mortgage underperformance, excluding these MSAs may strength the observed relations.

These leading lenders include Wells Fargo, JP Morgan Chase, Bank of America, U.S. Bank Home Mortgage, Rocket Mortgage (formerly Quicken Loans LLC), Flagstar, Provident Funding Associates, LoanDepot, Newroz (formerly Caliber Home Loans), and United Wholesale Mortgage. These institutions are headquartered in eight different MSAs, six of which are present in our data sample: New York-Jersey City-White Plains (NY-NJ), San Francisco-Redwood City-South San Francisco (CA), Detroit-Dearborn-Livonia (MI), Minneapolis-St. Paul-Bloomington (MN-WI), Anaheim-Santa Ana-Irvine (CA), and Charlotte-Concord-Gastonia (NC-SC).

We will re-estimate the mortgage performance regression from Equation (1), excluding observations from these six MSAs, to test the following hypothesis:

[Hypothesis 5-3: for the counter-cyclical lending quality effect of the business channel] The results that show mortgage underperformance worsens with increasing local long-term IPO activity, as shown in the regression based on Equation (1) and predicted by Hypothesis 1, become even stronger when observations from the six MSAs that host the largest mortgage lenders are excluded.

Evidence that support this hypothesis provides indirect support for the *counter-cyclical lending quality effect*. If IPO activities worsen local mortgage loan performance by leading to lower lending standards or quality, the relationship should be stronger when excluding MSAs that host the national leading lenders, because these lenders operate nationwide and are therefore less likely to be influenced by IPO activities or other local business conditions in the cities of their headquarters.

Our final test of the counter-cyclical lending quality effect is a robustness check. We aim to determine whether the negative impact of long-term IPO activity on local mortgage loan performance (as predicted in Hypothesis 1) persists when we control for the proxies of bank lending constraints at the time of loan

origination. If IPO occurrences coincide with the loosening of bank lending constraints for households, their observed effects could be superficial and may diminish after controlling for these constraints in the mortgage performance regressions. However, data on bank lending constraints are scarce. The best proxy available is a quarterly national-level variable - the *bank tightening rate*. This variable represents the net percentage of domestic banks that are tightening standards on household loans, weighted by their outstanding loan balances. The bank tightening rate is reported in the Senior Loan Officer Survey of the Federal Reserve Economic Data. We incorporate the long-term average bank tightening rate into the mortgage loan performance regressions based on Equation (1), thus ensuring that its timeframe aligns with that of the IPO variable. This alignment enhances the ability of the variable to reflect banking sector lending constraints at the time of IPO occurrences and mortgage loan originations. We test the following hypothesis:

[Hypothesis 5-4: for the counter-cyclical lending quality effect of the business channel] The finding that mortgage underperformance worsens with increasing local long-term IPO activity, as shown in the regression in Equation (1) and predicted by Hypothesis 1, persists even after we control for a bank lending constraint variable – the long-term average bank tightening rate.

If our empirical analyses confirm all the predictions of Hypotheses 2, 3, 4, and 5, this suggests that the positive association between IPOs and local mortgage loan underperformance is unlikely to be primarily driven by the effects of IPOs on local housing prices, wealth, or cash-out for stock market investment. Instead, this is more likely attributable to the *counter-cyclical lending quality effect*, in which lenders adopt more lenient lending standards or generate lower-quality borrower information during business booms following IPOs. Since our mortgage market performance regressions control for year and quarter fixed effects, the observed relationships between IPOs and mortgage performance are unlikely to be explained by temporal variations in nationwide mortgage policies and regulations. Additionally, by accounting for MSA fixed effects, these regressions indicate that the relationships are not merely due to differences in local mortgage policies and regulations across regions.

3. Descriptive Statistics

As mentioned earlier, our IPO data are mainly derived from the database of emerging and growing IPOs assembled by Martin Kenney and Donald Patton, with additional IPO information from the SDC database, Jay Ritter's IPO database and COMPUSTAT. We exclude IPOs from foreign firms and those that are not headquartered in any of the 39 MSAs included in the CoreLogic Market Trend database. This process yields a sample of 1,100 emerging and growing IPOs issued in the U.S. during 2000 to 2018. Subsequently, we aggregate this IPO data to the MSA level for each quarter of our study period,

thus generating a panel dataset that comprises 2,964 MSA-quarter observations. The definitions of our key variables are provided in the Appendix. Figure 1 plots the cross-year distribution of IPOs in our full sample as compared to that in Jay Ritter's IPO database. Although the latter includes more IPOs, both datasets generally show analogous time trends.

Figure 1 Number of IPOs by Year

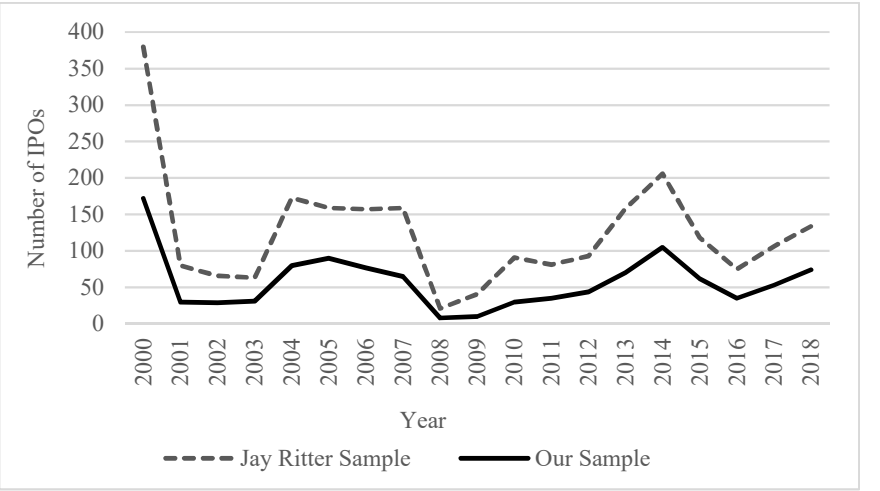


Table 1 provides more details of our descriptive statistic results. Panel A presents the summary statistics for the major variables across the full sample. The panel reveals significant variations in variables over time and/or across different MSAs. For example, among the mortgage market underperformance measures, the foreclosure rate is 1.71% by mean but it exhibits a wide range from 0.04% to 19.11%. Similarly, the 90-day delinquency rate is 3.88% by mean, but spans from 0.09% to 27.80%. The proportion of non-owner occupancy loans in the total mortgage loans averages 8.85% and varies between 1.08% and 30.00%. The scaled IPO variables also exhibit wide-ranging fluctuations. This heterogeneity is further exhibited by the substantial standard deviations of these variables.

In our sample, the national-level variables have time-series data, thus reflecting the dynamic market conditions from 2000 to 2018. For instance, the annual change rate of the S&P 500 index averages at 5.26%, with a significant volatility that ranges from -40.09% to 35.96%. The 3-month T-bill rate is 1.61% by mean, which ranges between 0.01% and 6.02%. The loan rate for the 30-year fixed-rate mortgage (non-seasonally adjusted) is 5.27% by mean and varies from 3.34% to 8.20%. Furthermore, the yield curve slope has an average of 2.996, with a range of 0.940 to 8.210.

Table 1 Summary Statistics

Panel A Full Sample (with Quarterly Observations)

Variable	N	Mean	Median	Minimum	Maximum	Std Dev
Year	2964	2009	2009	2000	2018	5
Loan count growth rate	2808	0.51%	-0.58%	-18.90%	21.91%	5.10%
Foreclosure rate	2964	1.71%	0.82%	0.04%	19.11%	2.38%
90-day delinquency rate	2964	3.88%	2.48%	0.09%	27.80%	3.97%
Pre-foreclosure rate	2683	0.23%	0.15%	0.00%	2.93%	0.28%
REO loan ratio	2956	0.33%	0.18%	0.00%	5.29%	0.44%
Auction loan ratio	2959	0.11%	0.06%	0.00%	4.79%	0.20%
Non-owner occupancy loan ratio	2964	8.85%	8.21%	1.08%	30.00%	3.86%
Loan-to-household ratio	2964	32.60%	28.38%	2.19%	280.44%	38.19%
OLTV	2183	88.22%	90.00%	75.00%	99.80%	6.32%
Price growth rate	2960	4.42%	4.97%	-35.22%	44.02%	8.59%
GMP growth rate	2925	4.13%	4.39%	-9.46%	16.33%	3.08%
Population growth rate	2954	0.96%	0.85%	-0.86%	5.56%	0.89%
Unemployment rate (%)	1444	6.0017	5.3700	1.6000	16.3300	2.2720
Affordability	2964	138.3256	129.9600	36.3400	373.8900	58.6324
IPO number (per thousand)	2964	0.0001	0.0000	0.0000	0.0055	0.0003
IPO size ($100 Million)	2964	0.5285	0.0000	0.0000	149.9542	3.7371
Number of IPOs for the most recent 5 years (per thousand)	2964	0.0025	0.0008	0.0000	0.0415	0.0044
IPO size for most recent 5 years ($100 Million)	2964	11.5366	1.6751	0.0000	285.9663	28.5517

(*Continued…*)

(Table 1 Panel A Continued)

Variable	N	Mean	Median	Minimum	Maximum	Std Dev
SP500 return (%)	2964	5.2599	8.8750	-40.0900	35.9600	15.7174
3-month T-Bill rate (%)	2964	1.6095	0.9850	0.0100	6.0200	1.8094
30-year mortgage rate (%)	2964	5.2672	5.0850	3.3400	8.2000	1.2883
Yield curve slope	2964	2.9963	2.1000	0.9400	8.2100	2.1999
SP500 return in most recent 5 years (%)	2964	5.5033	5.2250	-6.1000	24.2800	7.6830
Average bank tightening rate in most recent 5 years (%)	2964	7.1276	5.9000	-14.3000	33.8000	14.8561

Panel B Subperiod Comparisons

Variable	Full Sample (2000-2018)	Easy Loan (2000-2007)	Recession (2007-2009)	Rebound (2010-2018)
	Mean	Mean	Mean	Mean
Year	2009	2004	2008	2014
Loan count growth rate	0.51%	3.73%	-0.99%	-1.82%
Foreclosure rate	1.71%	0.56%	1.98%	2.55%
90-day delinquency rate	3.88%	1.43%	4.87%	5.56%
Pre-foreclosure rate	0.23%	0.10%	0.46%	0.25%
REO loan ratio	0.33%	0.16%	0.64%	0.38%
Auction loan ratio	0.11%	0.06%	0.16%	0.14%
Non-owner occupancy loan ratio	8.85%	8.22%	8.47%	9.68%
Loan-to-household ratio	32.60%	33.87%	35.41%	30.89%

(*Continued…*)

(Table 1 Panel B Continued)

Variable	Full Sample (2000-2018)	Easy Loan (2000-2007)	Recession (2007-2009)	Rebound (2010-2018)
	Mean	Mean	Mean	Mean
OLTV	88.22%	88.47%	88.83%	87.55%
Price growth rate	4.42%	8.81%	-6.27%	3.50%
GMP growth rate	4.13%	5.24%	1.08%	4.20%
Population growth rate	0.96%	1.01%	0.94%	0.93%
Unemployment rate (%)	6.002	4.816	6.652	6.670
Affordability	138.33	112.49	125.20	161.41
IPO number (per thousand)	0.000092	0.000122	0.000045	0.000083
IPO size ($100 Million)	0.5285	0.5134	0.1837	0.6472
Number of IPOs for most recent 5 years (per thousand)	0.0025	0.0037	0.0021	0.0015
IPO size for most recent 5 years ($100 Million)	11.5366	13.1745	9.1070	10.6631
SP500 return (%)	5.260	2.488	-8.448	13.151
3-month T-Bill rate (%)	1.609	3.181	1.961	0.401
30-year mortgage rate (%)	5.267	6.491	5.817	4.115
Yield curve slope	2.996	1.459	2.060	4.458
SP500 return in most recent 5 years (%)	5.5033	4.82	3.38	7.13
Average bank tightening rate in most recent 5 years (%)	7.1276	4.59	13.55	6.47
Number of observations	1444-2964	608-1248	228-468	684-1404

Panel C Distribution of IPOs across MSAs

MSA Name	Number of IPOs	Rank of Number of IPOs	Total Value of IPOs ($Billion)	Rank of Total Value of IPOs	Value of IPOs Held by Insiders ($Billion)	Rank of Value of IPOs Held by Insiders
San Francisco-Redwood City-South San Francisco, CA	230	1	261.30	1	216.30	1
Boston, MA	172	2	84.08	3	67.85	3
New York-Jersey City-White Plains, NY-NJ	132	3	102.30	2	78.51	2
Los Angeles-Long Beach-Glendale, CA	85	4	64.40	4	50.25	4
San Diego-Carlsbad, CA	75	5	29.17	9	22.30	10
Washington-Arlington-Alexandria, DC-VA-MD-WV	59	6	35.04	7	26.12	7
Dallas-Plano-Irving, TX	45	7	41.23	6	30.90	6
Seattle-Bellevue-Everett, WA	44	8	27.47	10	22.94	9
Chicago-Naperville-Arlington Heights, IL	43	9	45.04	5	38.08	5
Minneapolis-St. Paul-Bloomington, MN-WI	32	10	9.95	15	7.48	15
Denver-Aurora-Lakewood, CO	30	11	29.61	8	23.17	8
Atlanta-Sandy Springs-Roswell, GA	28	12	17.49	13	13.67	13
Miami-Miami Beach-Kendall, FL	22	13	7.77	16	5.93	16
Bridgeport-Stamford-Norwalk, CT	18	14	20.57	12	14.77	12
Phoenix-Mesa-Scottsdale, AZ	18	14	16.52	14	13.38	14

(*Continued…*)

(Table 1 Panel C Continued)

MSA Name	Number of IPOs	Rank of Number of IPOs	Total Value of IPOs ($Billion)	Rank of Total Value of IPOs	Value of IPOs Held by Insiders ($Billion)	Rank of Value of IPOs Held by Insiders
Las Vegas-Henderson-Paradise, NV	13	16	21.01	11	18.53	11
Detroit-Dearborn-Livonia, MI	11	17	3.33	20	2.28	20
New Haven-Milford, CT	9	18	3.41	19	2.51	19
Tampa-St. Petersburg-Clearwater, FL	9	18	3.52	18	2.77	18
Portland-Vancouver-Hillsboro, OR-WA	8	20	1.75	23	1.30	23
Trenton, NJ	7	21	3.07	21	2.26	21
Charlotte-Concord-Gastonia, NC-SC	6	22	2.41	22	1.46	22
Cleveland-Elyria, OH	3	23	3.87	17	3.05	17
Allentown-Bethlehem-Easton, PA-NJ	1	24	0.17	24	0.12	24
Total	1100		834.49		665.94	

***Notes*:** Summary statistics of the full sample in Panel A and its subsamples in Panel B. Distribution of IPOs among MSAs in full sample in Panel C. *Full Sample* includes observations for 2000-2018. *Easy Loan* subsample includes observations for 2000-2007. *Recession* subsample includes observations for 2007-2009. *Rebound* subsample includes observations for 2010-2018.

In addition to analyzing our panel data in the full sample period, we are also interested in the data characteristics during the different sub-periods. Their results are shown in Panel B. The first sub-period includes the observations from 2000 (the starting year of our sample) to 2007 and forms the *Easy Loan* subsample. As mentioned earlier, this period is marked by a relaxation in the mortgage market underwriting standards in the U.S., such as the adoption of low-documentation loans, in response to public policy initiatives that aimed to increase homeownership; this relaxation is argued to have contributed to heightened mortgage loan risk and the subsequent subprime crisis.

As anticipated, Panel B shows a significantly faster rate of growth in the number of mortgage loans during this period of lenient lending compared to the overall sample period, with an annualized growth rate of 3.73% versus 0.51%. This is paralleled by a more pronounced appreciation in housing market values, with an annualized housing price growth rate of 8.81% compared to 4.42%. With the housing markets booming, the mortgage market performance is substantially better than in the full sample period, as evidenced by the lower average foreclosure rate (0.56% vs. 1.71%) and the lower average 90-day delinquency rate (1.43% vs. 3.88%). However, the rapidly increasing housing price also results in reduced housing affordability, with the average affordability index dropping to 112.49 from 138.33. The data of the IPO variables suggest a generally more vibrant IPO market during this period of time than in the full sample period.

Another important sub-period is the Great Recession of 2007-2009, a critical phase when the U.S. mortgage market plunged into a severe crisis, which started with the subprime market collapse. Note that this period overlapped with the easy loan period during 2007, a transition year still under lenient lending standards which triggered the crash in the subprime market. The data of this period constitute the *Recession* subsample. As shown in Panel B, this period experienced a downturn in mortgage loan growth and a worsening in mortgage performance compared to the easy loan period. On average, the foreclosure rate increased to 1.98% from 0.56%, the pre-foreclosure rate rose to 0.46% from 0.10%, and the 90-day delinquency rate escalated to 4.87% from 1.43%. However, housing markets became more affordable, with the average affordability index increasing to 125.20 compared to the average of each loan period of 112.49. As expected, IPO markets were markedly less active during this timeframe than in the easy loan and full sample periods.

The last column of Panel B presents the statistical outcomes for the *Rebound* subsample. This phase is from 2010 to 2018 (the ending year of our sample) and marked by a more pronounced decrease in mortgage loan number than the recession period, with a loan count growth rate of -1.82% compared to -0.99%. Additionally, this period generally experienced an even poorer mortgage loan performance than the recession period, as evidenced by the higher rates of foreclosure (2.55% vs. 1.98%) and 90-day delinquency (5.56% vs. 4.87%).

Despite these challenges, housing markets during this time became significantly more affordable, with an average affordability index of 161.41 versus 125.20.

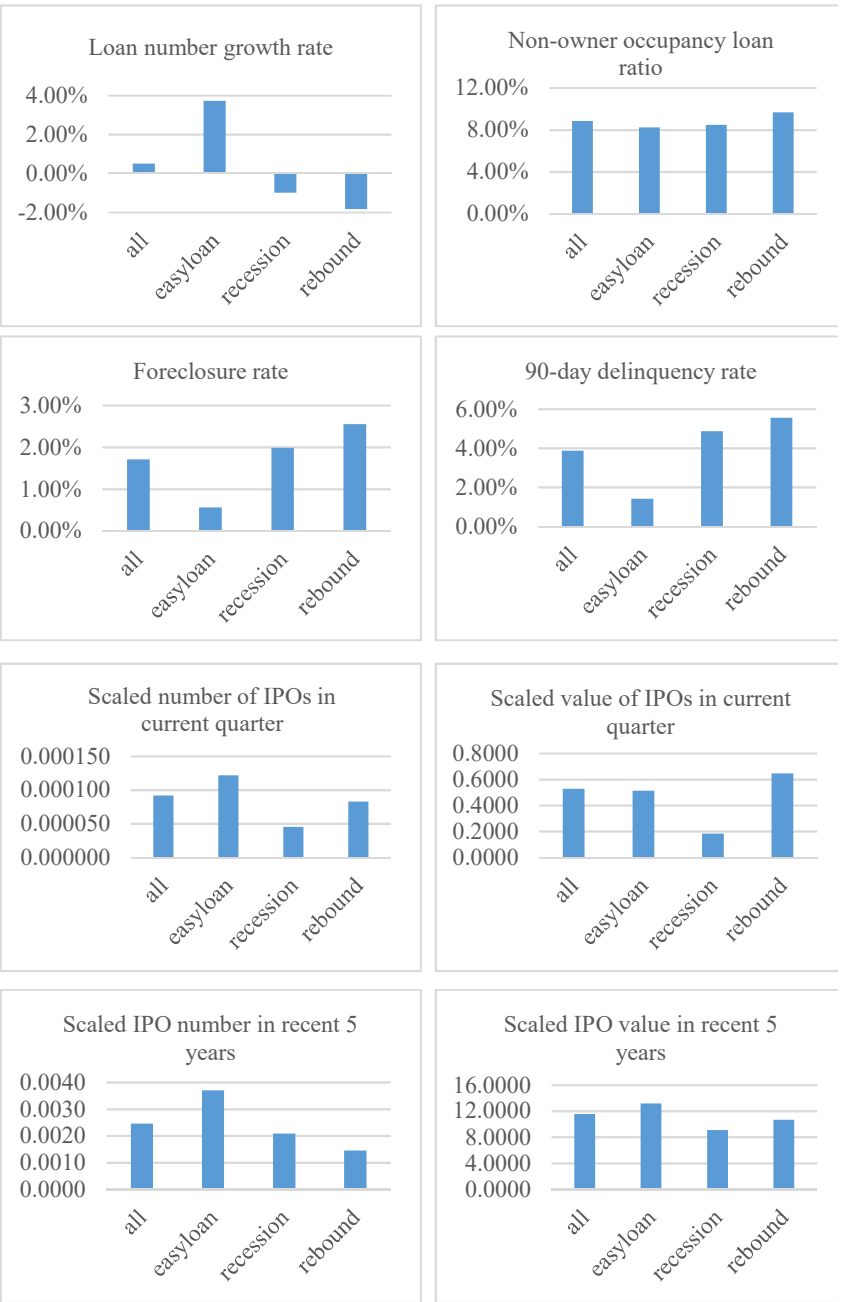
This period also recorded the highest average proportion of non-owner occupancy loans, likely due to lower market prices which increased the accessibility for investors. Meanwhile, there was a strong surge in the stock market, with the S&P 500 index growing by over 13% per year on average, which in turn spurred a rapid recovery in the IPO markets.

Figure 2 illustrates the contrasts among the different subperiods via showing the means of major variables of the varied samples. The findings presented in Table 1 and Figure 2 suggest that the Great Recession had a detrimental effect on mortgage performance and inhibited the pace of mortgage loan originations, with these impacts lingering into the rebound period. On the other hand, the recession also enhanced housing affordability. As the prevalence of bad loans diminished, there was a gradual correction in the housing markets, which increasingly attracted investors.

Finally, we analyze the distribution of IPOs across the MSAs, with the results presented in Panel C of Table 1. During our sample period, 24 of the 39 MSAs hosted IPO firms. The top 4 MSAs for IPO activity, based on various measures such as the number of IPOs, total IPO value, and value held by insiders[8], are San Francisco–Redwood City–South San Francisco (CA), Boston (MA), New York–Jersey City–White Plains (NY-NJ), and Los Angeles–Long Beach–Glendale (CA). These 4 MSAs account for around 55% to 62% of all IPO activity across the 24 MSAs, depending on the measurement used, thus suggesting the geographic concentration of IPOs. Chicago–Naperville–Arlington Heights (IL) follows in terms of IPO value, while San Diego–Carlsbad (CA) ranks next in terms of the number of IPOs. Notably, a significant proportion of the IPO value across all of the MSAs – 80% (US$665.94 billion of US$834.49 billion) – belongs to insiders. This shows the substantial welfare gains that insiders, including employees, may experience from IPOs.

[8] Insiders include executives, other employees, venture capitalists, and other parties restricted from selling their IPO shares until the end of the "lock-up" period (typically 90 or 180 days after the insurance). These IPO insider value variables provide insights into the changes of the wealth of the insiders upon and after their sales of IPO stocks. To estimate the number of insider shares to calculate the IPO internal size, we adopt the approach in Field and Hanka (2001), by subtracting the number of shares sold to the public from the number of shares outstanding after the offering.

Figure 2 Major Variables by Sample Means



4. Regression Results

In this section, we present the results of our panel-data GLS regressions, which examine the mortgage loan market performance in relation to IPO activities, and test the predictions in the 5 hypotheses mentioned earlier.

4.1 Mortgage Market Performance Measurements

We evaluate the performance of local mortgage markets by using a range of measurements at the MSA level, including: (1) foreclosure rate, or, the proportion of loans that are entering foreclosure processes; (2) 90-day delinquency rate, or, the proportion of loans with payment delinquencies of 90 days or more; (3) pre-foreclosure rate, or, the proportion of loans in pre-foreclosure status; (4) REO ratio, or, the proportion of loans for REO properties, namely properties owned by lenders due to unsuccessful sales during foreclosure auctions following payment defaults; and (5) auction ratio, or, the proportion of loans for properties going through auctions. These ratios are inversely related to the average performance of local mortgage loans, with larger magnitude of these ratios corresponding to a worse performance in local mortgage loan portfolios. As shown in Panel B of Table 1, the full-sample medians for these variables are 1.71%, 3.88%, 0.23%, 0.33%, and 0.11%, respectively. Our analysis focuses on the foreclosure and the 90-day delinquency rates, as they account for a significant portion of underperforming mortgage loans, 27.32% and 61.98%, respectively.

4.2 IPOs and Mortgage Market Performance – Benchmark Results

We start our analysis with single-stage regressions as per Equation (1), in order to explore the relationships between IPO activities and these mortgage market performance indicators while disregarding the potential influence of local housing price movements and other factors. The findings of this analysis are detailed in Table 2.

As mentioned earlier, to account for the scale of the local economy, we normalize the IPO variables (such as the number of IPOs and their size) by the population of the respective MSA for the corresponding quarter. These population-adjusted IPO variables serve as the key explanatory variables in our regression analyses. However, due to the high correlation among these variables, we employ multiple specifications for the regression analysis of every mortgage market performance variable, with each specification including only one of the IPO variables to avoid multicollinearity and to make the analysis reasonably focused.

Table 2 IPO Activities and Local Residential Mortgage Market Performance

Panel A Regression of MSA-level Foreclosure Rate for Full Sample

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Number of IPOs for most recent 5 years	0.656***							
Number of IPOs for most recent 7 years		0.430***						
Number of IPOs for most recent 10 years			0.176***					
Number of IPOs for most recent 12 years				0.022				
IPO size for most recent 5 years					3.550***			
IPO size for most recent 7 years						5.230***		
IPO size for most recent 10 years							5.660***	
IPO size for most recent 12 years								3.400***
1-year lagged GMP growth rate	-0.115***	-0.116***	-0.115***	-0.114***	-0.116***	-0.118***	-0.117***	-0.115***
Unemployment rate	0.004***	0.004***	0.004***	0.004***	0.004***	0.004***	0.004***	0.004***
30-year mortgage rate	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Yield curve slope	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
SP500 return	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Constant	0.005	0.005	0.008	0.012	0.012	0.010	0.009	0.011
Observations	1,443	1,443	1,443	1,443	1,443	1,443	1,443	1,443
R-squared	0.6698	0.6684	0.6665	0.6657	0.6676	0.6706	0.6709	0.6673
MSA, year and quarter FEs	YES	YES	YES	YES	YES	YES	YES	YES
Clustering by MSA and quarter count	YES	YES	YES	YES	YES	YES	YES	YES

Panel B Highlights of Mortgage Market Performance Regression Results by Underperformed Loan Categories for Full Sample

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
IPO variables	Number of IPOs for most recent 5 years	Number of IPOs for most recent 7 years	Number of IPOs for most recent 10 years	Number of IPOs for most recent 12 years	IPO size for most recent 5 years	IPO size for most recent 7 years	IPO size for most recent 10 years	IPO size for most recent 12 years
Foreclosure rate	0.656***	0.430***	0.176***	0.022	3.550***	5.230***	5.660***	3.400***
90-day delinquency rate	1.086***	0.790***	0.304***	0.007	5.440***	8.300***	8.370***	5.360***
Pre-foreclosure rate	0.045*	0.010	-0.040	-0.027	-0.050	0.010	-0.380	0.120
REO loan ratio	0.211***	0.167***	0.041**	-0.002	1.290***	1.420***	0.780***	0.680***
Auction loan ratio	0.078***	0.079***	0.058***	0.053***	0.180*	0.320***	0.290***	0.250***

Panel C Highlights of Mortgage Market Performance Regression Results by Underperformed Loan Categories for Subsamples

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
IPO variable	Number of IPOs for most recent 5 years	Number of IPOs for most recent 7 years	Number of IPOs for most recent 10 years	Number of IPOs for most recent 12 years	IPO size for most recent 5 years	IPO size for most recent 7 years	IPO size for most recent 10 years	IPO size for most recent 12 years
Easy loan subsample								
Foreclosure rate	0.106***	0.138***	0.111***	0.057	0.380	0.430	-2.260***	-2.930***
90-day delinquency rate	0.423***	0.569***	0.514***	0.478***	-0.190	-0.820	-9.480***	-12.200***
Recession subsample								
Foreclosure rate	2.897**	2.097***	-0.102	-0.198	0.670	19.240*	13.870***	-12.970
90-day delinquency rate	3.025	4.165***	0.516	0.436	-47.260**	38.090*	20.290**	12.730

(*Continued*…)

(Table 2 Panel C Continued)

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Rebound subsample								
Foreclosure rate	3.781***	3.465***	3.214***	0.451	10.100***	12.560***	12.770***	11.940***
90-day delinquency rate	4.828***	4.416***	4.155***	-0.103	14.700***	19.170***	19.620***	19.570***

***Notes*:** Panel A reports coefficient estimates for the GLS regressions of residential mortgage foreclosure rate at MSA-level of full sample (which includes observations for 2000-2018) for several scaled-adjusted IPO variables and control variables. Scale-adjusted IPO variables equal IPO activity variables divided by the population of the MSA in current quarter. In Model Specifications (1) to (4), coefficients of IPO variables are divided by 1000. In Model Specifications (5) to (8), coefficients of IPO variables are multiplied by 100,000. Variables are defined in Appendix. Panel B reports coefficients of IPO variables in regressions similar to regressions in Panel A but using different loan underperformance measurements including foreclosure, 90-day delinquency, and pre-foreclosure rates, and REO and auction loan ratios. Panel C reports coefficients of IPO variables in regressions of foreclosure and 90-day delinquency rates similar to those reported in Panel B but for different subperiods, i.e., *easy loan*, *recession*, and *rebound* periods. *Easy loan* subsample includes observations for 2000-2007. *Recession* subsample includes observations for 2007-2009. *Rebound* subsample includes observations for 2010-2018. Regressions use MSA, year and quarter fixed effects, along with double clustering on the MSA and quarter count. *, **, and *** denote significance at 10%, 5%, and 1% levels, respectively.

First, we report the detailed results from the foreclosure rate regressions by using the data of the full sample. As shown in Panel A of Table 2, Model Specifications (1) to (4) include the scaled number of IPOs from various timeframes: an aggregate of the most recent 5, 7, 10 and 12 years. Specifications (5) to (8) include scaled IPO size (value) variables of these four-time windows.[9] We analyze these diverse long-term timeframes to align with different loan ages, thus allowing for a more comprehensive examination of the potential impacts of IPOs on loan originations.

In each model specification, we incorporate the 1-year lagged annual growth rate of the GMP and the MSA unemployment rate to account for local economic conditions,[10] alongside 3 capital-market control variables: the average loan rate of the 30-year fixed rate mortgage, yield curve slope, and S&P 500 return. The influences of these control variables remain consistent across all model specifications. It is intuitive to observe that the foreclosure rate tends to increase with a slower growth in the GMP and/or a higher unemployment rate.

Our regressions indicate that all of the IPO variables, except for the number of IPOs in the most recent 12 years, are positively associated with the local mortgage market foreclosure rate, at a consistent significance level of 1%. For instance, in Model Specification (1), we include the number of IPOs in the most recent 5 years as one of the explanatory variables. This variable has a positive coefficient 0.656 at the 1% significance level. Similar results can be found in other specifications except for Specification (4). These findings suggest that mortgage market performance tends to be weaker in areas with more IPO issuances or a larger total IPO volume over various long-term timeframes.

Employing various measurements for mortgage market performance, as depicted in Panel B of Table 2, we observe that IPO activities in the different long-term periods, regardless whether measured via number of IPO or IPO size – generally intensify the mortgage loan underperformance. This is especially true when the underperformance is measured by the foreclosure rate, 90-day delinquency rate, REO loan ratio or auction loan ratio, with most findings being significant at the 1% level.

Among these underperformance variables, the 90-day delinquency rate is most sensitive to IPO variables, closely followed by the foreclosure rate. For example, the coefficients for the number of IPOs for the most recent 5 years are 1.086 for the 90-day delinquency rate and 0.656 for the foreclosure rate, both

[9] To maintain conciseness in the table presentations, we do not show the t-statistics or p-values for the coefficients. Instead, we indicate statistical significance by using the symbols ***, **, and * for the 1%, 5%, and 10% significance levels, respectively.

[10] Due to data availability on the unemployment rate, including this variable in our regressions results in a noticeable reduction in the number of observations. However, the missing data primarily pertain to MSA-quarters without IPO activity, thus minimizing their impact on our results

at the 1% significance level. In contrast, the coefficients are only 0.211 and 0.078 for the REO ratio and auction ratio, respectively, albeit that both are significant at the 1% level. The coefficient of the pre-foreclosure rate is as low as 0.045 and significant only at 10%. Similarly, when examining the impact of the IPO size for the most recent 5 years, the coefficients are 5.44 for the 90-day delinquency rate and 3.55 for the foreclosure rate, as compared to 1.29 for the REO ratio and 0.18 for the auction ratio, all significant at the 1% level except the coefficient for the auction ratio (which is significant at 10%). The coefficient of the pre-foreclosure rate is, however, insignificant. In essence, IPO activities generally bring a negative externality to local mortgage markets by worsening the performance of the mortgage loan market. This effect is particularly pronounced for the foreclosure and delinquency rates, with the latter possibly having a cascading effect on the future foreclosure rate. These findings provide strong support for the predictions in Hypothesis 1.

To further explore these relationships and their underlying rationale, we analyze the loan underperformance regressions across different periods of time, with the findings from the foreclosure rate and 90-day delinquency rate regressions highlighted in Panel C of Table 2. We find that the relations mentioned earlier are the strongest for the rebound period, while noticeably weaker or even reversed for the easy loan and recession periods. For instance, the coefficient of the number of IPOs for the most recent 5 years in the foreclosure and 90-day delinquency rate regressions is 3.871 and 4.828, respectively, with both significant at 1% for the rebound period, but only 0.106 and 0.423 for the easy loan period albeit still significant at 1%. For the recession period, the coefficient of this IPO variable is significant (at 5%) in only the foreclosure regression with a magnitude of 2.897, while insignificant in the 90-day delinquency rate regression. The coefficient of the IPO size for the most recent 5 years is 10.10 and 14.70 in the two regressions, both significant at 1% for the rebound period, while insignificant or negative in the two regressions for the easy loan and recession periods.

4.3 Influences from Housing Price Channel

Our previous findings were derived without isolating the impact of local housing price movements. As noted earlier, the existing literature indicates that IPO activities have a significant influence on local housing markets, which suggests that the relationship that we identified between IPOs and mortgage market performance may largely arise from IPO-driven housing price fluctuations. To determine if this is the case, we estimate a GLS regression of the annualized change rates of local housing prices, with the explanatory variables including an IPO variable and other independent variables in Equation (1). In addition, we also include the 1-year, 2-year and 3-year lagged terms of the dependent variable as the explanatory variables, to control for the time-serial correlations in the housing price movements reported in the real estate literature (Case and Shiller, 1989, Titman et al., 2014, etc.). Since IPO activities may have both immediate and gradual effects on housing price movements, we

include variables that capture IPO activity over both the long term (such as the most recent 5 or 7 years) and the short term (such as the last quarter or two quarters ago). The results are presented in Table 3.

According to Table 3, the housing price change rate is following time-serial correlations with a short-term (1-year) momentum and long-term (2-year and 3-year) reversals, in line with the findings in the literature. In addition, as expected, the housing price change rate increases with local population and recent GMP growths. With these and other factors controlled, the housing price change rate is also shown to be impacted by a few local IPO variables. For instance, the coefficient of the 1-quarter lagged IPO number is 7.223 which is significant at 5%, and the coefficient of the 2-quarter lagged IPO number is 6.687 which is significant at 1%. These show that the frequency of IPOs has positive short-term effects on local housing price growth, in line with the findings in the literature (such as Nguyen et al., 2022). Interestingly, one long-term IPO variable, the IPO size for the most recent 7 years, has a negative coefficient that is significant at 5%, thus suggesting that the impact of IPOs on accelerating local housing price appreciation is relatively short-lived.

Given these impacts of IPOs on local housing price movements, it is a valid concern that the negative relations between IPOs and local mortgage market performances shown in Table 2, might be largely driven by the effects of IPOs on local housing price changes. To address this concern, we adopt a two-stage regression approach mentioned earlier. In the first stage, we estimate a regression of the mortgage underperformance variable against the local housing price change rate, as outlined in Equation (2). The second stage is the regression of the residual from the first-stage regression. This residual represents the aspect of mortgage loan underperformance that cannot be attributed to changes in housing prices. At this stage, we examine the relationship between these residual and explanatory variables including an IPO variable and the control variables used in Table 2. Throughout both stages, we control for MSA, year, and quarter dummies and account for potential correlations within the same MSA or time period by using two-way clustered standard errors (MSA and quarter count). The results of this two-stage regression process are detailed in Table 4, which provide a more nuanced understanding of the interplay among IPO activities, housing price dynamics, and mortgage market performance.

Table 3 IPO Activities and Local Housing Price Changes

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1-quarter lagged IPO number	7.223**							
2-quarter lagged IPO number		6.687***						
Number of IPOs for most recent 5 years			-0.191					
Number of IPOs for most recent 7 years				-0.145				
1-quarter lagged IPO size					27.770			
2-quarter lagged IPO size						19.970		
IPO size for most recent 5 years							-5.550	
IPO size for most recent 7 years								-6.830**
1-year lagged price growth rate	0.626***	0.625***	0.626***	0.626***	0.627***	0.626***	0.626***	0.625***
2-year lagged price growth rate	-0.174***	-0.173***	-0.175***	-0.175***	-0.175***	-0.174***	-0.174***	-0.175***
3-year lagged price growth rate	-0.114***	-0.114***	-0.112***	-0.112***	-0.113***	-0.113***	-0.111***	-0.110***
Population growth rate	1.174***	1.173***	1.175***	1.171***	1.161***	1.167***	1.213***	1.203***
1-year lagged GMP growth rate	0.183***	0.184***	0.187***	0.188***	0.184***	0.184***	0.189***	0.192***
30-year mortgage rate	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
Yield curve slope	-0.001	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002
SP500 return	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***
Constant	0.029	0.027	0.030	0.030	0.029	0.029	0.029	0.030

(*Continued…*)

(Table 3 Continued)

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Observations	2,953	2,953	2,953	2,953	2,953	2,953	2,953	2,953
R-squared	0.7986	0.7986	0.7981	0.7981	0.7984	0.7982	0.7983	0.7984
MSA, year and quarter FE	YES	YES	YES	YES	YES	YES	YES	YES
Clustering by MSA and quarter count	YES	YES	YES	YES	YES	YES	YES	YES

***Notes*:** Coefficient estimates for GLS regressions of annualized change rate of housing prices at MSA-level with different samples for several variables and controls of scale-adjusted local IPO activity. Dependent variable is *price growth rate*, or annualized change rate of FHFA housing price index in current quarter. Scale-adjusted IPO variables equal IPO activity variables divided by population of MSA in current quarter. In Model Specifications (1) to (4), coefficients of variables for number of IPOs are divided by 1000. In Model Specifications (5) to (8), the coefficients of variables for IPO size are multiplied by 100,000. Variables are defined in Appendix. Regressions use MSA, year and quarter fixed effects, along with double clustering on the MSA and quarter count. *, **, and *** denote significance at 10%, 5%, and 1% levels, respectively.

Table 4 IPO Activities and Local Residential Mortgage Market Performance (2-stage Approach)

Panel A Foreclosure Rate Regression Results

Stage 1 - Regression of MSA-level Foreclosure Rate for Full Sample

Variable	Foreclosure rate
Price growth rate	-0.100***
Constant	0.039***
Observations	2,959
R-squared	0.6613
MSA, year and quarter FE	YES
Clustering by MSA and quarter count	YES

Stage 2 - Regressions of Residual Foreclosure Rate (Stage 1 Regression) for Full Sample

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Number of IPOs for most recent 5 years	0.802***							
Number of IPOs for most recent 7 years		0.579***						
Number of IPOs for most recent 10 years			0.311***					
Number of IPOs for most recent 12 years				0.149***				
IPO size for most recent 5 years					2.710***			
IPO size for most recent 7 years						3.690***		
IPO size for most recent 10 years							4.650***	
IPO size for most recent 12 years								2.430***
1-year lagged GMP growth rate	-0.070***	-0.071***	-0.070***	-0.069***	-0.069***	-0.070***	-0.070***	-0.068***

(*Continued…*)

(Table 4 Panel A Continued)

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Unemployment rate	0.002***	0.002***	0.002***	0.002***	0.002***	0.002***	0.002***	0.002***
30-year mortgage rate	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
Yield curve	0.002	0.002	0.002	0.001	0.001	0.001	0.001	0.001
SP500 return	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Constant	-0.006	-0.006	-0.004	0.000	0.003	0.002	0.001	0.003
Observations	1,441	1,441	1,441	1,441	1,441	1,441	1,441	1,441
R-squared	0.0673	0.0638	0.0563	0.0507	0.0521	0.0562	0.0593	0.0513
MSA, year and quarter FE	YES	YES	YES	YES	YES	YES	YES	YES
Clustering by MSA and quarter count	YES	YES	YES	YES	YES	YES	YES	YES

Panel B Highlights of Mortgage Market Performance Regression (Stage-2) Results by Underperformed Loan Categories for Full Sample

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
IPO variable	Number of IPOs for most recent 5 years	Number of IPOs for most recent 7 years	Number of IPOs for most recent 10 years	Number of IPOs for most recent 12 years	IPO size for most recent 5 years	IPO size for most recent 7 years	IPO size for most recent 10 years	IPO size for most recent 12 years
Foreclosure rate	0.802***	0.579***	0.311***	0.149***	2.710***	3.690***	4.650***	2.430***
90-day delinquency rate	1.347***	1.052***	0.544***	0.235***	3.980***	5.620***	6.640***	3.710***
Pre-foreclosure rate	0.047*	0.015	-0.031	-0.018	-0.160	-0.190	-0.500**	0.030
REO loan ratio	0.243***	0.197***	0.069***	0.025	1.120***	1.110***	0.580***	0.500***
Auction loan ratio	0.085***	0.087***	0.065***	0.059***	0.130	0.250***	0.240***	0.210***

Panel C Highlights of Mortgage Market Performance Regression (Stage-2) Results by Underperformed Loan Categories for Subsamples

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
IPO variable	Number of IPOs for most recent 5 years	Number of IPOs for most recent 7 years	Number of IPOs for most recent 10 years	Number of IPOs for most recent 12 years	IPO size for most recent 5 years	IPO size for most recent 7 years	IPO size for most recent 10 years	IPO size for most recent 12 years
Easy loan subsample								
Foreclosure rate	0.167***	0.191***	0.165***	0.125***	0.590	0.090	-3.270***	-4.170***
90-day delinquency rate	0.550***	0.679***	0.627***	0.620***	0.240	-1.520	-11.560***	-14.760***
Recession subsample								
Foreclosure rate	2.639*	2.025***	0.131	-0.483	3.680	18.050*	17.280***	-12.870
90-day delinquency rate	2.579	4.042***	0.917	-0.056	-42.070	36.040*	26.170**	12.900
Rebound subsample								
Foreclosure rate	3.697***	3.469***	3.023***	0.584*	10.780***	11.570***	12.290***	11.150***
90-day delinquency rate	4.654***	4.418***	3.774***	0.183	16.090***	17.140***	18.660***	17.970***

***Notes*:** Panel A reports coefficient estimates for two-stage GLS regressions of residential mortgage foreclosure rate at MSA-level of full sample (which includes observations for 2000-2018). In the first stage, dependent variable is local foreclosure rate, and explanatory variable is price growth rate, or annualized change rate of FHFA housing price index in current quarter. In second stage, dependent variable is residual from first-stage regression, and explanatory variables include local IPO variables and control variables. Scale-adjusted IPO variables equal IPO activity variables divided by the population of MSA in current quarter. In Model Specifications (1) to (4), coefficients of IPO variables are divided by 1000. In Model Specifications (5) to (8), coefficients of IPO are multiplied by 100,000. Variables are defined in Appendix. Panel B reports coefficients of IPO variables in the second-stage regressions similar to second-stage regressions in Panel A but using different loan underperformance measurements including foreclosure, 90-day delinquency, and pre-foreclosure rates, and REO and auction loan ratios. Panel C reports coefficients of IPO variables in second-stage regressions of foreclosure and 90-day delinquency rates similar to second-stage regressions in Panel B but for different subperiods: *easy loan*, *recession*, and *rebound* periods. *Easy Loan* subsample includes observations for 2000-2007. *Recession* subsample includes observations for 2007-2009. *Rebound* subsample includes observations for 2010-2018. The regressions use MSA, year and quarter fixed effects, along with double clustering on the MSA and quarter count. *, **, and *** denote significance at 10%, 5%, and 1% levels, respectively.

Panel A shows the results of the two-stage regression on the foreclosure rate by using the full sample. In the first-stage regression, we observe a noteworthy negative correlation between local housing price fluctuations and foreclosure rates. As previously discussed, high housing prices may help prevent equity – driven strategic defaults and declining-work-productivity related financial-driven defaults (*equity appreciation effect*) but may also increase high-housing-cost related financial-driven defaults (*cost inflation effect*). The negative relationship between housing price changes and foreclosure rates as shown in Panel A suggests that the former effect outweighs the latter. Relating this to the finding in Table 3 that the number of IPOs is positively correlated to near future housing price appreciations, we can assume that housing price appreciations after IPOs tend to reduce (rather than increase) the foreclosure rate, therefore housing price changes cannot explain for the positive relations between IPOs and the foreclosure rate.

To support this implication, we proceed to the second stage and find that the impact of the IPO variables is generally consistent with the results from the single-stage regression reported in Panel A of Table 2. The coefficients for all 8 IPO related variables are positive and significant at the 1% level. Moreover, some of these coefficients are larger in magnitude and/or more significant than those in Panel A of Table 2. For instance, the coefficient of the number of IPOs for the most recent 5 years is 0.802 (versus 0.656, although both are significant at 1%), and the coefficient of the number of IPOs for the most recent 12 years is 0.149 and significant at 1% (as versus insignificant).

In summary, the findings in Panel A align with the predictions of Hypothesis 2, thus suggesting that the negative relationship between IPOs and mortgage market performance (Hypothesis 1) is also evident in the two-stage regressions, just as in the single-stage regressions. This two-stage approach provides a better picture on the impact of IPO activities on mortgage market performance that is beyond their indirect effects via influencing housing market dynamics.

The results are generally consistent when alternative measurements for mortgage loan underperformance are employed, as outlined in Panel B. Essentially, after excluding aspects of mortgage performance potentially related to housing price changes, residual mortgage underperformance continues to exhibit a significantly positive correlation with all of the IPO variables when underperformance is measured by the foreclosure rate or 90-day delinquency rate. The relation is also shown with 7 of the 8 IPO variables when underperformance is measured by the REO loan ratio or auction loan ratio. Similar to Table 2, the effects are much weaker or absent when mortgage underperformance is measured by the pre-foreclosure rate. Overall, the results reinforce our main findings in Table 2, as well as validating Hypothesis 2 that IPOs do not worsen mortgage market performance through their impact on local housing prices.

We also re-estimate the foreclosure rate and 90-day delinquency rate regressions by using the two-stage regression method with data from the various subsamples of the full sample. The results, detailed in Panel C, are generally consistent with the subsample regression results reported in Table 2. Once again, the relationships observed for the full sample are the strongest for the rebound period, but in general, much weaker for the easy loan and recession periods.

4.4 Influences from Wealth Channel

Next, we explore whether the negative relationship between IPOs and mortgage performance is primarily influenced by the wealth channel. As previously discussed, the insider owners of IPO stocks may undergo wealth shocks upon selling their IPO shares after the expiration of IPO lock-up periods, thereby increasing their housing demand and reducing their risk of equity – driven strategic default and financial – driven default (*wealth shock effect*). Meanwhile, they may have reduced financial needs and reliance on the mortgage markets, thus potentially negatively impacting the average quality of mortgage loan borrowers and, consequently, the overall loan market performance (*rich retreat effect*). To make the wealth channel a driver for the negative relationship between IPOs and local mortgage market performance, the *rich retreat effect* should be present and outweigh the *wealth shock effect*. To examine the presence of the *rich retreat effect*, we investigate whether IPO activities reduce the fraction of non-owner occupancy loans in all mortgage loans. Non-owner-occupied properties are typically investment properties owned by wealthy individuals; thus, if these investors exit the mortgage markets post-IPO issuance, the proportion of non-owner occupancy loans should decrease, which is contrary to the predictions of Hypothesis 3.

Since insiders of IPO stocks are typically allowed to sell their shares 90 or 180 days after issuance, we examine the effects of IPOs over both the short term (such as the last quarter or two quarters ago) and the long term (such as the most recent 5 or 7 years).

Again, we start the analysis by using the full-sample data, with findings presented in Panel A of Table 5. As shown in this panel, the coefficients of the local IPO variables in 7 of the 8 regression specifications are positive and significant (at 1% for 2, 5% for 3, and 10% for 2 IPO variables). These positive correlations between the IPO variables and fraction of non-owner occupancy loans validate Hypothesis 3 and can be attributed to several factors. First, the anticipated short-term and cumulative long-term economic growths associated with IPO activities may stimulate more speculative or investment-driven housing demands than consumption-oriented demands, thus potentially resulting in a higher proportion of non-owner occupancy loans in local mortgage markets. Another possible explanation is the effect of IPO activities on local housing market affordability. If IPOs contribute to housing market price increases that outpace household welfare growth, housing affordability

may decline. This could impact house consumers more significantly than investors, who are typically less financially constrained, thereby leading to an increase in the fraction of non-owner-occupied houses and corresponding non-owner occupancy loans.

In an additional unreported test, we examine the effects of IPO stocks held by insiders, with the IPO variables lagged by one quarter, two quarters, as well as over the most recent 5 and 7 years. Interestingly, we find that the coefficients of the four IPO insider-stock-value variables are all positive and larger than 18. They are also all significant at the 1-5% levels. This finding suggests that when IPO activities influence the proportion of non-owner occupancy loans, this change is closely related to the wealth increases among the insiders (who own IPO stocks). In other words, if IPOs indeed attract more investment than consumption in the housing markets, these insiders are important contributors to this shift.

Panel B of Table 5 presents a comparison of the regression results across different sub-periods. It is notable that the positive association between the number of IPOs and the non-owner occupancy loan fraction is noticeably more significant for data from the easy loan and rebound periods, while it is absent or even reversed for the recession period. For instance, the coefficient of the number of IPOs for the most recent 5 years is 1.410 for the easy loan period and 1.662 for the rebound period, both significant at 1%. However, this relationship is statistically insignificant for the recession period. It is logical to attribute the surge in housing prices driven by IPO activities during the easy loan and rebound periods as a trigger for an increased investor presence among homebuyers.

Our findings of the generally positive relation between IPOs and the non-owner occupancy loan fraction contradict the justification based on the *rich retreat effect* of the wealth channel discussed earlier. Based on the *rich retreat effect*, the non-owner-occupancy loan fraction would have declined (instead of increased) after the issuance of IPOs. As explained earlier, some of those who are wealthy may not necessarily retreat from the mortgage markets in the face of positive wealth shocks. They may not always prefer cash purchases, and additionally, may still purchase second homes, investment homes, etc.

Table 5 IPO Activities and the Fraction of Non-owner Occupancy Loans in Local Residential Mortgage Loans

Panel A Regression of the MSA-level Fraction of Non-owner Occupancy Loans for the Full Sample

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1-quarter lagged IPO number	3.375*							
2-quarter lagged IPO number		2.583*						
Number of IPOs for most recent 5 years			0.549**					
Number of IPOs for most recent 7 years				-0.002				
1-quarter lagged IPO size					17.820**			
2-quarter lagged IPO size						17.740**		
IPO size for most recent 5 years							15.420***	
IPO size for most recent 7 years								15.690***
1-year lagged GMP growth rate	-0.124***	-0.123***	-0.128***	-0.122***	-0.124***	-0.125***	-0.135***	-0.140***
Unemployment rate	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	0.000	0.000
Population growth rate	-0.659***	-0.663***	-0.600***	-0.666***	-0.680***	-0.678***	-0.658***	-0.596***

(*Continued…*)

(Table 5 Panel A Continued)

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
30-year mortgage rate	0.008***	0.008***	0.008***	0.008***	0.008***	0.008***	0.008***	0.008***
Yield curve slope	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002
SP500 return	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***
Constant	0.009	0.009	0.005	0.011	0.010	0.010	0.005	0.003
Observations	1,437	1,437	1,437	1,437	1,437	1,437	1,437	1,437
R-squared	0.7645	0.7642	0.7646	0.7635	0.7645	0.7645	0.7770	0.7802
MSA, year and quarter FE	YES	YES	YES	YES	YES	YES	YES	YES
Clustering by MSA and quarter count	YES	YES	YES	YES	YES	YES	YES	YES

Panel B Highlights of Non-owner Occupancy Loan Fraction Regressions for Different Samples

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
IPO variable	1-quarter lagged IPO number	2-quarter lagged IPO number	Number of IPOs for most recent 5 years	Number of IPOs for most recent 7 years	1-quarter lagged IPO size	2-quarter lagged IPO size	IPO size for most recent 10 years	IPO size for most recent 12 years
Full (2000-2018)	3.375*	2.583*	0.549**	-0.002	17.820**	17.740**	15.420***	15.690***
Easy Loan (2000-2007)	2.679*	2.459	1.410***	1.255***	12.280	17.420	20.220***	23.310***
Recession (2007-2009)	1.175	-1.549	-2.489	-0.805	-42.080	-63.080**	-31.040	-25.130
Rebound (2010-2018)	2.853	-1.682	1.662***	1.184**	5.310	-1.050	8.820***	9.380***

***Notes*:** Panel A reports coefficient estimates for GLS regressions of the fraction of non-owner occupancy loans in MSA residential mortgage loans of full sample (which includes observations for 2000-2018) for several scaled-adjusted IPO variables and control variables. Scale-adjusted IPO variables equal IPO activity variables divided by the population of the MSA in current quarter. In Model Specifications (1) to (4), coefficients of IPO variables are divided by 1000. In Model Specifications (5) to (8), coefficients of IPO are multiplied by 100,000. Variables are defined in the Appendix. Panel B reports the coefficients of IPO variables in regressions similar to regressions in Panel A but for different subperiods. The *easy loan* subsample includes observations for 2000-2007. The *recession* subsample includes observations for 2007-2009. The *rebound* subsample includes observations for 2010-2018. The regressions employ MSA, year and quarter fixed effects, along with double clustering on the MSA and quarter count. *, **, and *** denote significance at 10%, 5%, and 1% levels, respectively.

4.5 Influences from Stock Market Channel

We now examine whether the positive relationship between local long-term IPO activity and mortgage market underperformance is driven by the stock market channel. Increased local IPO activity may prompt households to cash out home equity from their mortgages to fund increased participation in the stock market, thus leading to excessive borrowing and mortgage underperformance.

To test this, we re-estimate the loan underperformance regression from Equation (1) by incorporating the long-term annualized S&P 500 index return over a matching period of time (e.g., the most recent 5, 7, 10, or 12 years) used for the long-term IPO variables. For example, if the regression includes the number of IPOs for the most recent 5 years (or size) as the IPO variable, we also include the recent 5-year annualized S&P 500 return as a control variable. Similarly, if the regression includes the number of IPOs for the most recent 12 years (or size), we include the corresponding 12-year annualized S&P 500 return. If the stock market channel explains the positive relationship between IPO activity and mortgage market underperformance, we expect the long-term stock market return to play a positive role in the regression while eroding the effects of the IPO variables. The results are presented in Table 6.

Panel A of Table 6 presents the regression results for the foreclosure rate by using the full sample. The findings support Hypothesis 4. After incorporating the long-term stock market returns, the effects of the IPO variables remain highly consistent with those in Panel A of Table 2. Again, all 8 IPO variables – except the number of local IPOs in the most recent 12 years – are positive and significant at the 1% level, with the magnitude of the coefficients closely matching that in Table 2. For example, the coefficient for the number of IPOs for the most recent 5 years is 0.652 (compared to 0.656), while the coefficient for the IPO size for the most recent 12 years remains 3.4, which is the same as the earlier result. Meanwhile, the long-term S&P 500 return remains consistently insignificant across all of the regression specifications. These findings contradict the explanation of the stock market channel for the relationship between IPO activity and mortgage performance.

We also re-estimate the foreclosure rate and 90-day delinquency rate regressions by using both the full sample and various subsamples, by controlling for the long-term stock market returns. As shown in Panel B, the results remain largely consistent with those in Table 2, while the long-term stock market returns are mostly insignificant. Note that during the easy loan period, these returns are statistically significant at the 1% level, but their coefficients are close to zero, thus indicating no meaningful economic impact. These findings further challenge the hypothesized cash-out effect via the stock market channel in explaining the IPO-mortgage performance relationship.

Table 6 IPO Activities and Local Residential Mortgage Market Performance - with Long-term Stock Market Return Controlled

Panel A Regression of the MSA-level Foreclosure Rate for the Full Sample

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Number of IPOs for most recent 5 years	0.652***							
Number of IPOs for most recent 7 years		0.428***						
Number of IPOs for most recent 10 years			0.171***					
Number of IPOs for most recent 12 years				0.020				
IPO size for most recent 5 years					3.550***			
IPO size for most recent 7 years						5.220***		
IPO size for most recent 10 years							5.670***	
IPO size for most recent 12 years								3.400***
1-year lagged GMP growth rate	-0.114***	-0.116***	-0.115***	-0.113***	-0.115***	-0.118***	-0.117***	-0.114***
Unemployment rate	0.004***	0.004***	0.004***	0.004***	0.004***	0.004***	0.004***	0.004***
30-year mortgage rate	-0.001	-0.001	0.000	0.000	-0.001	0.000	0.000	0.000
Yield curve slope	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
SP500 return for matching period	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000

(*Continued*...)

(Table 6 Panel A Continued)

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Constant	0.005	0.004	-0.001	0.010	0.012	0.010	-0.001	0.008
Observations	1,443	1,443	1,443	1,443	1,443	1,443	1,443	1,443
R-squared	0.6698	0.6686	0.6667	0.6657	0.6676	0.6708	0.6713	0.6673
MSA, year and quarter FE	YES	YES	YES	YES	YES	YES	YES	YES
Clustering by MSA and quarter count	YES	YES	YES	YES	YES	YES	YES	YES

Panel B Highlights of Mortgage Market Performance Regression Results by Underperformed Loan Categories for the Full Sample

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	
IPO variable	Number of IPOs for most recent 5 years	Number of IPOs for most recent 7 years	Number of IPOs for most recent 10 years	Number of IPOs for most recent 12 years	IPO size for most recent 5 years	IPO size for most recent 7 years	IPO size for most recent 10 years	IPO size for most recent 12 years	SP500 return of matching period (average)
Full sample									
Foreclosure rate	0.652***	0.428***	0.171***	0.020	3.550***	5.220***	5.670***	3.400***	0.000
90-day delinquency rate	1.082***	0.782***	0.294***	0.002	5.460***	8.290***	8.350***	5.370***	0.001

(*Continued…*)

(Table 6 Panel B Continued)

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	
Easy loan subsample									
Foreclosure rate	0.095***	0.136***	0.109***	0.057	0.360	0.440	-2.270***	-2.940***	0.000***
90-day delinquency rate	0.402***	0.565***	0.507***	0.476***	-0.240	-0.810	-9.520***	-12.240***	0.001***
Recession subsample									
Foreclosure rate	2.942**	2.092***	-0.076	-0.214	1.160	18.900*	14.170***	-13.380	0.000
90-day delinquency rate	3.017	4.156***	0.537	0.418	1.160	37.710*	20.420**	12.300	0.000
Rebound subsample									
Foreclosure rate	3.816***	3.479***	3.279***	0.446	10.180***	12.550***	12.830***	11.970***	0.000
90-day delinquency rate	4.876***	4.420***	4.254***	-0.106	14.860***	19.160***	19.740***	19.610***	0.000

***Notes*:** Panel A reports coefficient estimates for the GLS regressions of the residential mortgage foreclosure rate at MSA-level of the full sample (which includes observations for 2000-2018) for several scaled-adjusted IPO variables and control variables. Scale-adjusted IPO variables equal IPO activity variables divided by population of MSA in current quarter. In Specifications (1) to (4), coefficients of variables for number of IPOs are divided by 1000. In Model Specifications (5) to (8), coefficients of IPO size are multiplied by 100,000. SP 500 return for matching period represents percentage change in S&P 500 index for the most recent 5, 7, 10, and 12 years for Model Specifications (1) to (4) and (5) to (8), respectively. Definitions of other variables can be found in Appendix. Panel B reports coefficients of IPO variables and cross-specification average coefficient of SP500 return for matching period in regressions of foreclosure and 90-day delinquency rates similar to those reported in Panel A but for different subperiods, i.e., *easy loan*, *recession*, and *rebound* periods. *Easy loan* subsample includes observations for 2000-2007. *Recession* subsample includes observations for 2007-2009. *Rebound* subsample includes observations for 2010-2018. Regressions use MSA, year and quarter fixed effects, along with double clustering on the MSA and quarter count. *, **, and *** denote significance at 10%, 5%, and 1% levels, respectively.

In summary, our regression results generally support Hypotheses 2, 3 and 4, which indicates that the positive relation between IPO and mortgage underperformance (which supports Hypothesis 1) is not driven by housing price changes, wealth changes or cashing out of the stock market after the issuance of IPOs, thus leaving room for the possibility of a fourth explanation – the *counter-cyclical* lending quality change found in the banking literature, with lenders adopting lenient lending standards or producing lower-quality borrower information during business booms followed by IPOs. The tests for this justification are presented in the following section.

4.6 Influences from Business Channel

As discussed earlier, IPO activity can impact local mortgage performance through two opposing effects within the business channel: the *business booming effect* and the *counter-cyclical lending standard effect*. Our corresponding tests are summarized below.

Business Booming Effect

The *business booming effect* is based on the assumption that IPOs can stimulate local business growth. To test this, we regress the annual GMP growth rate on various IPO-related variables and other explanatory factors. These additional explanatory variables include 1-year, and 2-year lagged GMP growth rates (to account for potential time serial correlations in GMP changes), the annual population growth rate of the MSA (to control for shifts in local economic or demographic conditions), and capital market variables such as the 3-month Treasury bill interest rate, the yield curve slope, and the annual change rate of the S&P 500 index. The IPO variables include the number or size of local IPOs in the current quarter, as well as those from one quarter earlier, two quarters earlier, the most recent five years, and most recent seven years. This allows us to analyze both the immediate and long-term effects of IPOs on local business growth. The full-sample results are reported in Table 7.

In Table 7, 6 of the 10 IPO variables show positive effects on GMP growth. For instance, the 2-quarter lagged number of local IPOs is significant at the 1% level, with a coefficient of 3.661. The number of local IPOs in the most recent 7 years is significant at the 5% level, with a coefficient of 0.527. Additionally, the coefficients of the current quarter and 1-quarter lagged local IPO size, as well as those of the number of IPOs and IPO size for the most recent 5 years are all positive and significant at the 10% level. These findings align with many previous studies, which suggest that IPOs can boost local business activity and employment, thus supporting the assumption of a *business booming effect*. However, this effect would likely lead to improvements rather than deterioration in the local mortgage market and thus cannot explain for the previously observed negative relationship between IPO activity and local mortgage market performance.

Table 7 IPO Activities and GMP Growth

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Current-quarter IPO number	2.526									
1-quarter lagged IPO number		2.437								
2-quarter lagged IPO number			3.661***							
Number of IPOs for most recent 5 years				0.389*						
Number of IPOs for most recent 7 years					0.527**					
Current-quarter IPO size						20.320*				
1-quarter lagged IPO size							13.460*			
2-quarter lagged IPO size								12.830		
IPO size for most recent 5 years									2.850*	
IPO size for most recent 7 years										0.890

(*Continued*...)

(Table 7 Continued)

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1-year lagged GMP growth rate	0.122***	0.121***	0.121***	0.120***	0.034	0.122***	0.121***	0.120***	0.120***	0.043
2-year lagged GMP growth rate	-0.037	-0.037	-0.035	-0.038	-0.006***	-0.036	-0.037	-0.036	-0.039	-0.006***
1-year lagged population growth rate	0.986***	0.989***	0.985***	0.997***	1.238***	0.979***	0.983***	0.983***	0.977***	1.130***
3-month T-Bill rate	0.006***	0.006***	0.005***	0.006***	-0.004*	0.006***	0.006***	0.006***	0.006***	-0.004*
Yield curve slope	0.001**	0.001**	0.001**	0.001**	0.001	0.001**	0.001**	0.001**	0.001**	0.001
SP500 return	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***
Constant	0.010	0.010	0.010	0.009	0.100***	0.011	0.010	0.010	0.011	0.110***
Observations	2,924	2,924	2,924	2,924	2,924	2,924	2,924	2,924	2,924	2,924
R-squared	0.5652	0.5652	0.5660	0.5655	0.6108	0.5656	0.5653	0.5652	0.5652	0.6087
MSA, year and quarter FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Clustering by MSA and quarter count	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

***Notes*:** Coefficient estimates for GLS regressions of GMP annual growth rate of full sample (which includes observations for 2000-2018) for several scaled-adjusted IPO variables and control variables. Scale-adjusted IPO variables equal IPO activity variables divided by population of MSA in current quarter. In Model Specifications (1) to (5), coefficients of IPO variables are divided by 1000. In Model Specifications (6) to (10), coefficients of IPO are multiplied by 100,000. Variables are defined in Appendix. Regressions use MSA, year and quarter fixed effects, along with double clustering on MSA and quarter count. *, **, and *** denote significance at 10%, 5%, and 1% levels, respectively.

Counter-Cyclical Lending Standard Effect

We now conduct tests for Hypotheses 5-1, 5-2, 5-3 and 5-4 to find evidence for the *counter-cyclical lending standard effect*, which may explain for the negative relationship between IPOs and local mortgage performance.

Loan to Household Ratio

We first test Hypothesis 5-1, that is, the MSA loan-to-household ratio increases with the degree of local IPO activity, where the ratio can reflect the degree of lending expansion and indicate the ease of lending. We regress the MSA loan-to-household ratio on various local IPO variables while controlling for MSA-level economic factors, such as the unemployment, population growth, and one-year lagged annual GMP growth rates. Additionally, we account for capital market variables, including the 30-year fixed-rate mortgage loan rate, yield curve slope, and annual change rate of the S&P 500 index. Moreover, we control for the average bank tightening rate during the period that corresponds to the timeframe of the IPO variables, which serves as a proxy for bank lending constraints at the time of the IPO and loan origination. The IPO variables include both short-term and long-term measures of the number of IPOs and IPO size, as we aim to evaluate whether IPOs have immediate and lasting impacts on the scaled volume of local mortgage lending. This is our first indirect test for the counter-cyclical lending standard effect. If this effect is significant, we would expect that increased IPO activity could lead to larger scaled volume of mortgage lending.

The regression results that use the full sample data are presented in Panel A of Table 8. Six of the eight IPO variables show positive effects on the MSA loan-to-household ratio, and their coefficients are consistently significant at the 1% level. These include all 4 variables for the number of IPOs and 2 long-term variables for IPO size. Among them, the number of IPOs from 1 quarter earlier, 2 quarters earlier, the most recent 5 years, and the most recent 7 years have coefficients of 6.720, 5.950, 1.696 and 0.838, respectively. The IPO size for the most recent 5 and 7 years have coefficients of 10.230 and 12.680, receptively. These findings greatly support Hypothesis 5-1.

Panel B of Table 8 compares the regression results across the different sub-periods. Interestingly, we find the most support for Hypothesis 5-1 from the rebound period, where the same 6 IPO variables have positive coefficients that are significant at the 1% or 5% level. In the easy loan period, 4 variables for the number of IPOs show significantly positive effects. However, during the recession period, none of the IPO variables have any significantly positive role.

Table 8 IPO Activities and Local Loan-to-household Ratio

Panel A Regression of the MSA-level Loan-to-household Ratio for the Full Sample

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1-quarter lagged IPO number	6.720***							
2-quarter lagged IPO number		5.950***						
Number of IPOs for most recent 5 years			1.696***					
Number of IPOs for most recent 7 years				0.838***				
1-quarter lagged IPO size					10.660			
2-quarter lagged IPO size						0.940		
IPO size for most recent 5 years							10.230***	
IPO size for most recent 7 years								12.680***
1-year lagged GMP growth rate	-0.033	-0.032	-0.046*	-0.047*	-0.029	-0.029	-0.037	-0.046*
Unemployment rate	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001

(*Continued*…)

(Table 8 Panel A Continued)

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Population growth rate	-0.291**	-0.305**	-0.115	-0.116	-0.313**	-0.311**	-0.310**	-0.235*
30-year mortgage rate	-0.004**	-0.004**	-0.005**	-0.004*	-0.004*	-0.004**	-0.004**	-0.004*
Yield curve slope	0.001	0.001	0.001	0.001*	0.001	0.001	0.001	0.002**
SP500 return	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Bank tightening rate for matching period	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-0.001**
Constant	0.385***	0.369***	0.373***	0.373***	0.389***	0.392***	0.387***	0.381***
Observations	1,437	1,437	1,437	1,437	1,437	1,437	1,437	1,437
R-squared	0.9738	0.9738	0.9745	0.9738	0.9734	0.9734	0.9741	0.9747
MSA, year and quarter FE	YES	YES	YES	YES	YES	YES	YES	YES
Clustering by MSA and quarter count	YES	YES	YES	YES	YES	YES	YES	YES

Panel B Highlights of MSA-level Loan-to-household Ratio Regressions for Different Samples

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
IPO variable	1-quarter lagged IPO number	2-quarter lagged IPO number	Number of IPOs for most recent 5 years	Number of IPOs for most recent 7 years	1-quarter lagged IPO size	2-quarter lagged IPO size	IPO size for most recent 5 years	IPO size for most recent 7 years
Full (2000-2018)	6.720***	5.950***	1.696***	0.838***	10.660	0.940	10.230***	12.680***
Easy Loan (2000-2007)	6.301***	6.061***	2.161***	1.708***	10.760	-10.490	3.920	9.200
Recession (2007-2009)	-1.682	1.109	-1.106*	-1.277	-16.550	-0.530	0.170	-14.590
Rebound (2010-2018)	4.067**	4.043**	2.421***	3.295***	-1.020	-1.750	8.300***	12.850***

***Notes*:** Panel A reports coefficient estimates for GLS regressions of MSA-median local residential mortgage loan-to-household ratio of full sample (which includes observations for 2000-2018) for several scaled-adjusted IPO variables and control variables. Scale-adjusted IPO variables equal IPO activity variables divided by population of MSA in current quarter. In Model Specifications (1) to (4), coefficients of IPO variables are divided by 1000. In Model Specifications (5) to (8), coefficients of IPO are multiplied by 100,000. *Bank tightening rate for matching period* represents cross-time average net percentage of US domestic banks tightening standards on household loans over the last quarter, 2-quarter earlier, most recent 5 and 7 years for Model Specifications (1) to (4) and (5) to (8), respectively. Definitions of other variables can be found in Appendix. Panel B reports coefficients of IPO variables in regressions similar to regressions in Panel A but for different periods of time. *Easy loan* subsample includes observations for 2000-2007. *Recession* subsample includes observations for 2007-2009. *Rebound* subsample includes observations for 2010-2018. Regressions use MSA, year and quarter fixed effects, along with double clustering on the MSA and quarter count. *, **, and *** denote significance at 10%, 5%, and 1% levels, respectively.

As mentioned earlier, this test allows us to examine whether IPOs have been associated with easier loan lending since 2000 but does not capture any relationship between IPOs and loan origination quality before 2000 – particularly for loans in the easy loan subsample since our CoreLogic mortgage loan market data begins in 2000. Therefore, our results are more relevant for studying the counter-cyclical lending quality effects of IPOs on local mortgage loan performance during the recession and rebound periods.

The findings in Panel B suggest that the scaled number of loans that originated during the easy loan period can be positively influenced by the frequency of recent or long-term local IPO activities. This may help to explain for the surge in loan foreclosures during the later periods including the recession and rebound periods. Although this loan number – IPO relation disappeared during the recession period – likely due to reduced IPO activity or stricter lending regulations – it reemerged, even more strongly, in the rebound period. This is a concerning trend, as it could signal future loan underperformance.

OLTV

To test Hypothesis 5-2 – namely, that the MSA median OLTV increases with local IPO activity – we regress the MSA median OLTV on various local long-term IPO variables, and control for factors such as the one-year lagged annual growth rate of the GMP, local MSA unemployment rate, and relevant capital market variables. Additionally, we also include the average bank tightening rate during the period that corresponds to the timeframe of the IPO variables, again as a proxy for bank lending constraints at the time of the IPO and loan origination. This serves as our second indirect test of the counter-cyclical lending standard effect. If this effect is significant, we would expect that increased IPO activity could lead to higher median OLTVs.

Panel A of Table 9 presents the regression results that use the full sample data. All 4 variables for number of IPOs exhibit positive effects on the MSA median OLTV ratio, with a consistent significance level of 1%. Their respective coefficients are 1.318, 1.637, 2.092, and 2.760 for the most recent 5, 7, 10, and 12 years of IPOs. Additionally, the IPO size for the most recent 7 and 10 years also have significantly positive coefficients. With 6 of the 8 long-term IPO variables showing significantly positive impacts on the MSA median OLTV ratio, the findings in Panel A largely support Hypothesis 5-2.

Panel B of Table 9 compares the regression results across the different sub-periods. In both the recession and rebound periods, we find that Hypothesis 5-2 is greatly supported, as most long-term IPO variables exhibit significantly positive effects on the local median OLTV ratio. These findings suggest that the lenient lending practices following IPOs (likely starting from the easy loan period) could have contributed to mortgage loan market risks and performance, which later became evident in both the recession and rebound periods.

Table 9 IPO Activities and OLTV (Original Loan-to-value Ratio) of Local Residential Mortgage Loans

Panel A Regression of the MSA-level OLTV for the Full Sample

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Number of IPOs for most recent 5 years	1.318***							
Number of IPOs for most recent 7 years		1.637***						
Number of IPOs for most recent 10 years			2.092***					
Number of IPOs for most recent 12 years				2.760***				
IPO size for most recent 5 years					-3.300			
IPO size for most recent 7 years						4.760*		
IPO size for most recent 10 years							7.760**	
IPO size for most recent 12 years								2.020
1-year lagged GMP growth rate	0.007	-0.003	-0.041	-0.037	0.013	0.007	-0.015	-0.017
Unemployment rate	0.006***	0.006***	0.002*	0.001	0.006***	0.007***	0.005***	0.004***
30-year mortgage rate	0.001	0.002	0.003	0.002	0.001	0.003	0.003	0.002

(*Continued*…)

(Table 9 Panel A Continued)

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Yield curve slope	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
SP500 return	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Bank tightening rate for matching period	0.000	-0.002*	-0.001	0.001	0.000	-0.002**	-0.001	-0.001
Constant	0.810***	0.789***	0.787***	0.759***	0.827***	0.814***	0.804***	0.806***
Observations	1063	1063	968	816	1063	1063	968	816
R-squared	0.7433	0.7498	0.773	0.7725	0.7394	0.7407	0.7541	0.7427
MSA, year and quarter FE	YES	YES	YES	YES	YES	YES	YES	YES
Clustering by MSA and quarter count	YES	YES	YES	YES	YES	YES	YES	YES
Yield curve	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
SP500 return	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Panel B Highlights of MSA-level OLTV Regressions for Different Samples

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
IPO variable	Number of IPOs for most recent 5 years	Number of IPOs for most recent 7 years	Number of IPOs for most recent 10 years	Number of IPOs for most recent 12 years	IPO size for most recent 5 years	IPO size for most recent 7 years	IPO size for most recent 10 years	IPO size for most recent 12 years
Full (2000-2018)	1.318***	1.637***	2.092***	2.760***	-3.300	4.760*	7.760**	2.020
Easy Loan (2000-2007)	-1.624***	-1.025***	-1.098***	-0.883	-18.160***	-3.370	3.450	11.800
Recession (2007-2009)	4.492	4.270*	6.741***	4.634***	2.520	84.340**	47.910*	166.590***
Rebound (2010-2018)	4.970***	0.542	2.243	-1.237**	11.600***	8.690***	9.260***	2.670

***Notes*:** Panel A reports coefficient estimates for the GLS regressions of the MSA-median OLTV of residential mortgage loans of full sample (which includes observations for 2000-2018) for several scaled-adjusted IPO variables and control variables. Scale-adjusted IPO variables equal IPO activity variables divided by population of MSA in current quarter. In Model Specifications (1) to (4), coefficients of IPO variables are divided by 1000. In Model Specifications (5) to (8), coefficients of IPO are multiplied by 100,000. *Bank tightening rate for matching period* represents the cross-time average net percentage of US domestic banks tightening standards on household loans over the most recent 5, 7, 10, and 12 years for Model Specifications (1) to (4) and (5) to (8), respectively. Definitions of other variables can be found in the Appendix. Panel B reports the coefficients of IPO variables in regressions similar to regressions in Panel A but for different periods of time. *Easy loan* subsample includes observations for 2000-2007. *Recession* subsample includes observations for 2007-2009. *Rebound* subsample includes observations for 2010-2018. Regressions use MSA, year and quarter fixed effects, along with double clustering on the MSA and quarter count. *, **, and *** denote significance at 10%, 5%, and 1% levels, respectively.

Excluding MSAs that Host Largest Lenders

We perform our third indirect test for the counter-cyclical lending quality effect by re-estimating the mortgage performance regression from Equation (1) but excluding observations from MSAs that host the largest national residential mortgage loan lenders. Our aim is to determine whether this exclusion strengthens the positive relationship between IPO activities and local mortgage underperformance, as predicted by Hypothesis 5-3. The results, along with comparisons to those in Table 2 (which is based on observations from all 39 MSAs), are summarized in Table 10.

Panel A reports the foreclosure rate regression results after excluding the 6 MSAs from the full sample. The findings show that 6 of the 8 IPO variables exhibit significantly positive effects on the local residential mortgage foreclosure rate, with 5 at the 1% significance level and 1 at the 5% significance level. To evaluate the impact of excluding these MSAs, we compare the results from the full sample with and without them. Panel B highlights these comparisons for both the foreclosure and the 90-day delinquency rate regressions.

Interestingly, when the 6 MSAs are excluded, the positive effects of the variables for the number of local IPOs (in Model Specifications 1, 2, 3, and 4) are generally reduced in terms of the magnitude and significance level of the coefficient. In contrast, the positive effects of variables for the local IPO size (in Model Specifications 5, 6, 7, and 8) become substantially higher. For instance, in the 90-day delinquency rate regressions, the coefficients for the IPO size in most recent 5, 7, 10, and 12 years are 7.93, 10.36, 9.75, and 5.44, respectively, compared to 5.44, 8.30, 8.37, and 5.36, and remain significant at the 1% level.

Our results with the variables for IPO size support Hypothesis 5-3 in that the positive relationships between IPO activities and local mortgage underperformance increase when the 6 MSAs are excluded. This provides another piece of indirect evidence for the *counter-cyclical lending quality effect*. National leading lenders conduct business nationwide and are therefore less likely to be influenced by IPO activities or other business dynamics in their headquarters. Consequently, if lenders do influence the positive relationship between IPO activities and local mortgage loan underperformance, excluding the MSAs where these leading lenders are headquartered may strengthen the relationship.

Table 10 IPO Activities and Local Residential Mortgage Market Performance - Excluding 6 MSAs that Host National-leading Lenders

Panel A Regression of MSA-level Foreclosure Rate with 6 MSAs Excluded from Full Sample

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Number of IPOs for most recent 5 years	0.659***							
Number of IPOs for most recent 7 years		0.260**						
Number of IPOs for most recent 10 years			0.027					
Number of IPOs for most recent 12 years				-0.039				
IPO size for most recent 5 years					7.230***			
IPO size for most recent 7 years						8.180***		
IPO size for most recent 10 years							7.350***	
IPO size for most recent 12 years								3.480***
1-year lagged GMP growth rate	-0.114***	-0.114***	-0.113***	-0.114***	-0.113***	-0.112***	-0.109***	-0.111***

(*Continued*...)

(Table 10 Panel A Continued)

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Unemployment rate	0.005***	0.005***	0.005***	0.005***	0.005***	0.005***	0.005***	0.005***
30-year mortgage rate	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Yield curve slope	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
SP500 return	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Constant	0.002	0.005	0.009	0.002	0.006	0.006	0.004	0.007
Observations	1291	1291	1291	1291	1291	1291	1291	1291
R-squared	0.6777	0.6761	0.6755	0.6755	0.6788	0.6802	0.6793	0.6763
MSA, year and quarter FE	YES	YES	YES	YES	YES	YES	YES	YES
Clustering by MSA and quarter count	YES	YES	YES	YES	YES	YES	YES	YES

Panel B Highlights of Full-sample Mortgage Market Performance Regression Results vs. Results with Exclusion of 6 MSAs

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
IPO variable	Number of IPOs for most recent 5 years	Number of IPOs for most recent 7 years	Number of IPOs for most recent 10 years	Number of IPOs for most recent 12 years	IPO size for most recent 5 years	IPO size for most recent 7 years	IPO size for most recent 10 years	IPO size for most recent 12 years
Foreclosure rate								
full sample	0.656***	0.430***	0.176***	0.022	3.550***	5.230***	5.660***	3.400***
6 MSAs excluded	0.659***	0.260**	0.027	-0.039	7.230***	8.180***	7.350***	3.480***
90-day delinquency rate								
full sample	1.086***	0.790***	0.304***	0.007	5.440***	8.300***	8.370***	5.360***
6 MSAs excluded	0.806***	0.356**	0.048	-0.062	7.930***	10.360***	9.750***	5.440***

***Notes*:** Panel A reports coefficient estimates for GLS regressions of residential mortgage foreclosure rate at MSA-level of full sample (which includes observations for 2000-2018) but excluding 6 MSAs for several scaled-adjusted IPO variables and control variables. These 6 MSAs host the national-leading residential mortgage loan lenders in our sample period, including New York-Jersey City-White Plains (NY-NJ), San Francisco-Redwood City-South San Francisco (CA), Detroit-Dearborn-Livonia (MI), Minneapolis-St. Paul-Bloomington (MN-WI), Anaheim-Santa Ana-Irvine (CA) and Charlotte-Concord-Gastonia (NC-SC). Scale-adjusted IPO variables equal IPO activity variables divided by population of MSA in current quarter. In Model Specifications (1) to (4), coefficients of IPO variables are divided by 1000. In Model Specifications (5) to (8), coefficients of IPO are multiplied by 100,000. Variables are defined in Appendix. Panel B reports coefficients of IPO variables in regressions of foreclosure and 90-day delinquency rates similar to those reported in Panel A but for different samples, and full sample and its subsample which exclude these 6 MSAs. The regressions employ MSA, year and quarter fixed effects, along with double clustering on the MSA and quarter count. *, **, and *** denote significance at 10%, 5%, and 1% levels, respectively.

Control for Lending Constraints

Finally, we test Hypothesis 5-4, which examines whether the negative impact of long-term IPO activity on local mortgage loan performance persists after controlling for proxies of bank lending constraints at the time of loan origination. This test evaluates whether the observed effects of IPOs on loan performance are merely superficial or arise from their coincidence with periods of loosening bank lending constraints. If this is the case, the effects of IPOs should decrease when we control for the degree of lending constraints. This serves as our fourth indirect test of the *counter-cyclical lending quality effect* of IPOs. To conduct this analysis, we re-estimate the loan underperformance regression from Equation (1), adding in the cross-time average bank tightening rate during the period that corresponds to the timeframe of the IPO variables, a proxy for bank lending constraints at the time of the IPO and loan origination. The results are presented in Table 11.

As shown in Panel A of this table, the foreclosure rate regression results with the use of the full sample support Hypothesis 5-4. After incorporating the average bank tightening rate, the effects of the IPO variables remain highly consistent with those in Panel A of Table 2. Once again, all 8 IPO variables – except for the number of local IPOs in most recent 12 years – exhibit positive and significant effects at the 1% level, with the magnitude of the coefficients closely aligning with those in Table 2. Interestingly, the average bank tightening rate itself does not show any significant impact in the regressions.

We also re-estimate the foreclosure rate and 90-day delinquency rate regressions by using both the full sample and various subsamples, after controlling for the average bank tightening rate. As shown in Panel B, the results remain largely consistent with those in Table 2, while the average bank tightening rate remains mostly insignificant. These findings reinforce the robustness of the IPO-mortgage performance relationship, which suggests that it is not merely a superficial outcome of IPO occurrences that coincide with the loosening of bank lending constraints for households.

In summary, our findings broadly support Hypotheses 5-1, 5-2, 5-3, and 5-4, and provide indirect evidence for the *counter-cyclical lending standard effect*, which may help to explain the negative relationship between IPO activity and local mortgage performance.

Table 11 IPO Activities and Local Residential Mortgage Market Performance - with National Bank Lending Situation Controlled

Panel A Regression of MSA-level Foreclosure Rate for Full Sample

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Number of IPOs for most recent 5 years	0.665***							
Number of IPOs for most recent 7 years		0.428***						
Number of IPOs for most recent 10 years			0.183**					
Number of IPOs for most recent 12 years				-0.062				
IPO size for most recent 5 years					3.540***			
IPO size for most recent 7 years						5.240***		
IPO size for most recent 10 years							6.000***	
IPO size for most recent 12 years								4.400***
1-year lagged GMP growth rate	0.116***	0.116***	-0.129***	-0.117***	0.117***	0.118***	-0.131***	-0.120***
Unemployment rate	0.004***	0.004***	0.004***	0.005***	0.004***	0.004***	0.004***	0.005***
30-year mortgage rate	0.000	0.000	0.000	-0.001	0.000	0.000	0.000	-0.001

(*Continued*...)

(Table 11 Panel A Continued)

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Yield curve slope	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
SP500 return	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Bank tightening rate for matching period	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Constant	0.004	0.005	0.007	0.017	0.011	0.009	0.005	0.012
Observations	1443	1443	1348	1196	1443	1443	1348	1196
R-squared	0.8122	0.8112	0.8116	0.8179	0.8097	0.8123	0.8156	0.82
MSA, year and quarter FE	YES	YES	YES	YES	YES	YES	YES	YES
Clustering by MSA and quarter count	YES	YES	YES	YES	YES	YES	YES	YES

Panel B Highlights of Mortgage Market Performance Regression Results by Underperformed Loan Categories for Subsamples

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
IPO variable	Number of IPOs for most recent 5 years	Number of IPOs for most recent 7 years	Number of IPOs for most recent 10 years	Number of IPOs for most recent 12 years	IPO size for most recent 5 years	IPO size for most recent 7 years	IPO size for most recent 10 years	IPO size for most recent 12 years

(*Continued*…)

(Table 11 Panel B Continued)

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Full sample								
Foreclosure rate	0.665***	0.428***	0.183**	-0.062	3.540***	5.240***	6.000***	4.400***
90-day delinquency rate	1.103***	0.790***	0.259**	-0.300***	5.430***	8.310***	9.100***	7.710***
Easy loan subsample								
Foreclosure rate	0.105***	0.133***	0.065*	-0.046	0.390	0.360	-2.400***	-1.950**
90-day delinquency rate	0.421***	0.558***	0.461***	0.247	-0.170	-0.990	-10.450***	-11.560***
Recession subsample								
Foreclosure rate	2.884**	2.179***	-0.102	-0.189	0.530	19.680*	13.820***	-12.690
90-day delinquency rate	3.060	4.179***	0.516	0.479	-47.200**	37.350*	20.520**	13.910
Rebound subsample								
Foreclosure rate	3.838***	3.494***	3.354***	0.427	10.210***	12.610***	12.970***	11.960***
90-day delinquency rate	4.888***	4.447***	4.319***	-0.124	14.820***	19.210***	19.860***	19.580***

***Notes*:** Panel A reports coefficient estimates for GLS regressions of residential mortgage foreclosure rate at MSA-level of full sample (which includes observations for 2000-2018) for several scaled-adjusted IPO variables and control variables. Scale-adjusted IPO variables equal IPO activity variables divided by population of MSA in current quarter. In Specifications (1) to (4), the coefficients of IPO number variables are divided by 1000. In Model Specifications (5) to (8), the coefficients of IPO size are multiplied by 100,000. *Bank tightening rate for matching period* represents the cross-time average net percentage of US domestic banks tightening standards on household loans over the most recent 5, 7, 10, and 12 years for Model Specifications (1) to (4) and (5) to (8), respectively. Definitions of other variables can be found in Appendix. Panel B reports coefficients of IPO variables in regressions of foreclosure and 90-day delinquency rates for sample period and its different subperiods: *Easy loan* subsample includes observations for 2000-2007. *Recession* subsample includes observations for 2007-2009. *Rebound* subsample includes observations for 2010-2018. Regressions use MSA, year and quarter fixed effects, along with double clustering on the MSA and quarter count. *, **, and *** denote significance at 10%, 5%, and 1% levels, respectively.

Our results suggest that the negative impact of IPOs on mortgage performance, driven by the *counter-cyclical lending standard effect*, outweighs the potential positive effects such as the *wealth shock effect* through the wealth channel, *business booming effect* through the business channel, and *equity appreciation effect* through the housing price channel. Several factors may explain for this phenomenon. The positive effect of the wealth shock, which reduces financially driven defaults, may primarily benefit IPO-firm insiders and thus have a limited overall impact. Meanwhile, the effects of business booming and pricing, which improve employment, income and equity stability, may inadvertently lead to more lax standards for mortgage origination, thus resulting in long-term negative consequences for loan performance.

4.7 Economic Significance

We now want to evaluate the economic impact of the relationship between IPO activity and mortgage market performance outlined above. Given the complexities of quantifying this relationship with the two-stage regression results, our analysis primarily relies on the single-stage regression findings from Table 2. These results offer a comprehensive perspective on the effects of IPO activities on local mortgage performance, including both direct and indirect effects through channels such as the housing price channel. For instance, from the full sample regression results in Panel B, based on Model Specification (4), a one standard deviation increase in the number of IPOs for the most recent 5 years can increase the local mortgage foreclosure rate by 0.291% in the current quarter, which represents 35.294% of the sample median foreclosure rate (0.824%), and 12.236% of the sample standard deviation of foreclosure rate (2.377%). Following a similar analysis, a one standard deviation increase in the number of IPOs for the most recent 5 years also results in an increase of 19.428% for the 90-day delinquency rate, 13.471% for the pre-foreclosure rate, 51.419% for the REO ratio, and 53.689% for the auction ratio, from their respective full-sample medians. These translate to 12.132%, 7.224%, 21.249% and 17.525% of the standard deviation for the 90-day delinquency rate, pre-foreclosure rate, REO ratio, and auction ratio, respectively. These statistics indicate significant adverse effects of IPOs on the local mortgage market performance.

We can further measure the economic significance of the effects of IPO activities on the local mortgage market performance during specific sub-periods, based on the regression results in Panel C of Table 2. We find that, in alignment with the pattern of statistical significance of the IPO effects, their economic impact is generally more pronounced during the rebound period than in the easy loan or recession period. For example, with the rebound period, a one standard deviation increase in the number of IPOs for the most recent 5 years can lead to a 65.061% increase in the foreclosure rate and a 29.569% increase in the 90-day delinquency rate from their respective full-sample medians. In contrast, these figures are only 11.697% and 19.019% for the easy loan period. Our analyses that use alternative regression specifications for

mortgage loan underperformance also reveal substantial economic significance. These findings collectively suggest that IPO activities play a significant role in influencing the local mortgage market performance.

5. Conclusions

This paper presents a pioneering investigation into the potential interplay between the IPO activities of firms and performance of the mortgage loan market in MSAs where these firms are headquartered. Using a dataset that covers 1,100 U.S. IPOs from firms headquartered in 39 U.S. MSAs during the period of 2000-2018, we explore the relationships between long-term IPO activities and local mortgage loan market performance, with the latter measured based on different performance indicators. We also examine several potential mechanisms underlying these relationships, including those via the effects of IPOs on local housing prices, wealth of residents, cash-out behaviors, and business environment factors such as mortgage lending standards.

Our analysis shows an unexpected negative externality of IPOs via the contribution to the deterioration of local mortgage market performance, particularly reflected by the inflated local foreclosure and 90-day delinquency rates. This effect is more pronounced during the rebound period following the 2007-2009 Great Recession. Interestingly, this negative externality is higher when we isolate the impacts of housing price changes that result from IPOs, as post-IPO housing price increases tend to eliminate (instead of worsening) mortgage loan underperformance. Additionally, we observe a correlation between long-term IPO activities and an increase in the proportion of non-owner occupancy loans in local mortgage portfolios, contrary to the hypothesis that IPOs exacerbate local mortgage performance due to a wealth effect – wherein residents, enriched by IPOs, withdraw from the mortgage markets, thereby reducing the average quality of local mortgage loan borrowers. Furthermore, the relationship between long-term IPO activity and loan underperformance remains persistent even after controlling for long-term stock market returns. This challenges the hypothesis that IPOs drive cash-outs from mortgage markets to chase stock market gains, thus leading to excessive borrowing and subsequent loan underperformance.

We find that most IPO variables are positively associated with the MSA loan-to-household ratio and the median OLTV ratio of local mortgage loans. Moreover, the negative correlation between IPO size and the average performance of local loans is generally higher when we exclude MSAs that host national leading lenders (which have nationwide businesses and are least likely to be influenced by local events). The relationship between IPO activity and mortgage underperformance remains robust even after we control for lending constraints in the banking sector. These findings suggest a potential

alignment of the relation between IPOs and mortgage performance with the *counter-cyclical* lending quality changes identified in the banking literature.

An implication of our study is that major business events, such as IPOs, can significantly impact their local business environments.

Acknowledgments

We acknowledge helpful comments from several anonymous journal referees, Alexandr Akimov, Alla Koblyakova, Brent Ambrose, Akmalia Ariff, Pin-Te Lin, Yiran Niu, Tien Foo Sing, Eva Steiner, Yonglin Wang, Tao Yuan, and participants of the 2023 Asian Finance Association Annual Conference, 2023 AsRES-GCREC Joint International Real Estate Conference, 2024 AsRES-GCREC & AREUEA Joint International Real Estate Conference, 2025 European Financial Management Association Annual Conference, and 2025 European Real Estate Society Annual Conference.

References

Amromin, G., Huang, J., and Sialm, C. (2007). The tradeoff between mortgage prepayments and tax-deferred retirement savings. *Journal of Public Economics*, 91(10): 2014-2040.

Babina, T., Ouimet, P., and Zarutskie, R. (2017). 'Going Entrepreneurial? IPOs and New Firm Creation', SSRN Scholarly Paper No. ID 2692845. https://dx.doi.org/10.2139/ssrn.2924633

Baxter, V., and Lauria, M. (2000). Residential Mortgage Foreclosure and Neighborhood Change. *Housing Policy Debate*, 11(3): 675-699. https://doi.org/10.1080/10511482.2000.9521382

Becker, B., Bos, M., and Roszbach, K. (2020). Bad Times, Good Credit. *Journal of Money, Credit and Banking*, 52(S1): 107-142. http://dx.doi.org/10.1111/jmcb.12736

Bernstein, S. (2015). Does Going Public Affect Innovation? *Journal of Finance*, 70(4): 1365–1403. https://doi.org/10.1111/jofi.12275

Bernstein, S., McQuade, T., and Townsend, R. (2021). Do Household Wealth Shocks Affect Productivity? Evidence from Innovative Workers during the Great Recession. *Journal of Finance*, 76: 57–111. https://doi.org/10.1111/jofi.12976

Borisov, A., Ellul, A., and Sevilir, M. (2021). Access to public capital markets and employment growth. *Journal of Financial Economics*, 141(3): 896–918. https://doi.org/10.1016/j.jfineco.2021.05.036

Branikas, I., Hong, H., and Xu, J. (2020). Location Choice, Portfolio Choice. *Journal of Financial Economics*, 138(1): 74-94. https://doi.org/10.1016/j.jfineco.2019.10.010

Butler, A. W., Fauver, L., and Spyridopoulos, I. (2019). Local Economic Spillover Effects of Stock Market Listings. *Journal of Financial and Quantitative Analysis*, 54(3): 1025–1050.

Case, K., and Shiller, R. J. (1989). The Efficiency of the Market for Single-Family Homes. *The American Economic Review*, 79(1): 125–137.

Chen, C., and Stafford, F.P. (2016). Stock Market participation: Family Responses to Housing Consumption Commitments. *Journal of Money, Credit and Banking*, 48(4): 635-659. http://dx.doi.org/10.1111/jmcb.12313

Cornaggia, J., Gustafson, M., Kotter, J. D., and Pisciotta, K. (2024). Initial public offerings and the local economy: Evidence of crowding out. *Review of Finance*, 28(4): 1245-1273. https://doi.org/10.1093/rof/rfae011

Courchane, M., Kiefer, L., and Zorn, P. (2015). A Tale of Two Tensions: Balancing Access to Credit and Credit Risk in Mortgage Underwriting. *Real Estate Economics*, 43(4): 993-1034. https://doi.org/10.1111/1540-6229.12105

Dell'Ariccia, G., Igan, D., and Laeven, L. (2012). Credit booms and lending standards: Evidence from the subprime mortgage market. *Journal of Money, Credit and Banking*, 44(2-3): 367-384. http://onlinelibrary.wiley.com/doi/10.1111/j.1538-4616.2011.00491.x/abstract

Dell'Ariccia, G., and Marquez, R. (2006). Lending Booms and Lending Standards. *Journal of Finance*, 61(5): 2511-2546. https://doi.org/10.1111/j.1540-6261.2006.01065.x

Eriksen, M., Kau, J. H., and Keenan, D. (2013). The Impact of Second Loans on Subprime Mortgage Defaults. *Real Estate Economics*, 41(4): 858-886.

Fahlenbrach, R., Prilmeier, R., and Stulz, R. (2018). Why Does Fast Loan Growth Predict Poor Performance for Banks? *Review of Financial Studies*, 31(3): 1014-1063. https://doi.org/10.1093/rfs/hhx109

Field, L. C., and Hanka, G. (2001). The Expiration of IPO Share Lockups. *Journal of Finance*, 56(2), 471–500. DOI: 10.1111/0022-1082.00334

Fisher, L., and Lambie-Hanson, L. (2012). Are Investors the Bad Guys? Tenure and Neighborhood Stability in Chelsea, Massachusetts. *Real Estate Economics*, 40(2): 351-386. https://doi.org/10.1111/j.1540-6229.2011.00317.x

Focardi, C. (2002). Servicing Default Management: An Overview of the Process and Underlying Technology. *TowerGroup Research Note*, No. 033-13C (November 15, 2002).

Gao, W., Ng, L., and Wang, Q. (2011). Does Corporate Headquarters Location Matter for Capital Structure? *Financial Management*, 40(1): 113-138. https://doi.org/10.1111/j.1755-053X.2010.01136.x

Gao, X., Ritter, J. R., and Zhu, Z. (2013). Where Have All the IPOs Gone? *Journal of Financial and Quantitative Analysis*, 48(6): 1663–1692. https://doi.org/10.1017/S0022109014000015

Goetzmann, W.N., Peng, L. and Yen, J. (2012). The Subprime Crisis and House Price Appreciation. *Journal of Real Estate Finance and Economics*, 44(1): 36–66. doi: 10.1007/s11146-011-9321-4

Hartman-Glaser, B., Thibodeau, M., and Yoshida, J. (2023). Cash to Spend: IPO Wealth and House Prices, *Real Estate Economics*, 51(1): 68-102. https://doi.org/10.1111/1540-6229.12406

Howes, C., and Weitzner, G. (2023). Bank Information Production over the Business Cycle. SSRN Working Paper. http://dx.doi.org/10.2139/ssrn.3934049

Immergluck, D., and Smith, G. (2006). The External Costs of Foreclosure: The Impact of Single-Family Mortgage Foreclosures on Property Values. *Housing Policy Debate*, 17(1): 57-79. http://dx.doi.org/10.1080/10511482.2006.9521561

Jiang, F., Lowry, M., and Qian, Y. (2024). Local IPOs and Household Stock Market Participation. *Review of Finance*, 28(6): 1919–1952.

Jones, T., and Sirmans, G. S. (2015). The Underlying Determinants of Residential Mortgage Default. *Journal of Real Estate Literature*, 23(2): 169-205.

Kahn, C. M., and Yavas, A. (1994). The economic role of foreclosures. *Journal of Real Estate Finance and Economics*, 8: 35-51. https://doi.org/10.1007/BF01098915

Kenney, M., Patton, D., and Ritter, J. (2012). *Post-IPO Employment and Revenue Growth for U.S. IPOs, June 1996-2010* (SSRN Scholarly Paper No. ID 2063829). Rochester, NY: Social Science Research Network. http://dx.doi.org/10.2139/ssrn.2063829

Kraft, E., and Jankov, L. (2005). Does Speed Kill? Lending Booms and Their Consequences in Croatia. *Journal of Banking and Finance*, 29(1): 105-121. https://doi.org/10.1016/j.jbankfin.2004.06.025

LaCour-Little, M., and Yang, J. (2010). Pay Me Now or Pay Me Later: Alternative Mortgage Products and the Mortgage Crisis. *Real Estate Economics*, 38(4) (4): 687-732. https://doi.org/10.1111/j.1540-6229.2010.00280.x

LaCour-Little, M., and Yang, J. (2013). Taking the Lie Out of Liar Loans: The Effect of Reduced Documentation on the Performance and Pricing of Alt-A and Subprime Mortgages. *Journal of Real Estate Research*, 35(4): 507-554.

Li, L. (2016). The Role of Foreclosures in Determining Housing Capital Expenditures. *Journal of Real Estate Finance and Economics*, 53(3): 325-345.

Lin, Z., Rosenblatt, E., and Yao, V. W. (2009). Spillover Effects of Foreclosures on Neighborhood Property Values. *Journal of Real Estate Finance and Economics*, 38(4): 387-407. http://dx.doi.org/10.1007/s11146-007-9093-z

Lisowsky, P., Minnis, M., and Sutherland, A. (2017). Economic Growth and Financial Statement Verification. *Journal of Accounting Research*, 55(4): 745-794. https://doi.org/10.1111/1475-679X.12165

Loutskina, E., and Strahan, P. (2011). Informed and Uninformed Investment in Housing: The Downside of Diversification. *The Review of Financial Studies*, 24(5): 1447-1480.

Marshall, A. (1980). *Principles of Economics.* London: Macmillan.

Rohe, W. M., Van Zandt, S., and McCarthy, G. (2002). 'The Social Benefits and Costs of Homeownership: A Critical Assessment of the Research'. In Retsinas, N. and Belsky, E. (eds.) *Low-Income Homeownership: Examining the Unexamined Goal*. Washington DC: Brookings Institution Press, pp. 381–406.

Mian, A., and Sufi, A. (2011). House Prices, Home Equity-Based Borrowing, and the US Household Leverage Crisis. *American Economic Review*, 101(5): 2132 – 2156. DOI: 10.1257/aer.101.5.2132

Nguyen, T., Staer, A., and Yang, J. (2022). Initial Public Offering and Local Housing Markets. *Journal of Real Estate Research*, 44(2): 184-218. https://doi.org/10.1080/08965803.2021.2011559

Ong, S. O., Neo, P. H., and Spieler, A. (2006). Price Premium and Foreclosure Risk. *Real Estate Economics*, 34(2): 211-242. http://dx.doi.org/10.1111/j.1540-6229.2006.00165.x

Passmore, W., and Sherlund, S. (2021). FHA, Fannie Mae, Freddie Mac and the Great Recession. *Real Estate Economics*, 49(3): 733-777. https://doi.org/10.1111/1540-6229.12296

Pirinsky, C., and Wang, Q. (2006). Does Corporate Headquarters Location Matter for Stock Returns? *Journal of Finance*, 61(4): 1991-2015. https://econpapers.repec.org/scripts/redir.pf?u=https%3A%2F%2Fdoi.org%2F10.1111%2Fj.1540-6261.2006.00895.x;h=repec:bla:jfinan:v:61:y:2006:i:4:p:1991-2015

Rodano, G., Serrano-Velarde, N., and Tarantino, E. (2018). Lending Standards over the Credit Cycle. *Review of Financial Studies*, 31: 2943-2982.

Simons, R. A., Quercia, R. G., and Maric, I. (1998). The Value of Residential Construction and Neighborhood Disinvestment in Residential Sales Price. *Journal of Real Estate Research*, 15(2): 147-161. https://doi.org/10.1080/10835547.1998.12090921

Titman, S., and Tsyplakov, S. (2010). Originator Performance, CMBS Structures, and the Risk of Commercial Mortgages. *Review of Financial Studies*, 23(9): 3558-3594. http://dx.doi.org/10.2307/40865485

Titman, S., Wang, K., and Yang, J. (2014). The Dynamics of Housing Prices. *Journal of Real Estate Research*, 36(3), 283–317. http://dx.doi.org/10.2139/ssrn.2199115

Zurek, M. (2022). Real Estate Markets and Lending: Does Local Growth Fuel Risk? *Journal of Financial Services Research*, 62: 27-59.

Appendix: Variable Definitions

Variable	Definition
Year	Observation year
Loan count growth rate	Mortgage-loan-number annual change rate
Foreclosure rate	Fraction of mortgage loans with foreclosure
90-day delinquency rate	Fraction of mortgage loans with 90 or more days of delinquency
Pre-foreclosure rate	Fraction of mortgage loans with pre-foreclosure
REO loan ratio	Fraction of mortgage loans with REO
Auction loan ratio	Fraction of mortgage loans with auction
Non-owner occupancy loan ratio	Fraction of mortgage loans for non-owner-occupied houses
Loan-to-household ratio	MSA mortgage loan number to household number ratio
OLTV	MSA median original loan to value ratio
Price growth rate	Annualized change rate of FHFA housing price index
GMP growth rate	GMP annual change rate
Population growth rate	MSA population annual change rate
Unemployment rate (%)	MSA unemployment rate
Affordability	MSA housing affordability index
IPO number (per thousand)	Number of IPOs per capita
IPO size ($100 Million)	Value of IPOs per capita (based on stock price at the IPO date)
SP500 return (%)	S&P 500 index annual change rate
3-month T-Bill rate (%)	3-month Treasury Bill interest rate
30-year mortgage rate (%)	Average loan rate of the 30-year fixed rate mortgage in the U.S., not seasonally adjusted
Yield curve slope	Ratio of the 10-year Treasury bond rate to the 2-year Treasury note rate
Bank tightening rate (%)	Net percentage of domestic banks tightening standards on household loans (that is, percentage of banks tightening lending standards - percentage of banks easing lending standards), weighted by outstanding loan balances of banks, not seasonally adjusted