The Impact of Collateral Value on Mortgage Originations

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Abstract

Collateral, a debt contracting feature, affects risk of investments. I investigate how investment risk responds to stronger creditor rights, which increase collateral pledgeability. Exploiting the 2005 bankruptcy policy change – strengthening mortgage collateral creditor rights – shows stronger creditor rights shift new mortgages toward risky alternative structures. Minority-dominant zip codes are more exposed to these alternative mortgages featuring low documentation and negative amortizing payments. These mortgages have correlated payment resets, higher defaults, and lead to worse longer-term credit outcomes. The results highlight the importance of ensuring collateral maintains price stability before granting it super-senior bankruptcy status, which increases both product innovation and salability – fueling fire sales.

Keywords: collateral, superpriority, bankruptcy, contract types, repo safe harbor, bapcpa, mortgage backed securities, race
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Expanding homeownership rates among low income and high income volatility borrowers has long been a policy goal of federal agencies. Yet the distributional consequences of credit expansion depend critically on the funding structures and contract types through which it is delivered. The Global Financial Crisis (GFC) revealed that foreclosure rates were heavily concentrated in minority neighborhoods, but the mechanisms linking seemingly race-neutral credit supply shocks to these disparate outcomes and the longer-term effects remain poorly understood.

This paper studies how strengthening creditor rights in wholesale funding markets altered the allocation and risk of mortgage lending, with disproportionate consequences for minority borrowers. I exploit the April 2005 Bankruptcy Abuse Prevention and Consumer Protection Act (BAPCPA), which granted private-label mortgage loans and related securities super-senior bankruptcy status by exempting them from the automatic stay. This change sharply increased the "pledgeability" of such collateral in the sale and repurchase ("repo") market, allowing dealer-banks to repledge mortgages funded with repo warehouse lines – thereby reducing their cost of capital (Lewis (2023)). While BAPCPA increased the capacity of Independent Mortgage Companies (IMCs)—non-depository lenders that originated roughly one-third of U.S. mortgages in 2005—it also created incentives to originate loan types that maximized near-term origination volume but heightened default levels in downturns. I combine detailed loan-level and zip code–level mortgage data with a continuous difference-in-differences design using pre-2005 IMC market share as treatment intensity. Centering the empirical analysis around BAPCPA isolates the causal role that the policy change plays in the expansion of risky alternative mortgage products – such as balloon, negative amortizing, and two step mortgages – and the type of borrowers exposed to them. I document four main findings.

First, the policy change leads to an increase in alternative mortgages originated disproportionately to minority-dominant zip codes. An increase in pre-period treatment, IMC market share, leads to a sharp relative decline in total mortgage originations in Black zip codes even while it led to an increase in white zip codes and no significant change in Latino zip codes. Although minority zip codes did not experience a significant increase in overall originations, their exposure to alternative mortgage products increased disproportionately relative to white zip codes. A 10% increase in treatment increased balloon mortgages by 46% for Latino zip codes, 29% for Black zip codes, and 17% for white zip codes. Other alternative products, such as negative amortizing and two-step mortgages, exhibit similar results at the zip code level. Merging a subset of novel loan level data to originator information enables me to create a loan level indicator for loans originated by IMCs at the monthly frequency. Consistently, in the loan level data, IMCs disproportionately increase originations of alternative

mortgages in response to BAPCPA and especially so in minority zip codes.

Second, the policy change leads to a modest increase in credit scores but a pronounced decline in full documentation mortgages. Following BAPCPA, average credit scores rose significantly in white and insignificantly in Black and Latino zip codes. While these increases suggest a slight improvement in borrower creditworthiness, they were likely too modest to offset the heightened risk associated with the alternative mortgage structures. Additionally, full documentation mortgages decreased sharply for Black zip codes, decreased insignificantly for Latino zip codes, and increased for white zip codes. Lower documentation indicates that borrower income and assets are not fully verified, which increases the likelihood that borrowers will be ill-equipped to handle future mortgage payment resets, creating implications for default.

Third, both early payment defaults and total defaults, by month of origination, increase disproportionately in minority zip codes following the policy change. For early payment default, a unit increase in pre-period treatment drives a percentage point increase 4.5 times larger in Black zip codes than in white and Latino zip codes. Early payment default is typically an indicator of potential risk management issues since mortgages that are underwritten well are unlikely to default in the first year. Latino zip codes experience the largest increase in total defaults, with a percentage point increase nearly twice as large as that in white zip codes, and Black zip codes experience an increase that is 1.7 times that in white zip codes. I estimate a robustness test that controls for income growth in the racial subgroup regressions and the differential increase in alternative mortgages and defaults persists for minority-dominant zip codes. Majority Black and Latino zip codes also experienced disproportionately large increases in foreclosure rates relative to white zip codes, despite receiving similar or smaller increases in overall mortgage originations and bankruptcy filings rose consistent with higher rates of mortgage distress. Home prices in these communities fell more steeply during the subsequent downturn, amplifying wealth losses and widening preexisting racial gaps in housing equity. Consumer Credit Panel data show that, relative to white zip codes, more treated minority zip codes saw elevated revolving balances for mortgage, student, and auto loan through 2010, consistent to 2004 exposure to IMCs driving higher rates of broader financial distress in 2010.

Fourth, the rapid expansion of alternative mortgages created timing coordination on borrower payment reset dates. The results show that BAPCPA drove introductory interest rates to decrease, increasing the likelihood of large payment shocks when the mortgage payments reset to market rate. Limiting to mortgages that experience an interest rate reset, I create a payment shock indicator, equal to one if a mortgage payment increases by 10% or more at the time of the first reset. Beginning six months after the policy change, the probability of

experiencing a payment shock increases disproportionately if the mortgage was originated in a zip code with higher pre-period IMC market share. This timing is consistent with a burst of adjustable rate mortgages being originated immediately following BAPCPA. Since alternative mortgage products have reset dates that cluster around six, twelve, and 24 months, the elevated pay shock probability begins to set in six months after the policy change. In the post-period, Latino, Black, and white borrowers all face an increased probability of experiencing a payment shock, conditional on having a payment reset. However, minority zip codes were more likely to receive mortgages featuring resets with lower rates of full documentation, making them more exposed to payment shock risk, as their income and assets –even in normal times– were not fully verified. At the county level, mortgage application data indicate that alternative mortgages post-BAPCPA drove a demand amplification mechanism and the FHA share of lending fell in treated markets, consistent with private-label securitization displacing government-backed loans that traditionally served higher-risk borrowers.

Studying the effects of the 2005 policy change has important macro and micro implications for the design of the bankruptcy code. At the macro level, exemption from automatic stay can exacerbate fire sales of collateral during a downturn. The exemption allows creditors to seize and sell collateral immediately upon bankruptcy, bypassing court proceedings and accelerating liquidation. While the automatic stay is in place, the creditor's focus is to keep the debtor out of bankruptcy to avoid having their claims tied up. In contrast, exemption from automatic stay shifts the creditor's focus to the market value of collateral and incentivizes creditors to demand collateral as prices decline (Maclachlan (2014)). This shift increases the risk of fire sales, especially when the underlying collateral cannot maintain its value under stress. In order to mitigate the risk of fire sales, the collateral's ability to maintain its price in a crisis becomes of primary importance. If the policy change incentivizes lenders to originate riskier collateral, as the results show, then the likelihood of sharp price declines – and resulting fire sales – increases. At the micro level, the theory documented in Bond et al. (2009) shows that highly collateralized loans can be associated with predatory lending characterized by improper regard to borrower ability to repay, balloon payments, and poorly informed borrowers. My empirical results are consistent with this theory.

A growing literature has documented that the majority of foreclosures during the GFC were clustered in minority zip codes (Haughwout et al. (2020), Kermani and Wong (2021), Rugh (2015)).[1] However, why these minority borrowers were the hardest hit remains less well understood. This paper sheds light on this question by documenting that BAPCPA allowed

[1]Early 2021 versions of the proposed Congressional Bill, the Down Payment Toward Equity Grant, awarded subsidies to first time home buyers whose parents suffered a foreclosure during the GFC. The conventional wisdom at the time was that since minorities suffered higher rates of foreclosure during the GFC, this provision would implicitly offer grants to minority home buyers.

loans to vulnerable borrowers to be more easily securitized in the private market, backed by a runnable funding pipeline with limited oversight. Davis et al. (2023) and Adelino et al. (2020) show that during 2005-2006, private-label mortgages became a substitute for Federal Housing Administration (FHA) and Veterans' Affairs (VA) mortgages – mortgages designed to support homeownership for households with limited financial means. The micro and macro effects of the policy change expose borrowers to increased risk of default in the following ways. First, BAPCPA shifted mortgage loans toward risky alternative mortgages and increased correlation in borrower payment resets. The increased correlation in the underlying loans would diminish the mortgage collateral's ability to maintain its price in a crisis – especially if the increased correlation was not priced correctly – making the repo funding pipeline susceptible to sudden fire sales. Second, this fragility in the private-label funding pipeline would reduce the availability of credit. When paired with negative amortizing loans, reduced credit availability would impede borrowers – especially vulnerable ones – from refinancing to avoid costly near-term payment resets, thereby increasing defaults and foreclosures.

The results are consistent with the stronger creditor rights allowing the risk of newly originated mortgage collateral to increase while leaving the lender's expected recovery value unchanged. Therefore, an implication for bankruptcy code design is that verifying collateral's price stability in a crisis before granting it superpriority is important since superpriority increases both collateral risk and creditors' ability to sell collateral, increasing the likelihood of fire sales. The Global Financial Crisis (GFC) provoked significant bank regulation aimed at preventing its reoccurrence. Yet, although Roe (2010) referred to the 2005 bankruptcy code change as a "financial crisis accelerator," revisions to the bankruptcy code have largely been neglected. Furthermore, if another lightly regulated repo collateral class – conducive to product innovation – was granted exemption from automatic stay in the future, the risks documented in this paper could re-emerge.

Literature Review This paper contributes to several strands of the literature. First it helps to reconcile the open debate of whether the housing boom was driven by an expansion in credit supply or expectations (at the macro level: Acharya et al. (2011); Kaplan et al. (2020), and at the micro level: Mian and Sufi (2009); Adelino et al. (2018)). Lewis (2023) documents that BAPCPA 2005 created a credit supply increase by creating a money multiplier effect in the repo market and traces out the transmission of this credit supply increase. This paper innovates by establishing that BAPCPA shifted mortgage originations toward alternative amortization products and that minority-dominant, low-income-growth zip codes received a disproportionately large fraction of these alternative mortgages post-BAPCPA. Although these alternative products were originated in low-income growth, minority dominant zip

codes, I show they were originated to borrowers with moderately higher credit scores, likely in an attempt to offset the risk associated with the alternative products, and were recorded as prime mortgages.

This paper offers an explanation to the puzzle of why the 2005-2007 cohort mortgages performed much worse than the 2000-2004 cohorts controlling for borrower characteristics (Gerardi et al. (2008); Haughwout et al. (2008); Mayer et al. (2009); Demyanyk and Van Hemert (2011); Bhardwaj and Sengupta (2012)). Haslag et al. (2024) find that competition among securitization sponsors induces innovation in mortgages following the 2000 HUD directive to the GSEs to increase securitization of low-income borrower mortgages. Palmer (2024) proposes that negative equity increases borrower likelihood of default in the face of even small home price declines. I document that 2005-2007 borrowers were disproportionately likely to receive alternative mortgages, including negative amortizing loans, with less than fully documented assets and income post-April 2005, due to BAPCPA.

My paper also contributes to the robust discussion around the effect of bankruptcy code on creditors' priority over pledged assets and the ex ante incentives it creates (see, e.g., Scott (1977); Jackson and Kronman (1978); Stulz and Johnson (1985); Hart (1995); Bebchuk and Fried (1995); Vig (2013); Duffie and Wang (2017); Donaldson et al. (2020)) and to the debate on whether repo should receive preferred bankruptcy treatment (Lubben (2010), Roe (2010), Skeel and Jackson (2012)). Supporters argue it improves stability of the financial markets (Edwards and Morrison (2005)). However, Duffie and Skeel (2012) propose four risks associated with granting repo preferred bankruptcy status: lowering repo lenders' incentive to monitor collateral; increasing their ability to become too big or interlinked to fail; increasing inefficient substitution toward short-term repo funding; and increasing risk of fire sales. Lewis (2023) documents empirical evidence of increased interlinkages and use of repo financing post-BAPCPA. Ganduri (2023) documents that the policy change decreased monitoring of non-bank mortgage companies. Theoretically, Acharya et al. (2024) documents that repo safe harbor can lead to an increase in leverage among the most levered counterparties and Dybvig and Hou (2023) argue that it can lead counterparties to gamble. Morrison et al. (2013) note that preferred bankruptcy treatment for repos was intended for collateral with price stability. This paper innovates by documenting that BAPCPA drives innovation in mortgage product types and creates synchronized payment shocks, which destabilize the price of mortgage securities in a crisis and amplify the risk of repo fire sales.

This paper also relates to the literature on the private creation of safe debt. Bernanke (2005) describes a global savings glut characterized by foreign countries' increasing demand for safe assets. Diebold and Richter (2023) find that a large fraction of the total supply of US credit prior to the GFC was funded by foreigners. Gorton et al. (2012) suggest that the

demand for safe debt exceeds the supply of US Treasuries and that the private sector can produce substitutes for government debt. My paper proposes that BAPCPA created the technology that allowed foreign credit to enter the US housing market to fund private-label mortgages by enabling dealers to finance these mortgages by repledging mortgage collateral in the tri-party market. Consistently, Srinivasan (2024) shows that post-BAPCPA, dealer tri-party borrowing backed by private-label mortgages increased and Krishnamurthy et al. (2014) state that the tri-party repo market is the market through which cash enters the shadow banking system.

This paper also relates to the literature on collateral value and credit provision. The literature shows that an increase in collateral value increases credit provision by decreasing interest rates and increasing debt maturity (Cerqueiro et al. (2016); Benmelech (2009); Benmelech and Bergman (2009, 2011); Benmelech et al. (2005)). I innovate relative to this literature by establishing that increasing collateral value in the secondary market changes primary market debt contract types from conforming to alternative mortgages.

Finally, this paper contributes to a growing literature on racial disparities in housing markets: returns to housing (Kermani and Wong (2021); Drukker and Ma (2024)), home prices (Bayer et al. (2017); Ihlanfeldt and Mayock (2009); Myers (2004), unfavorable property tax assessments (Avenancio-León and Howard (2022)), interest rates and fees (Bartlett et al. (2022); Bhutta and Hizmo (2021); Fuster et al. (2022); Ambrose et al. (2021)), down payment constraints (Gupta et al. (2023)), and refinancing behavior (Gerardi et al. (2023)). Li and Mayock (2019) show that minority loans originated during 2005-2009 were more likely to have several high-risk characteristics – consistent with actual minority borrowers receiving these loans. not just minority zip codes. I innovate both by documenting why minority loans were more likely to exhibit these high-risk characteristics and by showing differential credit expansion, contraction, and credit outcomes by demographic group. As shown in Li and Mayock (2019) individual minority borrowers were receiving alternative loans, thus I use racial makeup of a zip code to proxy for race, and the evidence suggests we can interpret these effects as actual effects for borrowers of that race themselves.

1 Data

Dealer Repo Financing Data. I use the Federal Reserve Bank of New York's weekly survey of primary dealers (FR 2004) to measure primary dealers' aggregate trading activity by collateral class. Due to their role making the market for US Treasuries, the primary dealers are required to report trading data to the Federal Reserve. There is no external data dictionary identifying financing positions and collateral classes for these data outside

the Federal Reserve. To overcome this, I hand match the FR 2004 variables to the survey instructions given to the survey respondents in order to create a weekly time series of total dealer holdings and secured financing by collateral class. Matching the FR 2004 variables to the survey instructions allows me to establish that, prior to 2013, the data included dealers' trading in private-label mortgage collateral in the line item *corporate securities*, as discussed in Lewis (2023) online appendix A.1.

These data allow me to study whether primary dealers' repledging of private-label collateral in the repo markets increased post BAPCPA. The key variables that I utilize are *securities out* and *securities in*. Securities out reports dealers' secured borrowing (cash received) and securities in reports dealers' secured lending (cash lent).[2] The FR 2004 data is likely to be representative of trading activity in the repo markets as a whole during 2005-2007 since it reports the primary dealers' aggregate activity in both the tri-party and bilateral repo markets. Copeland, Martin and Walker (2014) states that primary dealers made up 79% of all dealer activity in the tri-party repo market in July and August 2008 and assumes that this percentage holds across both the bilateral and tri-party repo markets.

Home Mortgage Disclosure Act (HMDA) Data. To establish the effect of BAPCPA on IMCs' lending to households, I utilize the HMDA data. In order to supervise and enforce fair lending practices nationwide, the US Congress mandates that all loan applications related to home purchase, refinancing, and home improvement are reported to the federal government. The main variables that I use are who the originator was, whether the originator was an IMC, the year, and region in which it was originated, the race of the borrower, and mortgage status (denied, approved, originated).

I use these data to construct the IMC zip-code-level market share in 2004, the year prior to BAPCPA. To identify the IMCs, I use the crosswalk maintained by Robert Avery to match subsidiaries to their parent company and aggregate mortgages originated by the parent company. I define a mortgage company as an IMC if it underwrites and funds a loan in its own name, following the HMDA definition of IMCs. In Appendix J, I study mortgage acceptance rates by lender type and race.

CoreLogic Data. I use the CoreLogic Loan Level Market Analytics (LLMA) data to study mortgage characteristics pre- and post-BAPCPA. Due to data restrictions, in this dataset I do not observe the originator of a mortgage, prohibiting comparison of the individual mortgages originated directly by IMCs versus non-IMCs, pre- and post-BAPCPA. To overcome this in the main analysis, I aggregate all variables to the zip code level and merge them with the 2004 IMC market share in a region to analyze the effect of exposure to IMC lending on

[2] *Securities out* and *securities in* include repos/securities lending and reverse repos/securities borrowing, respectively. See: FR 2004 and Infante (2019) p. 46.

changes in mortgage characteristics.

The LLMA data contain detailed information on mortgage characteristics at origination as well as monthly performance data for a large sample of anonymized borrowers. CoreLogic collects these data from 25 of the largest mortgage servicers in the US. The data track approximately 5.7 million mortgages each year and in a typical year during 2003-2008, include 45% of mortgages originated in the US.

I also utilize the Non-Agency Residential Mortgage Backed Securities (NARMBS) data. These data cover private-label mortgages and include originator name. I conduct a fuzzy merge to HMDA data which allows me to identify originators as IMCs for a subset of the data. I describe the merge in Appendix M. I utilize these data to verify that patterns in the zip-code-level regressions remain consistent in the loan level data.

Income and Race Data. This paper merges data on income and race by zip code. Average income is estimated from the IRS's Statistics of Income (SOI) data between 2001 and 2004 using the number of tax returns filed in a given income bracket relative to the total number of tax returns filed in that zip code. Race data is from the 2000 Census data. A detailed description of the race variables used can be found in Appendix A.

Consumer Credit Panel Data. This paper utilize the University of California's Consumer Credit Panel data to study borrower credit outcomes. The key variables that I study are borrowers' mortgage, student loan, and auto loan balances. I merge on the zip code level independent mortgage company market share in 2004 as well as race and income data.

2 Institutional Background

The exposition in this section largely follows that in Lewis (2023). In order to understand the credit supply increase that BAPCPA generated, and therefore the research design, this section describes (1) the structure of IMC repo credit lines from dealers; (2) how dealers operate in the repo market; (3) how BAPCPA affected the interactions between dealers and IMCs.

2.1 Institutional Background of the Sale and Repurchase "Repo" Market

The sale and repurchase, or "repo," markets are large short-term funding markets where securities are sold and repurchased by the borrowing institution, creating short-term loans from the lending institution, which are collateralized by financial assets.[3] These repo loans serve

[3]For a succinct description of repos see *Bevill, Bresler & Schulman Asset Management Corp. v. Spencer Sav. & Loan Ass'n* (1989) 878 F.2d 742, 743 (3d Cir. 1989).

the same economic function as collateralized loans, except that the exchange of collateral is considered an outright sale followed by a repurchase.

Large securities dealers often lend cash in the repo markets and use the securities they obtain in those transactions as collateral to borrow for their own interest, i.e., dealers re-pledge, rehypothecate, or reuse the collateral they receive. The dealer will typically offer a lower interest rate on the repo loan if the client allows the dealer to rehypothecate the assets that serve as collateral (Copeland et al. (2014)). This suggests both that the ability to repledge collateral is valuable for the dealer, and that dealers have a valuation for ability to repledge collateral that can be expressed as an interest rate.

Independent Mortgage Company Warehouse Repurchase Facilities. Independent mortgage companies are not deposit taking institutions. They depend heavily on the sale of their mortgages in order to fund themselves. This sale typically takes between 30-60 days. In the meantime, mortgage companies originate mortgages, package them into a warehouse facility and use this warehouse facility to borrow against. The repayment of these warehouse credit lines varies by contract but they are often repayable either when the financed mortgages are sold or on the maturity date of the contract.[4]

Lewis (2023) carefully studies the warehouse credit lines for the 12 largest IMCs and shows that the 29 largest dealers were their main funders and that the dealers passed their credit supply increase on to the IMCs that they were funding. Stanton, Walden and Wallace (2014) finds that five of these 12 IMCs originate a minimum of 49% of all IMC mortgage lending in 2006. As a lower bound, I estimate that the 12 IMCs are responsible for 59% of all IMC originations in 2006. I estimate this by adding mortgage purchases to the origination figures for the top five IMCs in Stanton, Walden and Wallace (2014) and estimating the remaining seven IMCs' originations using HMDA market share. This number is a lower bound since I do not observe the correspondent purchases by the additional seven IMCs. Given that the 12 largest IMCs studied in Lewis (2023) make up a minimum of 59% of all IMC originations in 2006, and that they all utilize the same warehouse funding structure, in the empirical section of the paper, I assume that all IMCs are treated by BAPCPA.

Repo Market Functioning. Copeland, Martin and Walker (2014) estimate that during July-August 2008, the sum of all repos outstanding on a typical day was approximately $6.1 trillion. The sum of all reverse repos outstanding was about $4 trillion.[5] The main users of repos are large dealer banks and other financial institutions such as money market funds

[4]See: HomeBanc 2005 10-Q3 p 101 of 173.

[5]About 40% of repo activity was in tri-party repos and the remaining 60% was in bilateral repos. About 92% of reverse repos took place in the bilateral market. Due to double counting, summing the total repo and reserve repo values may overstate the total size of the market. Copeland, Martin and Walker (2014) p. 2348.

(MMFs), hedge funds, and IMCs.

The repo market consists of two segmented markets: the **bilateral** and the **tri-party** market. The tri-party market is the market that connects dealers with large credit worthy nonbank cash lenders such as MMFs and securities lenders. Krishnamurthy, Nagel and Orlov (2014) state that the tri-party market is the way in which cash funding enters the shadow banking system through repo. Dealers play an important role as repo intermediaries between cash lenders and cash borrowers across these markets. Dealers are likely to be cash borrowers (send securities out), in the tri-party market (Infante (2019)), and to be cash lenders (receive securities in) in the bilateral market (Copeland, Martin and Walker (2014)). Dealers prefer to use borrowed capital to finance their borrowing rather than to use their own scarce capital, so they repledge collateral received in the bilateral market to borrow in the tri-party market (Tuckman (2010); Copeland, Martin and Walker (2014)). This reuse of collateral allows dealers to take advantage of the differential between haircuts in the bilateral and tri-party markets to generate a cash "windfall" (Infante (2019)).

Lower overcollateralization rates or "haircuts" are charged in the tri-party market, due to lower counterparty risk. This is because of the traditionally more creditworthy market participants – large dealers and cash investors – and because the collateral is held by a clearing house (the third party), and the contracts are short-term in nature. The clearing house plays several important roles, such as settling and netting transactions, and the bankruptcy treatment of collateral affects the clearing house's ability to perform these functions. The bilateral market is where opaque, less credit-worthy agents seek short-term funding. The cash borrowers in this market are riskier and face larger haircuts on collateral to protect the dealers lending to them. The bilateral repo market is the market through which funds are reallocated between dealers and across dealers and hedge funds, or mortgage companies.

Bankruptcy Abuse Prevention and Consumer Protection Act of 2005. As background, the automatic stay places a hold on a firm's assets when the firm enters bankruptcy proceedings. This hold would interfere with the clearing houses' timely settlement of collateral in the event of bankruptcy. This would make the tri-party market unwilling to hold collateral exposed to automatic stay and thus limit dealers' ability to reuse such collateral.

Repurchase agreements that use collateral types explicitly defined in the bankruptcy code receive an exemption from the automatic stay, which grants the holder of the underlying collateral superpriority, or super-senior bankruptcy status, also called safe harbor. However, collateral types that are not explicitly defined in the bankruptcy code are also traded in the repo markets. All repurchase agreements are written with the standard contract in the hopes that the court will interpret them as receiving preferred bankruptcy status. However, the preferred bankruptcy status relies on the court's interpretation of the repo contract

(Lumpkin (1993)). For example, the court decided against the safe harbor of repo collateral for Lombard Wall (1982) and Criimi Mae (2000). This shocked the market and led to a steep contraction, implying that upon the court's decision, the collateral was less valuable than previously perceived. The market response to these court cases suggests that collateral must be legally exempt from automatic stay in the bankruptcy code to unequivocally qualify for preferred bankruptcy status. I discuss these court cases further in the Lewis (2023) Online Appendix A.

BAPCPA was introduced in Congress in February 2005 and signed into law in April 2005.[6] The law expanded the definition of repurchase agreements in the Bankruptcy Code to include: (1) mortgage loans; (2) mortgage-related securities; (3) interests in mortgage-related securities or mortgage loans. This granted private-label mortgage securities and whole loans exemption from the automatic stay, giving the final creditor super senior bankruptcy status or safe harbor. This expansion of the bankruptcy code only affected private-label mortgage collateral, since agency mortgage collateral had been granted the same exemption by the Bankruptcy Amendments Act of 1984.

The evidence in Lewis (2023) is consistent with BAPCPA enabling the clearing house in the tri-party market, or other counterparties, to hold private-label mortgage collateral without worry that a counterparty's failure would trigger automatic stay. Consistent with tri-party market lenders increasing their willingness to lend against private-label mortgage collateral, Srinivasan (2024) finds that, following BAPCPA, haircuts on private-label mortgage collateral in the tri-party market fell from above 20% to 3%. Suggesting that BAPCPA enabled dealers to reuse, or repledge, warehoused private-label mortgage loans or newly minted mortgage-backed securities in the tri-party market in larger quantities than they had been able to prior to the law change. The below example would go through if dealers were able to repledge whole mortgage loans from the mortgage warehouse, or if they were able to securitize the warehoused loans quickly and pledge the newly minted securities.[7,8]

BAPCPA's Expansion of Repo Safe Harbor. This section sets up a simple example

[6]The law was introduced in Congress on February 1, 2005 by Republican Senator Chuck Grassley, passed by Congress on April 14, 2005, and signed into law by the president of the US on April 20, 2005 (https://www.congress.gov/bill/109th-congress/senate-bill/256/text/enr). It applied to consumer bankruptcy cases after October 17, 2005. See: Bankruptcy Abuse Prevention and Consumer Protection Act of 2005, Pub. L. No. 109-8, §907, 119 Stat. 23, 171-172 (codified as amended at 11 U.S.C. §101(47) (2012))

[7]From speaking with market participants, dealers were able to securitize collateral usually within several days or weeks.

[8]The drop in haircuts is consistent with the collateral being considered safer and more likely to be held in the tri-party market. Adrian et al. (2009) discusses the increased use of private-label mortgage collateral in the tri-party market saying: originally focused on the highest quality collateral - Treasury and Agency debt - repo transactions by 2008 were making use of below-investment- grade corporate debt and equities and even whole loans.

depicting the effect that BAPCPA had on dealers' reuse, or repledging of collateral. The example illustrates why IMCs are defined to be treated in the empirical results, since IMCs are very exposed to dealer credit lines.

Figure 1 depicts the proposed change from pre-BAPCPA (panel (a)) to post-BAPCPA (panel (b)) in dealers' ability to repledge the warehoused mortgage loans posted by an IMC.[9] In (a) the collateral was held – with limited reinvestment capability – to protect dealers from the default risk of the mortgage companies. In (b), Lewis (2023) shows that that the policy change increased dealers' ability to repledge the collateral. This allowed dealers to take advantage of the differential between the haircuts, that they charged in the bilateral market and received in the tri-party market, to create a repo money multiplier which expanded credit supply.

[FIGURE 1 about here.]

The literature documents, both theoretically (Gottardi, Maurin and Monnet (2019)) and empirically (Copeland, Martin and Walker (2014), Infante (2019)), that differences in haircuts between the bilateral and tri-party market are larger for riskier collateral classes. The larger haircut differentials imply larger repo money multiplier potential. To establish the size of the haircut that dealers charged the IMCs, Lewis (2023) utilizes data from a subset of the IMCs that report both their utilization on credit lines and the value of mortgages they post. In 2005Q4 an *IMC* posted a 36% haircut to insulate dealers from the IMC's risk of default. BAPCPA's improved creditor rights on private-label collateral (securities or whole mortgage loans) decreased haircuts required on collateral posted by the *dealer* in the tri-party market to 5% (as in Copeland et al. (2014) or 3% as in Srinivasan (2024)).

Imagine that pre-BAPCPA, the dealer funded the IMC initially with $100 of capital (the "*first round*" of lending), the 36% haircut implies that the IMC posted $136 worth of collateral to secure the repo loan, and the dealer held the collateral. Figure 1, depicts this as a dealer paying $100 to buy mortgage collateral valued at $136, from the mortgage company in the bilateral market, with an agreement to sell it back in 60 days at $100. The above haircuts imply that post-BAPCPA, dealers could re-sell the $136 collateral for $130 in the tri-party market. The process would work as follows. If the dealer funded the IMC with the initial $100 of capital, the dealer could borrow $130 by repledging the IMC's $136 collateral in the tri-party repo market at a haircut of 5%. If the dealer reinvested in warehouse mortgage loans by lending the $130 back to the IMC (the "*second round*" of lending), and haircuts

[9] Although Figure 1 (b) and the argument below focus on reuse of warehoused mortgage collateral in the tri-party market, the argument would go through if dealers increased reuse of collateral in the bilateral market at lower haircuts than they received prior to the policy change.

remained the same, the IMC would post $176.8 of new mortgages to secure the repo loan. By repledging this $176.8 of mortgage collateral, the dealer could borrow $169 in the tri-party market. This cycle of: lending to an IMC, receiving collateral from the IMC, repledging the collateral to a cash lender, and reinvesting the cash in the IMC could continue for many rounds.

This haircut differential would lead to a money multiplier, similar to the multiplier in the fractional reserve banking system. Moreover, the dealer has incentive to reinvest each round of cash back into private-label mortgages, because the haircut differential on this collateral means that each dollar reinvested would generate more than a dollar in the dealers' own borrowing potential, lowering the cost of capital. This example abstracts from an interest rate charged on the repo borrowing to simplify the exposition of overcollateralization.

Consistent with the collateral becoming a valuable tool to lower their cost of capital, the dealers offer increasingly favorable overcollateralization terms to the IMCs in the data post-BAPCPA. The haircut dealers required was 36% in 2005Q4, 26% in 2006Q1, 11% in 2006Q2, 15% in 2006Q3, and 16% in 2006Q4. The slight increase in 2006Q3 and 2006Q4 could be driven by an increase in risk of underlying mortgages. As long as the IMC generated enough money from fees or interest on the mortgages originated, it would have enough equity to fund the haircut charged by the dealer. The haircuts that I measure in 2006 are consistent with the haircut differential measured in Copeland, Martin and Walker (2014), which measures the difference between median repo haircuts on private-label collateralized mortgage obligations across the bilateral and tri-party repo market in July 2008 to be 17%. As a reference, the haircut differential on agency MBS at the time was 2%.

The haircuts calculated for the IMCs from 2005Q4-2006Q4 imply the following upper bound on the multiplier that dealers could generate following BAPCPA. The majority of private-label mortgage securitizations sold in 30 days (Adelino, Gerardi and Hartman-Glaser (2019)). Therefore one month is used as the interval for the rounds of lending that generate the bilateral/tri-party haircut differential.[10] Given the quarterly haircut differentials between 2005Q4-2006Q4,[11] 15 rounds of lending across 15 months would create a multiplier equal to:

[10]The IMC was paid when the dealer purchased the warehoused loans. If the dealer financed its purchase of the warehoused loans in the tri-party market, then once the security was sold to the final investor, the dealer would pay off the cash lender and begin another round of funding to the IMC.

[11]The earliest that IMCs report overcollateralization is 2005Q4 and the latest is 2006Q4. Dividing one plus each of these numbers by 1.05 as in Equation 16 (in the Online Appendix of Lewis (2023)), yields the haircut differential utilized.

$$1+\sum_{i=1}^{3}1.3^i+1.3^3\sum_{i=1}^{3}1.2^i+1.3^3(1.2^3)\sum_{i=1}^{3}1.06^i+1.3^3(1.2^3)(1.06^3)\sum_{i=1}^{3}1.095^i \quad (1)$$
$$+1.3^3(1.2^3)(1.06^3)(1.095^3)\sum_{i=1}^{3}1.10^i = 66.5.$$

The multiplier in Equation 1 implies that the dealer can expand its leverage secured by private-label mortgage collateral to 66.5 times its initial equity, such that the dealer can supply $6,650 of credit to the economy with its initial $100 of funding.[12]

2.2 Effect of BAPCPA on Collateral Reuse

To motivate the research design used in the empirical section, I illustrate the effect of BAPCPA on dealers' collateral reuse, which is an indicator for their ability to generate the money multiplier effect discussed above. Figure 2, recreated from Lewis (2023) online appendix A.6, plots dealers' securities out (borrowing) collateralized by agency versus private-label mortgage collateral, each as a fraction of total securities out. The agency mortgage collateral is comprised of Federal Agency and GSE MBS, and the private-label mortgage collateral is proxied for by corporate securities which contains Non-Agency Residential MBS. The figure shows that prior to BAPCPA a relatively constant fraction of dealers' total borrowing was collateralized each by private-label and by agency collateral. After BAPCPA the fraction of dealer borrowing collateralized by private-label collateral nearly doubled, from about 6% to close to 12%, while the fraction backed by agency collateral remained almost constant at about 22%. The value of PLS collateral used to borrow also almost doubled, jumping from $247 billion in March 2005 to $466 billion in July 2007, before crashing in late 2007, consistent with the timing of the GFC. This increase suggests an increase in dealers' ability to borrow against private-label mortgage collateral in the tri-party market, since dealers are likely to be borrowers in the tri-party market (Infante (2019)).

[Figure 2 about here.]

To test the statistical significance of dealers' increased borrowing backed by private-label collateral, I estimate the regression in Equation 2, recreated from Lewis (2023) online

[12]There are 15 months of lending. The haircut differential is assumed to reset every 3 months because this is how often I see the haircut charged by the dealer in the bilateral market change. The value of the haircut in the tri-party market is assumed constant. This is reasonable given the similar estimates in Copeland et al. (2014); Krishnamurthy et al. (2014); Srinivasan (2024). The value of credit supplied to the IMC each round is calculated by multiplying the previous rounds' haircut differentials by each other. The total amount of credit that the dealer can supply to the economy is equal to the sum of lending across all rounds.

appendix A.6, from January 1, 2001 through July 31, 2007. The regression compares private-label versus agency mortgage collateral pre versus post BAPCPA:

$$Y_{i,t} = \omega Post_t + \nu PLS_i + \beta Post_t \times PLS_i + \epsilon_{i,t}. \quad (2)$$

$Y_{i,t}$ is set equal to both the log value of securities out and the fraction of total securities out (fraction of total dealer borrowing). For collateral class i at time t, $Post_t$ is an indicator equal to zero prior to April 15, 2005 and equal to one on this date and later. PLS_i is an indicator equal to one for private-label mortgage collateral and zero for agency mortgage collateral. $Post_t \times PLS_i$ is the interaction of interest. The coefficient on this term measures the difference in borrowing backed by private-label and agency mortgage collateral post-BAPCPA, less the difference between the two pre-BAPCPA.

[Table 1 about here.]

Table 1 reports the regression results. The coefficient on the interaction term, $Post_t \times PLS_i$, estimates a statistically significant 18.6% increase in private-label securities out relative to agency securities out in the post period, consistent with an increase in dealers' ability to borrow against private-label mortgage collateral. Dealer's increased borrowing collateralized by PLS indicates increased ability to generate a repo money multiplier effect discussed above, creating a credit supply increase that began in the repo market. The credit supply increase pertains to the mortgage market because BAPCPA created a repo haircut differential specific to private-label mortgage collateral. Lewis (2023) Figure 7 establishes that dealers pass this credit supply increase on to the IMCs that they fund.

2.3 Alternative Mortgage Products

The second wave of the housing boom, following BAPCPA, featured alternative mortgages which artificially lowered introductory mortgage payments using alternative amortization schedules that require mortgage payment resets at a later date. For example, negative amortizing mortgages do not pay the full amount of interest and principal to amortize, or pay down, the loan over time. Therefore, the interest owed and not paid is added to the balance of the mortgage and recapitalized, so that the principal owed on the loan increases and interest is owed on the deferred interest. Negative-amortizing mortgages increase borrowers' balance and thus their indebtedness over time, rather than decreasing it.

Negative amortizing include option-adjustable-rate-mortgages (option-ARMs). Piskorski and Tchistyi (2010) finds that mortgage contracts which simplify the terms of the option-ARM contract have little loss in efficiency. Therefore to study the rise in alternative mort-

gages following BAPCPA, I include balloon, negative amortizing, and two-step mortgages. These alternative mortgage products offered artificially low mortgage payments for an initial time period, which deferred interest payments to later periods, when the payment reset to the fully amortizing price at the market rate. As I discuss later in the paper, close to 40% of the loans at this time had the first reset clustered 6 months, 1, and 2 years after origination. Alternative mortgage products may appeal to borrowers with high income volatility because they offer the ability to postpone the full interest and principal payment at times when borrowers' incomes may be low, and to repay the amount owed at a later time when their income may be higher.

Additionally, the annual reports of mortgage companies state that mortgage originators determined the mortgage affordability based on the initial scheduled monthly payment rather than on future monthly payments after the interest rate reset date. This would allow borrowers to qualify for larger mortgages than they may otherwise qualify. To illustrate this, in Appendix B, I provide an example excerpt from independent mortgage company, HomeBanc.

Additionally, Davis et al. (2023) and Adelino et al. (2020) show that during 2005-2006, PLS became a substitute for Federal Housing Administration (FHA) and Veterans' Affairs (VA) mortgages, which play a key role in providing access to homeownership for households with limited financial means.[13]

3 Effect of BAPCPA on Mortgage Lending

In this paper, I use IMC market share as a treatment measure to capture zip-code-level exposure to the policy change and study the effects on mortgage borrowers. The money multiplier created a credit supply increase and the IMCs were the most exposed to the dealers, given their credit line funding. Thus I use the IMCs as my treated entities in the empirical section.

However, although mortgage companies received increased funding from dealers post-2005, IMCs could have originated more of the same type of mortgages they originated prior to BAPCPA. The results in this paper study whether IMCs originated different types of mortgage products post-BAPCPA and which types of borrowers were exposed to these products.

[13]The Department of Justice (DOJ) brought unprecedented law suits against FHA lenders under the False Claims Act. Several billion dollars of claims were also brought against IMCs for their lending in the PLS market. These lawsuits in the PLS market are consistent with the PLS mortgages targeting a similar demographic as FHA mortgages and regulators enacting penalties on the PLS market similar to the FHA market as a warning to lenders operating in these markets.

3.1 Empirical Design

In this section, I empirically test whether dealer-banks originate more mortgages via IMCs, consistent with an expansion of their lending on the left hand side of Figure 1. I test whether the IMCs differentially increase alternative product types following the policy change, and whether they do so disproportionately in high minority zip codes. I use a treatment intensity DiD research design. The treatment variable is market share of IMCs in 2004, $IMCMktShr_{z,04}$, the year prior to BAPCPA. Since IMCs were directly linked to the dealers affected by BAPCPA, the underlying assumption is that $IMCMktShr_{z,04}$ captures exposure to BAPCPA. This variable is calculated using the number of IMC mortgage originations relative to all mortgage originations in the HMDA data:[14]

$$IMCMktShr_{z,04} = \frac{Number\ of\ originations\ by\ IMCs_{z,2004}}{Total\ number\ of\ all\ originations_{z,2004}}. \tag{3}$$

Figure 3 panel (a) depicts IMC market share by zip code in 2004. The spatial variation in IMC market share is likely due to the Fannie Mae and Freddie Mac scandals in 2003 and 2004 which decreased barriers to entry for IMCs to enter the mortgage market in 2003. The market share of IMCs was relatively stable throughout 2004, the year that I define treatment. The insight of the research design however is that BAPCPA was a national policy change so to the extent that it directly affected borrower behavior, this would have been internalized by both IMC and non-IMC lenders. Therefore, the way non-IMCs lend to minority versus non-minority or high- versus low-income growth areas pre- versus post-BAPCPA is an economic barometer for trends in lending. The effect associated with high- relative to low-IMC market share captures the effect of BAPCPA increasing secondary market collateral value on primary market lending.

[FIGURE 3 about here.]

In Table 2, I report summary statistics for above versus below median $IMCMktShr_{z,04}$ zip codes. The higher IMC zip codes have a slightly higher fraction of Black and Latino inhabitants. However, I create subgroups for majority Black, Latino, and white zip codes and I find that all three groups demonstrate pre-period parallel trends.

$\%RACE_z$ is defined as the total number of inhabitants of a certain race in a zip code divided by the total population of the zip code. I define the percent race of a zip code to be:

[14] I construct the 2004 IMC zip code market share using value of mortgage originations and find that the distribution of market share is very similar to the measure using number of originations.

$$\%RACE_z = \frac{Number\ of\ RACE\ inhabitants_z}{Total\ number\ of\ inhabitants_z}. \tag{4}$$

Zip codes are defined as majority Black (BLK) or Latino (LTN) if they have above 30% of inhabitants identifying as a given race.[15] If a zip code is defined as Black, the fraction of the population identifying as Black is greater than the fraction of the population identifying as Latino, and vice versa. Zip codes with 30% of inhabitants identifying as either Black or Latino are above the 80^{th} percentile of the minority distribution of zip codes in 2000. Zip codes with above 84% of inhabitants identifying as white (WHT) are defined as majority white zip codes. 84% of inhabitants identifying as white is close to the median of the distribution of white inhabitants by zip code in 2000. For the remainder of the paper, I refer to zip codes as Black, Latino, and white respectively. This measure is motivated by the theory of place-based clustering which establishes that people choose to live near other people like them (Logan and Molotch (2007); Charles (2003)).

This suggests that high and low IMC zip codes move in parallel within each of these racial groups, mitigating the concern, discussed in Roberts and Whited (2013), that race or other covariates are correlated with differences in pre-period trends of treated and control zip codes.

[Table 2 about here.]

To study how $IMCMktShr_{z,04}$ affects zip-code-level mortgage characteristics, I estimate the following DiD specification in Equation 5, which measures the differential effect of moving from 0% to 100% IMC market share, pre- versus post-policy change. This regression estimates the differential effect that a high IMC market share has on mortgage originations and characteristics post-BAPCPA. The granular monthly data, around the month when BAPCPA was passed, strengthens the identification of the effect. I estimate the regression separately for each racial subgroup:

$$Y_{z,t} \quad = \quad \gamma_z + \eta_{s,t} + \sum_T \beta_T IMCMktShr_{z,04} \times \mathbb{1}_{t=T} + \epsilon_{z,t}. \tag{5}$$

Where $Y_{z,t}$ is $\log(Originations_{z,t})$, $\log(Balloon_{z,t})$, $\log(NegAm_{z,t})$, $\log(TwoStep_{z,t})$, $\log(InitialInterestRate_{z,t})$, $\log(FullDoc_{z,t})$, and $\log(CreditScore_{z,t})$ in zip code z, at month t, and log is the natural logarithm. γ_z denotes Zip level fixed effects, and $\eta_{s,t}$ denotes $State \times Month$ fixed effects. $IMCMktShr_{z,04} \times \mathbb{1}_{t=T}$ is the interaction term between the market

[15] Results are robust to varying the cutoff for high minority zip codes and to excluding the Sand States.

share variable and an indicator variable for month of origination.[16] β_T is the coefficient on the interaction term that measures the effect of a one unit increase in IMC market share on the dependent variable in each month relative to March 2005, the month prior to the passage of BAPCPA. Standard errors are clustered at the zip code level.

I exploit a narrow window pre- and post-BAPCPA from August 1, 2004 to October 31, 2006 to help ensure that the pre-period is a valid counterfactual for the post-period. I report the regression results with Zip fixed effects alone and with both Zip and $State \times Month$ fixed effects. The regression with both Zip and $State \times Month$ fixed effects is the preferred specification since it compares mortgage characteristics in zip codes with high versus low IMC market shares within the same state and month, absorbing state-month housing market effects. The narrow window, fixed effects, and stable pre-period IMC market share help to ensure that the pre-period is a valid counterfactual for the post-period. Callaway, Goodman-Bacon and Sant'Anna (2021) note that continuous treatment in a DiD setting can introduce bias if the estimator's weighting of treatment doses differs from the population-weighted treatment doses. Lewis (2023) develops a method to test this, which I follow in Appendix D and show that the population-weighted doses are close to normally distributed and the estimator closely approximates the population weights, indicating that the estimator can be interpreted as the average treatment effect of the treated (ATT).

To study whether minorities were disproportionately impacted by IMCs' expansion of credit following BAPCPA, I estimate Equation 5 separately for subgroups of zip codes categorized by race. Figure 3 contains a US heat map that documents, for each zip code, the proportion of Black inhabitants in panel (b), the proportion of Latino inhabitants in panel (c), and the proportion of white inhabitants in panel (d). I define zip codes to be a given race as defined in Equation 4. I estimate the same DiD specification on each of these separate subgroups, using an empirical design similar to that in Curtis, Garrett, Ohrn, Roberts and Serrato (2021).

The econometric design studies mortgage originations pre- versus post-BAPCPA as the first difference and across zip codes with high- versus low-IMC market share as the second difference. Estimating the regression separately in Black, Latino, and white zip codes allows me to study how originations responded to BAPCPA in high-IMC areas relative to low-IMC areas while comparing the effect in Black and Latino areas each relative to white areas. If BAPCPA increased lending, zip codes with a higher proportion of IMCs should

[16] I also estimate the following static version of this regression with a single pre and post period:

$$Y_{z,t} = \gamma_z + \eta_{s,t} + \beta IMCMktShr_{z,04} \times Post_t + \epsilon_{z,t}. \tag{6}$$

increase their mortgage originations relative to zip codes with a lower proportion of IMCs. This regression specification tests whether IMCs have a larger origination response post-BAPCPA in minority zip codes relative to white zip codes. Taking Latino relative to white zip codes as an example, holding fixed the market share of IMCs in a zip code, if Latino zip codes experience a larger increase in originations relative to white zip codes in response to BAPCPA it implies that Latino zip codes received a disproportionately large effect of the credit supply increase.

Estimating the difference-in-differences specification by subgroup controls for pre-existing differences in lending in high-IMC relative to low-IMC areas separately in Black, Latino, and white zip codes. The regression coefficients for Black and Latino zip codes are each plotted relative to those for white zip codes. For each racial subgroup, the regression controls for pre-existing trends and estimates the differential effect of treatment in the post-period relative to the pre-period. The null hypothesis is that zip codes with different racial makeups were all affected by BAPCPA in the same way. If the null holds, I would expect to see no differential increase (decrease) in mortgage lending by the IMCs in areas with different racial makeup. Post policy change, if I observe a differential increase in originations for minority zip codes relative to white zip codes, it indicates that one subgroup was disproportionately affected by treatment relative to another subgroup.

3.2 Mortgage Lending Results

Table 3 and Figure 4 panel (a) report the coefficient that measures the effect of the pre-period IMC market share on $\log(Originations_{z,t})$ each month relative to March 2005. $Originations_{z,t}$ is the total number of originations including both purchase and refinance mortgages. In the pre-period there was no differential change in lending between treated and control zip codes for any racial subgroup. Following the policy change, a 10% increase in pre-period IMC market share leads to a statistically significant 0.8% increase in originations for white zip codes post BAPCPA. However, a 10% increase in pre-period IMC market share leads to a 5.8% decrease in mortgage originations for Black zip codes and a 0.4% decrease for Latino zip codes, with the decrease for Black zip codes being statistically significant and significantly different from white zip codes. This evidence is consistent with BAPCPA leading to a credit supply increase in white zip codes, while it led to a decrease in minority zip codes. In particular, Black zip codes with high-IMC market share receive fewer mortgages relative to Black low-IMC zip codes post-BAPCPA relative to pre-BAPCPA.

[Figure 4 about here.]

[Table 3 about here.]

In Table 3 and Figure 4, I report balloon (panel (b)), negative amortizing (panel (c)), and two-step mortgages (panel (d)) as outcome variables. These results indicate whether the increase in originations in white zip codes was driven by alternative mortgage products and whether these products played a role in the disproportionate effect by racial subgroup. Negative amortizing, balloon, and two-step mortgages constitute products that are similar to the option ARM in key ways that allow borrowers to shift payments when their income is low into future periods when their income may be higher. The main benefit of these products was that their initial mortgage payments were typically lower than those on fully amortizing mortgages. However, this introductory mortgage payment would reset, usually to a much higher payment. In panel (e), I study how initial interest rates change on these loans.

The panels in Figure 4 establish that all subgroups' mortgage originations had pre-period parallel trends and they all responded at the same time to BAPCPA. Thus, this research design establishes that pre-period distributional shifts in a subgroup's mortgage originations are not driving the results following BAPCPA. Following BAPCPA, the results document a disproportionate increase in originations of alternative mortgages in minority zip codes. Figure 4 panel (b) shows that a 10% increase in pre-period IMC market share leads to a 17% increase in balloon mortgages in white zip codes, a 29% increase in Black zip codes, and a 46% increase in Latino zip codes. I report a t-test of whether the average effect of treatment in the post period is statistically significantly different for white zip codes relative to Black zip codes and for white zip codes relative to Latino zip codes. The increases in balloon mortgages for Black and Latino zip codes were both statistically significantly higher than the increase for white zip codes.

Similarly Figure 4 panel (c) shows that relative to the pre-period, a 10% increase in pre-period IMC market share leads to statistically significant increases in negative amortizing mortgages of 9% for white zip codes, 8% for Black zip codes, and 28% for Latino zip codes. Relative to white zip codes, the increase in negative amortizing mortgages in Latino zip codes is significantly higher while the increase in Black zip codes is not statistically different. In panel (d), I study two-step mortgages which increased by 31% for Latino zip codes and this number is statistically larger than the 0.6% decrease that white zip codes experienced. I find a 3% increase for Black zip codes, though the increase is not statistically significant.

Figure 4 panel (e) documents the dynamic coefficients for $\log(InitialInterestRate_{z,t})$ on adjustable rate mortgages. The results show that the initial interest rate falls statistically significantly for all subgroups following the policy change. A 10% increase in pre-period treatment drove the initial interest rate to fall 4.6% in Latino, 1.5% in Black, and 2.7% in white zip codes. The declines in each subgroup are statistically different both from each other and from zero, and the point estimate on the average effect is the largest for Latino zip codes.

These falling initial interest rates are consistent with originators lowering initial interest rates to increase affordability of mortgages, amidst the Federal Reserve raising interest rates from 2004 through 2006. The low initial interest rates also indicate that borrowers would face large payment shocks when their mortgage payments reset to the market rate. Figure 16 panel (e), in the appendix, reports the overall results for initial interest rates, not broken down by subgroup, and results remain consistent.

In Appendix L, I estimate these specifications for mortgage product types using a Poisson model and find that the results remain consistent. In Appendix M, I utilize loan level data to estimate the increase in probability of originating alternative mortgage products in the post-period relative to the pre-period. For a subset of private-label mortgages, I am able to merge originator type to the originator name using a fuzzy name merge. Using these loan level data, I find that post-BAPCPA, IMCs were more likely to originate negative amortizing and balloon mortgages than they were pre-BAPCPA.[17] These results are also more prevalent in Black and Latino zip codes, consistent with minority zip codes receiving disproportionately more alternative mortgages post-BAPCPA.

To study borrower characteristics pre- and post-BAPCPA, I estimate the specification in Equation 5 with $\log(FullDoc_{z,t})$ as an outcome variable, separately by racial group. Full documentation mortgages are mortgages originated with fully documented income and assets. I report the results in Table 4 and Figure 5 panel (a). Prior to the policy change, there was no statistically significant change in full documentation mortgages between more- versus less-treated zip codes for any subgroup. I find that post policy change, a 10% increase in treatment led to a statistically significant 1.0% increase for white zip codes, a statistically significant 6% decrease for Black zip codes, and an insignificant decrease in full documentation mortgages for Latino zip codes of 0.7%. The results for Black zip codes are statistically significantly different from white zip codes, while there is no statistically significant difference between white and Latino zip codes in the post-period.

[Figure 5 about here.]

[Table 4 about here.]

I also estimate Equation 5 with $\log(CreditScore_{z,t})$ as an outcome variable, separately by racial group. I report the results in Table 4 and Figure 5 panel (b). Prior to the policy change, there was no statistically significant increase in credit scores between more- versus less-treated zip codes for any subgroup. Post policy change, a 10% increase in pre-period

[17] I am not able to estimate the effect for two-step mortgages due to lack of two-step originations in this merged subsample.

treatment leads to a significant increase of 0.15% for white zip codes, and insignificant increases of 0.17% for Black zip codes, and 0.16% for Latino zip codes.[18] These results are consistent with lenders attempting to compensate for the increased risk of alternative amortization structures and lack of full documentation by requiring higher credit scores. However, this increase in credit scores was likely too modest to sustain the increased risk of these alternative mortgage products. For example, a 0.20% increase in credit score for Latino borrowers equates to about a one point increase from 690 to 691.

To study the consequences of these alternative mortgage products to borrowers, I study early payment default (EPD_i) and total loan default following the policy change. Early payment defaults are reported using the Government Sponsored Entity (GSE) methodology, which flags whether a loan enters 90 day delinquency within the first 12 months since origination.[19] Historically, mortgages that are underwritten well are unlikely to default in the first year of origination (Mayer et al. (2009)). Early payment default is typically an indicator of potential risk management issues such as lax underwriting standards. It signals that the borrower's ability to repay a mortgage may not have been accurately assessed at the time of the mortgage origination. I also create an indicator variable, $Defaulted\ Loan_i$, that is equal to one if the loan ever enters 90 day delinquency, foreclosure, or REO property in its lifetime and zero if the loan remains active. I estimate the following regression which is the loan level version of Equation 5:

$$Y_i = \gamma_z + \eta_{s,t} + \sum_T \beta_T IMCMktShr_{z,04} \times \mathbb{1}_{t=T} + \Gamma_{z,t} + \epsilon_i. \tag{7}$$

Where Y_i is EPD_i and $Defaulted\ Loan_i$, and $\Gamma_{z,t}$ includes a control for the unemployment of a zip code in 2001 interacted with $Post_t$ (an indicator equal to one in and after April 2005, and zero before). All other variables are defined the same as in Equation 5.[20] I estimate this regression separately by racial subgroup and standard errors are clustered at zip code level.

[18] Second home purchases are decreasing during this time period (Lewis (2023) appendix B.4) and taking on additional debt via a second mortgage would decrease credit scores rather than increase them. Thus the increased credit score result is consistent with new borrowers entering the housing market with disproportionately higher credit scores in areas with higher IMC market share post-BAPCPA.

[19] Early payment defaults reported using the Federal Housing Administration (FHA) methodology flags whether a loan enters 60 day delinquency within the first six months since origination. Results using the FHA measure are consistent with the GSE measure.

[20] I also estimate the following static version of this regression with a single pre and post period:

$$Y_i = \gamma_z + \eta_{s,t} + \beta IMCMktShr_{z,04} \times Post_t + \Gamma_{z,t} + \epsilon_i. \tag{8}$$

Figure 5 and Table 4 report the results. Figure 5 panel (c) shows that a 10% increase in pre-period IMC market share leads to a statistically significant 0.59 percentage point (pp) increase in early payment default (EPD_i) for Black zip codes. This increase is statistically significantly higher than that for white and Latino zip codes, which experienced insignificant 0.14 and 0.02 pp increases respectively, for an equivalent increase in pre-period IMC market share. Panel (d) shows a 10% increase in pre-period IMC market share leads total default to increase statistically significantly by 3.8 pp in Latino and 3.3 pp in Black zip codes. The increase in Latino zip codes is statistically significantly larger than the significant 1.9 pp increase for white zip codes. Combined with the results for full documentation originations, the increased defaults in minority-dominant zip codes are consistent with these zip codes receiving disproportionately more alternative mortgages with risky amortization schedules, and lower income documentation.

Morduch et al. (2018) document that minority income volatility is significantly higher than that of white earners. I use income growth to proxy for income volatility because income volatility and growth are highly negatively correlated, i.e. households with low rates of income growth also have more volatile incomes,[21] and individual level income data are difficult to access. I measure income growth as the 2004 minus 2001 average estimated income in a zip code, divided by the average estimated income in 2001. Borrowers which experienced low rates of income growth are those in the first quartile of income growth (IG1), and borrowers which experienced high rates of income growth are those in the fourth quartile of income growth (IG4). In Appendix G, I estimate Equation 5 separately for the top and bottom income growth quartiles. I find that both IG1 and IG4 see an increase in alternative mortgages following BAPCPA at similar rates, and similar increases in default, suggesting that the racial component explains additional variation in how the alternative mortgages were originated post-BAPCPA. In Appendix N, I test whether controlling for income growth quartile in the regressions by racial subgroup eliminates the effect of race on the increase in alternative mortgage originations, credit score, and defaults, and the decrease in loan documentation. I find that significance and magnitude by racial makeup of each zip code remains the same as in the regressions in Section 3.2.

In Appendix F, Table 7, I estimate the Equation 6 replacing $IMCMktShr_{z,04}$ from Equation 3 with a treatment measure comprised of the market share of 2004 IMC originations that list purchaser as "Private Securitization" in HMDA. This robustness analysis further tests the proposed mechanism since the policy change only affected private-label mortgage origi-

[21] See for example: the January 9, 2025 Brookings article "Low-income workers experience-by far-the most earnings and work hours instability." I also test the correlation between income growth and income volatility both at the zip code level and find that they are statistically significantly negatively correlated.

nations and I utilize exposure to the IMCs that sold their mortgages to private-securitization prior to the shock. The underlying assumption is that areas that were more heavily exposed to IMC originated private label mortgages in the pre-period would be more exposed the the BAPCPA policy change. The results remain consistent with those in the main draft.

3.3 Payment Shock Results

The evidence in the paper suggests that rather than a single wave of the housing boom, there were two waves. The first wave consisted of subprime mortgages during 2000-2004 and the second wave consisted of alternative mortgages, following BAPCPA, in 2005 through 2007. The first wave involved originations of subprime mortgages with below 660 (Adelino et al. (2016)) or 620 (Keys et al. (2010)) credit score but fully amortizing mortgage payment schedules.[22] The second wave featured borrowers with "near prime" credit scores who received mortgages with alternative amortization schedules and less than full documentation. Alternative mortgages were typically called Alt-A for "alternate A paper" meaning that the mortgage backed securities that they formed were treated as similar to A rated securities. The alternative mortgages were defined as prime in CoreLogic data since they had higher credit scores than typical subprime mortgages. Figure 23 in Appendix K shows that the fraction of prime mortgages increased following BAPCPA and the fraction of subprime mortgages decreased, consistent with the fraction of Alt-A mortgages increasing, following BAPCPA. The differential increase in prime relative to subprime loans was highest for Latino zip codes.

By 2005 most 'would be' home buyers who were not constrained by either credit score or wealth/income already had a mortgage. Home prices were near peak and the Federal Reserve had been increasing interest rates since 2004. Thus, absent BAPCPA, to take out a fully amortizing mortgage (either fixed rate or fully amortizing ARM) would have required a high mortgage payment per dollar of initial mortgage balance. The results in Section 3.2 are consistent with BAPCPA enabling originators to boost mortgage originations by lowering the initial cost of the mortgage via offering borrowers alternative mortgages, with artificially low initial payments. BAPCPA lowered dealer-banks' cost of capital in the secondary market for private-label mortgages and in response, dealer-banks incentivized IMCs to decrease the primary market interest rate on these mortgages. In Appendix O I create a toy model that illustrates the demand stimulation mechanism that the decreased mortgage payments in this market created to boost alternative mortgages in minority dominant areas with low-income growth (high-income volatility).

[22] Adelino et al. (2016) states that 660 corresponds to a widely used FICO cutoff for subprime borrowers and Keys et al. (2010) use 620 FICO as the cutoff below which subprime loans were less easily securitized.

The alternative mortgages had artificially low initial mortgage payments due to features like interest only payments, artificially low "teaser" interest rates, or mortgage payments that did not fully amortize the loan. For reference, The Financial Crisis Inquiry Report refers to interest-only adjustable rate mortgages as having "affordability features."[23] Consistent with a second wave of the housing boom that contributed to the GFC, Figure 6 illuminates two phenomena. First, that interest-only mortgages, for example, increased suddenly in 2005 and remained at elevated levels before falling dramatically in 2008, with the onset of the GFC. Second, the expansion of these alternative mortgages was more prominent among borrowers with low rates of income growth and those in minority-dominant zip codes.[24] The dynamics of the plot are consistent with BAPCPA driving these alternative originations, which were originated in an unsustainable way, contributing to the Global Financial Crisis – at which time the market for these mortgages crashed.

Interest-only mortgage products include option-adjustable rate mortgages (option-ARMs) which offer the option to pay the fully amortizing principal and interest, only the interest payment, or a minimum amount that is less than the interest accrued. Option-ARMs were one of the main types of negative amortizing mortgage products originated in the lead up to the GFC. I plot the equivalent figure for negative amortizing mortgages in Appendix C.

[Figure 6 about here.]

By offering "affordability features," the alternative mortgages would loosen the wealth/income constraint and allow new home buyers into the market at a time when standard mortgage contracts were very expensive. Consistently in Table 11 in Appendix J, I show that the mortgage acceptance rate for Black and Latino applicants to IMCs decline statistically significantly in the post period, while it increases for white applicants. This evidence is consistent with the alternative products' apparent "affordability features" increasing demand for these products disproportionately among minority borrowers. Consistent with this idea, in Figure 7 I estimate a county-level difference-in-differences regression that is equivalent to equation Equation 5, using log mortgage applications as the dependent variable and estimating the effect of county-level IMC market share. Prior to the policy change, applications in high- versus low-market share counties moved in parallel to each other. Following the change, a 10% increase in IMC market share drove a 3% increase in application through 2006, followed

[23] See: "The Financial Crisis Inquiry Report" page 111. Available via Stanford: https://fcic-static.law.stanford.edu/cdn_media/fcic-reports/fcic_final_report_full.pdf.

[24] I plot interest only mortgages as a fraction of all originations in a zip code, rather than the total number of these originations. Black and Latino households have lower homeownership rates than white households, thus for these descriptive plots, plotting the fraction of alternative mortgages better captures the disproportionate exposure that minority zip codes had to alternative mortgage products.

by a exaggerated collapse in mortgage applications between 2007 and 2008. The results are consistent with originations of these alternative mortgages with "affordability features" enabling IMC to bring new home buyers into the market, creating a demand stimulating mechanism. However, these originations were substantially riskier than traditional mortgage products and began to default in 2007 and 2008, amplifying downturns in high-IMC areas.

[Figure 7 about here.]

These results provide a potential explanation for the question posed in Rugh (2015) of why white borrowers were backing out of the housing market during the late 2000s while Latinos kept borrowing. Access to alternative mortgages likely made these mortgages seem affordable for borrowers without proper assessment of their ability to repay over the longer term – given the decrease in documentation rates in Figure 5 panel a.

I test whether, relative to subprime mortgages issued during the same period, the Alt-A mortgages – accelerated by BAPCPA – were more affordable initially. I classify mortgages as either Alt-A or subprime based on the name of the deal-pool that it belongs to in CoreLogic. In Table 5, I calculate the mean difference between the value of the initial mortgage payment scaled by the original balance, for subprime loans versus Alt-A loans originated following BAPCPA.[25] The results show that the scaled mortgage payment was significantly lower for alternative mortgages than it was for subprime mortgages.

[Table 5 about here.]

I also test whether the IMC market share is associated with a decline in FHA mortgages, consistent with the private-label mortgages crowding out government agency approved lenders. In Table 6 I estimate Equation 5 on the fraction of FHA mortgages in the Corelogic LLMA origination data and I find that a 10% increase in IMC market share drives statistically significant declines of .35% in FHA mortgage originations in white zip codes, .3% in Black zip codes, and .76% in Latino zip codes.

[Table 6 about here.]

While the Alt-A mortgages were more affordable in the short term, they necessitated large payment resets – making it difficult for borrowers to make consistent debt payments on

[25] I utilize loans originated between April 2005 and December 2007 because alternative mortgages were not common prior to BAPCPA's passage in April 2005, and the earlier sections demonstrate that BAPCPA drove the expansion into Alt-A mortgages. Following September 2007 the number of alternative mortgages decreases steeply. Thus I extend the sample through the end of 2007 for both subprime and Alt-A loans.

a long-term basis. Thus, large payment shocks provide a plausible mechanism spurring the onset of defaults. To establish the role of BAPCPA driving large payment resets, I define a payment shock to be a mortgage payment reset that is $\geq 10\%$ above the initial mortgage payment, at the time of first reset. I estimate the following regression specification separately by subgroup:

$$PayShock_{z,t} = \gamma_z + \eta_{s,t} + \sum_T \beta_T IMCMktShr_{z,04} \times \mathbb{1}_{t=T} + \Phi_{z,t} + \epsilon_{z,t}. \tag{9}$$

Where $PayShock_{z,t}$ is the average fraction of loans that experience a pay shock in a given zip code out of all loans that experience a payment reset in that month, where the month indicates the month of the payment reset. The dataset is limited to all loans that experience a mortgage reset. $\Phi_{z,t}$ represents control variables comprising of $Post_t \times avgLTV_{z,04}$, $Post_t \times avgCreditScore_{z,04}$, $Post_t \times avgDTI_{z,04}$. These controls allow for certain borrower and mortgage characteristics in the pre-period to have differential trends in the post period. All other variables are defined the same as in Equation 5. Standard errors are clustered at the zip code level.[26] The regression studies the remaining effect that being originated in a high versus low IMC market share zip code has on whether a mortgage experiences payment shock.

The regression results shown in Figure 8 as well as Table 15 indicate that, in the post period, mortgages originated in zip codes with high IMC market share are statistically significantly more likely to experience pay shocks relative to mortgages originated in low IMC zip codes. Comparing the response in BLK and LTN zip codes to WHT zip codes, I find that, on average in the post-period, a 10% increase in pre-period treatment leads majority WHT zip codes to experience a statistically significant 4.4 pp increase in likelihood of experiencing a payment shock when their mortgage payment resets. The average increase in payment shock likelihood for the majority LTN zip codes is a significant 2.5 pp. The average increase in payment shock likelihood for the majority Black zip codes is an insignificant 0.7 pp. In Figure 22, I estimate the payment shock regression by income growth quartiles. I find that pay shocks are more likely in zip codes with higher pre-period IMC market share for both the highest and lowest income growth quartiles. A 10% increase in treatment leads to a 3.4 pp increase in pay shock likelihood, which is not statistically different between the high-

[26] I also estimate the following static version of this regression with a single pre and post period:

$$PayShock_{z,t} = \gamma_z + \eta_{s,t} + \beta IMCMktShr_{z,04} \times Post_t + \Phi_{z,t} + \epsilon_{z,t}. \tag{10}$$

and low-income-growth zip codes. In Figure 4 and Figure 17, I document that the initial interest rate on adjustable rate mortgages decreases disproportionately in zip codes with high IMC market share, which is consistent with high IMC zip codes experiencing larger payment shocks when interest rates reset. While the pay-shock-probability increase is relatively similar across subgroups, the minority and low-income-growth zip codes have a larger fraction of total mortgages that are exposed to these types of resetting mortgages, and lower levels of full documentation, making them especially vulnerable to these pay shocks.[27]

[FIGURE 8 about here.]

The pay shock results are economically significant in magnitude. For example, Fuster and Willen (2017) find that changes in payment size have a large effect on default rates - reducing the payment size by 50% decreases the default rate by 55%. If the response is symmetric, increasing payment size by 10% would increase borrower default by 11%. Fulford and Low (2024) find that expense shocks significantly affect households' financial fragility. Thus in high income variability and minority-dominant zip codes, correlated mortgage payment shocks are poised to have a large effect on borrower default. Additionally, while the increase in payment shock likelihood is slightly lower in majority Black zip codes, these zip codes may have more difficulty enduring payment shocks, due to higher income volatility (Morduch et al. (2018)) and wealth (Derenoncourt et al. (Forthcoming)) gaps between white and Black zip codes.

The timing of the pay-shock-likelihood increase is also important. It begins to increase in high IMC market share zip codes close to six months after the policy change and becomes increasingly common through October 2006. Argyle et al. (2020) find that borrowers target low payment size at origination when making debt decisions. These results are consistent with BAPCPA creating a coordination device for IMCs to originate alternative mortgages. Therefore creating an ensuing burst of IMC alternative mortgage originations, with artificially lower mortgage payments beginning in April of 2005, directly following BAPCPA. Since alternative mortgage products have reset dates that cluster around 6 months, 12 months, and 24 months[28] the reset dates on these mortgage products are clustered in time, demographics, and geographic regions. Consistent with the idea of a second wave of the housing boom that featured risky alternative mortgages, Ospina and Uhlig (2018) show that the Alt-A AAA performed worse than subprime mortgage backed securities.

[27] Although alternative mortgages were underwritten only to the standard of being to afford the initial payment (which is itself a concern), borrowers with lower documentation were disproportionately common among the lowest income growth quartile (IG1), as shown in Figure 18, increasing the likelihood that a large pay shock could coincide with a particularly low realization of income.

[28] Close to 4% of loans with a payment reset have the first reset at 6 months, 16% within one year, and 20% within two years.

4 Real Effects of BAPCPA

4.1 Real Effects on Foreclosure, Bankruptcy, and Home Prices

To understand the real effects of these alternative mortgages on households, I test whether zip codes that were more exposed to the policy change experience higher rates of foreclosure and bankruptcy. I estimate the following regression, which is the loan level version of Equation 5:

$$Y_i = \gamma_z + \eta_{s,t} + \sum_T \beta_T IMCMktShr_{z,04} \times \mathbb{1}_{t=T} + X_i + \epsilon_i. \tag{11}$$

Where Y_i is $Foreclosed\ Loan_i$, an indicator equal to one if a loan ever forecloses and zero otherwise, and $Bankruptcy_i$, an indicator for whether a borrower ever entered bankruptcy by month that their mortgage is originated. As a control, I include $Post_t \times Unemploy_{z,00}$, where $Post_t = 1$ for loans originated past April 2005, and $Unemploy_{00}$ is zipcode-level unemployment in 2000. All other variables are defined the same as in Equation 5. I estimate this regression separately by racial and income growth quartile subgroups and standard errors are clustered at zip code level. I estimate this regression only for private-label (PLS) mortgages, because these are mortgages for which I have information on foreclosures and because are the mortgages that were directly affected by the policy change. Since agency mortgages were granted the exemption from automatic stay in 1985, they were not affected by the policy change. The regression is looking within private-label mortgage loans and testing whether among all private-label loans, those that were originated in zip codes with a higher IMC market share were more likely to experience foreclosure. The control group is also private-label loans, but those in zip codes with lower market shares of IMCs. To the extent that banks were also originating private-label loans, these are in the control group and would bias my result downward if all bank and nonbank PLS loans were equally risky.

Higher rates of foreclosure and bankruptcy among loans originated following the policy change, in areas more exposed to IMCs, are consistent with the BAPCPA policy change driving the increase in foreclosures and bankruptcies. The intuition is that IMCs experienced a larger influx in cash from their repo lenders post-BAPCPA, and these lenders also relaxed warehousing requirements on the loans that the IMCs originated, allowing IMCs' post-period originations to become riskier.

[Figure 9 about here.]

In Figure 9 (panels a and c),[29] I plot the dynamic coefficients measuring the effect of

[29]The plot ends in July of 2007 because the number of alternative mortgages decreases steeply beginning

higher IMC market share on foreclosure and bankruptcy. The plots show that loans originated to Latino borrowers are disproportionately more likely to experience foreclosures beginning in May 2005 and bankruptcies beginning in February 2006. This is inline with these zip codes experiencing high levels of negative amortizing mortgages following the policy change, as shown in Figure 17. Loans originated in white zip codes are also statistically significantly more likely to experience foreclosures beginning in May 2005 and bankruptcies beginning in February 2006. However, the rate of increase in white zip codes is not as steep as in Latino zip codes. Loans originated in BLK zip codes experience a slight delay in the increase of foreclosure and bankruptcy likelihood. Black zip codes with higher IMC market share begin to see an uptick in foreclosure likelihood beginning with loans originated in July 2005, and to see an uptick in bankruptcy likelihood beginning with loans originated in January 2006. The slight delay in BLK relative to WHT and LTN zip codes can be explained by the results on mortgage products in Figure 4. Black zip codes began receiving negative amortizing mortgages with a delay relative to Latino and white zip codes. Additionally, Black zip codes received an overall decrease in total mortgage originations relative to the pre-period, consistent with Black zip codes having later exposure to the risky Alt-A mortgage products. Majority Black zip codes also experience a delay in likelihood of receiving a pay shock, relative to majority white and Latino zip codes as shown in Figure 22 (panel a). In Figure 19 in the appendix, I find that both the lowest and highest income growth quartiles experience an increase in foreclosure and bankruptcy likelihood by month of origination. However, the lowest income growth quartile, IG4, experiences a higher increase in both foreclosures and bankruptcies by month of origination.

To understand the effect of alternative mortgage products – increasing access to credit – on home prices, I study the effect of 2004 IMC market share on home prices, separately by racial subgroup. I test whether increased mortgage originations drove up short run home prices by increasing access to mortgage credit and thus increasing the demand for homes. The regression design also indicates whether access to these alternative mortgage products drives down home prices in the longer-term due to increased defaults, foreclosures, and bankruptcies. I estimate Equation 5 where the dependent variable is $\log(HomePrice_{z,t})$ over the period from August 2004 to December 2010.

Figure 10 shows the dynamic response of home prices to the 2004 market share of IMCs in that zip code. Prior to BAPCPA, IMC market share in 2004 was not associated with a differential change in home prices, as demonstrated by relatively flat and parallel pre-period

in September 2007– coinciding with the run on UK Mortgage Bank Northern Rock. Shin (2009) (p. 102) calls Northern Rock the mortgage bank that heralded the Financial Crisis and notes that the short-term funding markets froze on August 9, 2007. Consistently Figure 6 also shows a steep decrease in alternative mortgages in 2007 and 2008.

coefficients. The figure shows that areas more exposed to the IMC market share experienced a statistically significant increase in home price between April 2005 and end of 2006, followed by a steep and significant decline in home prices beginning in 2008 through 2010. Both the boom and bust in home prices are more pronounced for Latino and Black zip codes than they are for white zip codes. This is consistent with alternative mortgage – more prominent in minority zip codes – products playing a "financial accelerator role" and amplifying both the increase in the price of capital in the boom and its decrease in the bust. The home price decline also begins later in Latino and Black zip codes, which is consistent with home prices in these areas being propped up for longer due to the disproportionate increase in alternative mortgages, however the ultimate home price decline is more severe in these areas. In Latino zip codes, a 10% increase in pre-period IMC market share leads to a 3% increase in home prices in the boom and 6% decline in the bust. A 10% increase in IMC market share leads to a 1.75% increase in home prices in the boom and a 5% decline in the bust. A 10% increase in IMC market share leads to a .05% increase in home prices in majority white zip codes in the boom and 2.5% decline in the bust.

[FIGURE 10 about here.]

4.2 Real Effects on Longer-Term Credit Outcomes

To study the long-term effects on borrower credit outcomes, I utilize the University of California's Consumer Credit Panel (UCCCP) to examine how exposure to the IMC market share in the pre-period impacts households' borrowing portfolio. I study households' mortgage, auto loan, and student loan balances through 2010. I estimate the following regression, using the credit panel, at the individual level:

$$Y_{i,t} = \gamma_i + \eta_{s,t} + \delta IMCMktShr_{z,04} + \sum_T \beta_T IMCMktShr_{z,04} \times \mathbb{1}_{t=T} + \epsilon_{i,t}. \quad (12)$$

Where Y_{it} is the balance on an individual's mortgage loan, student loan, and auto loan over time. γ_i indicates individual level fixed effects. The individual level fixed effects indicate that changes in debt balances reflect changes within a given individual. All other variables are defined as they are in Equation 5. The data is quarterly and begins in 2004Q1 and I study outcomes through 2010Q4. I sample 1% of individuals and track them throughout the data to create a 1% panel. [30] Prior to BAPCPA, IMC market share in 2004 was not

[30]The results are consistent when adding controls individual level time-varying credit score and for zip code level 2000 census unemployment and fraction college educated, each interacted with the post period.

associated with a differential change in outcome variables, as demonstrated by relatively flat and parallel pre-period coefficients in all plots below.

The identifying assumption of the regression is that the IMC market share in 2004 in a zip code is plausibly exogenous, as explained in subsection 3.1 such that, zip codes are not selected into treatment by BAPCPA. Thus high IMC market share acts as an instrument for increased exposure to alternative mortgage products. While the fraction of minority borrowers are slightly higher in high-IMC areas in Table 2, the within racial subgroup analysis shows that the treated and control zip codes exhibit pre-period parallel trends – mitigating the concern that high- and low-IMC areas were on different trends prior to BAPCPA. Thus, any significant increase in debt balances in high IMC zip codes relative to low IMC zip codes located in the same state, and within a given racial subgroup are consistent with exposure to alternative mortgages driving the increase.

In Figure 11 (panel a), I study mortgage balances from 2004 to 2010 by racial subgroup. I find that zip codes with higher 2004 exposure to IMCs experience an increase in reported mortgage balance following the policy change. The effect is the most prominent in Latino zip codes, followed by Black zip codes, and finally by white zip codes. A 10% increase in pre-period IMC market share leads to a highly significant 6.3% increase in revolving balance in Latino zip codes. It leads to a 2.1% increase in Black zip codes, which is significant at the 82% level, and no significant increase in white zip codes. Figure 21 (panel a) is also consistent with higher-income-growth zip codes revolving larger balances on their mortgage loans following the policy change. The regression utilizes individual level fixed effects, so an increase in mortgage balance indicates that the balance increased within an individual. This could be driven by a borrower either increasing the number of mortgage loans held or the balance revolved. The increase in balance through 2010 combined with the collapse of the housing market beginning at the end of 2007, shown in Figure 10, is consistent with borrowers revolving larger balances on their mortgage loans post-BAPCPA. This increase in revolving balance is consistent with the alternative mortgage products discussed in the previous section driving larger revolving balances.

In Figure 11 (panel b), I study student loan balances from 2004 to 2010. I find that in zip codes with higher 2004 exposure to IMCs, borrowers are statistically more likely to revolve their student loan balance through 2010. The differential increase in individuals who revolve their student loan balance is highest among Black, next highest among Latino, and lowest among white zip codes. A 10% increase in IMC market share leads to a highly significant 9% increase in revolving student loan balances in Black zip codes, an insignificant 3% increase in Latino zip codes, and and insignificant decrease in revolving student debt in white zip codes, in the post period. Mueller and Yannelis (2019) documents that student debt repayment

fell during the Global Financial Crisis, indicating that the results in Figure 11 are consistent with students disproportionately increasing the amount of student debt that they revolve in areas with a higher pre-period exposure to the BAPCPA policy change. This effect is largest for majority Black zip codes, followed by majority Hispanic zip codes, while majority white zip codes do not seem to be affected.[31]

In Figure 11 (panel c), I study auto loan balances from 2004 to 2010. Zip codes with higher 2004 IMC market share exposure experience a disproportionate increase in auto loan balances in the post period, consistent with auto balances increasing within an individual. This could either be driven by an increase in number of auto loans that a borrower has, or it could be driven by a borrower increasing the amount of balances that it revolves. However, the Federal Reserve indicates that new auto loan sales began decreasing in 2007Q4, and did not recover to pre-period levels until the end of 2013, consistent with individuals increasing their revolving auto balances.[32]

The increase in auto balances is highest in Latino zip codes. For Latino zip codes auto loan balances begin rising in the first quarter of 2006 and becomes statistically significant during 2008 through the first quarter of 2010. A 10% increase in 2004 IMC market share leads auto balances to increase by a statistically significant 8% post BAPCPA. This is consistent with borrowers in Latino zip codes revolving their auto and student loans in order to prioritize paying their mortgage payments, during the height of the Global Financial Crisis. In Black zip codes, a 10% increase in pre-period IMC market share leads to an 5% increase in revolving auto balances, statistically significant above the 85% level. This is also consistent with an increase in financial stress in minority areas during and after the Global Financial Crisis. In white zip codes, auto loan balances increases remained close to zero and insignificant through 2010.

Borrowers begin to see an increase in unpaid auto and student loan balances that are coincident with the increase in their mortgage loan balances, before the Global Financial Crisis began. This timing, and parallel pre-period trends across all three racial subgroups ameliorates the concern that these areas were pre-disposed to fare worse in the Financial Crisis. The results are more consistent with the increase in auto and student loan balances being driven by the increase in alterative mortgage products. The previous sections show that these borrowers were disproportionately exposed to mortgages with artificially low initial

[31] Consistent with Mueller and Yannelis (2019), I find that the increase in revolving student loan balances seems to be due to spillover effects of exposure to BAPCPA depressing economic activity resulting from the severe drop in home prices in high-IMC zip codes, rather than a home equity channel.

[32] See FEDS Notes: "Auto Financing during and after the Great Recession," by Ralf Meisenzahl, available here: https://www.federalreserve.gov/econres/notes/feds-notes/auto-financing-during-and-after-the-great-recession-20170622.html.

mortgage payments, which reset to much higher rates and exposed borrowers to payment shocks.

The results show that high IMC areas are first more exposed to increasing mortgage balances beginning in 2005. The increase in mortgage balances was followed first by an increase in auto loan balances beginning in 2006, and then by increased student loan balances beginning in 2008. Figure 21 shows that these effects are more prominent in the lowest income growth quartile relative to the highest income growth quartile. The results suggest that the increase in auto and student loan balances are driven by the increase in alterative mortgage products. The results in Section 3.3 and Section 4.1 show that these alternative products had artificially low initial mortgage payments, which reset to much higher rates and exposed borrowers to payment shocks, defaults, foreclosures and bankruptcies. These real effects likely caused borrowers to reallocate their auto and student debt payments toward mortgage related expenses. The results are consistent with majority Black and Latino households having fewer buffers available to weather foreclosure and bankruptcy, and needing to substitute away from paying their student loans, toward making debt payments on their mortgages. The evidence suggests that the 2005 exposure to the credit supply expansion via risky mortgage products exacerbated systemic vulnerabilities and financial inequality for minority groups.

[FIGURE 11 about here.]

5 Conclusion

In Appendix O, I introduce a stylized model that illustrates how an increase in collateral value in the secondary market lowers dealers' cost of capital, allowing dealer-banks to lower the interest rate that they charge borrowers in the primary market. The intuition of the model is that the alternative products were always optimal for borrowers with higher income volatility (lower income growth) but before the policy change, the price of these mortgages was above borrowers' reservation price. Following the policy change, the price dropped below borrowers' reservation price, creating a demand stimulating mechanism that enabled new borrowers to enter the market. The result of the model suggests that the policy change would create an expansion of alternative products at an unprecedented level. This mechanism helps to explain why, although alternative mortgage products had existed since the 1980s, we had not seen them originated at the scale they reached just prior to the GFC.

Empirically, I find that in response to BAPCPA, lenders increased their originations of alternative mortgage products. Post-BAPCPA, minority borrowers receive disproportionately more alternative mortgages and suffer the brunt of mortgage defaults during the GFC.

The alternative mortgages originated in response to BAPCPA were disproportionately likely to experience payment shocks, where their mortgage payments reset to payments that were 10% or more higher at the first reset date. These high payment resets and complex features such as low documentation and negative amortizing structures made the mortgage products more susceptible to default. The results further suggest that the defaults would be correlated in time, due to synchronized payment resets, as well as in geographic areas. Duffie and Garleanu (2001) shows that increased correlation in exposure to negative shocks would impact the value of the MBS that they supported in a downturn, amplifying MBS price changes in a crisis.

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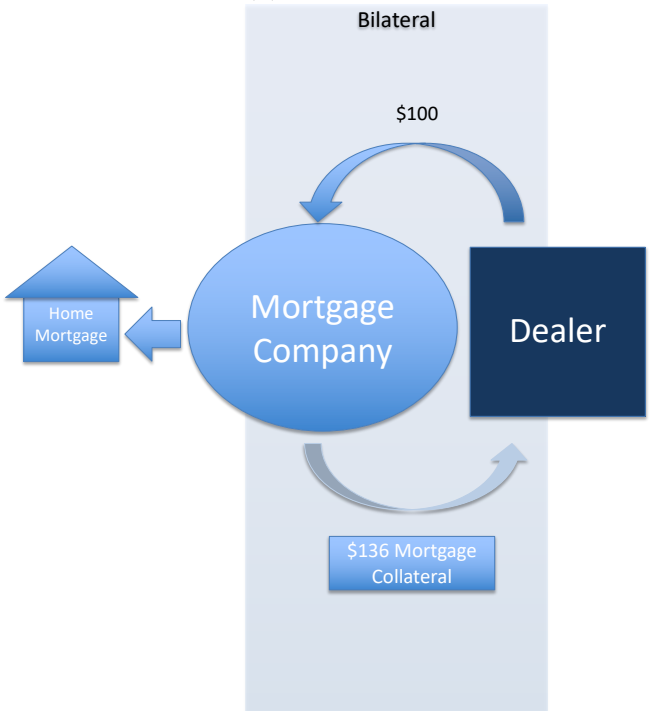
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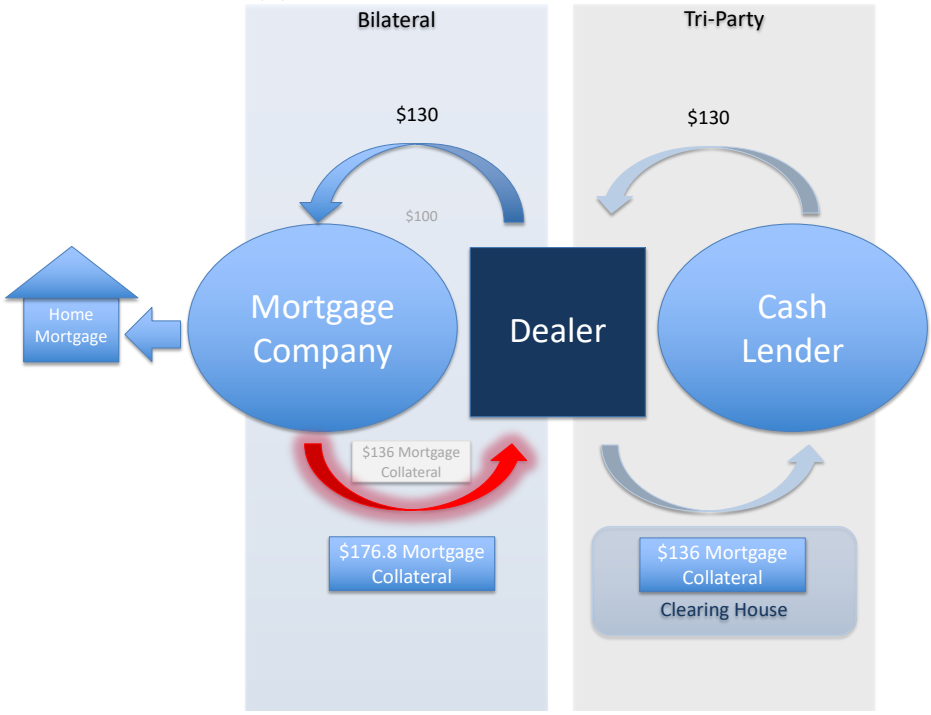
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FIGURE 1: REPO MARKETS BEFORE AND AFTER BAPCPA 2005

(a) Repo markets before BAPCPA

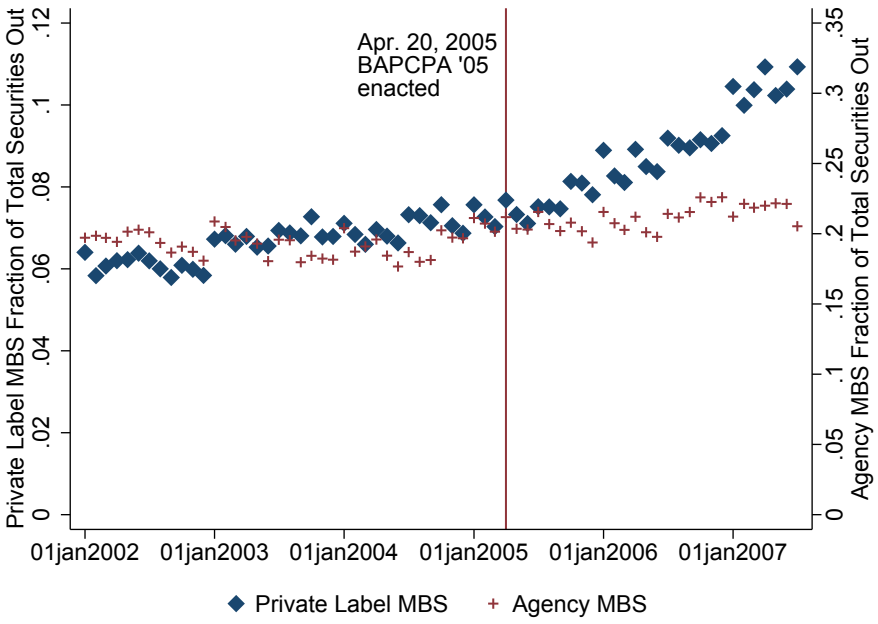


(b) Repo markets after BAPCPA



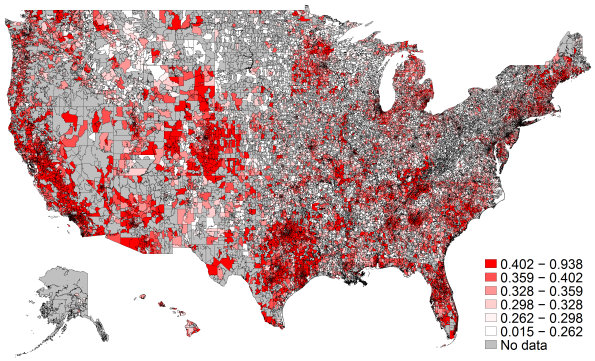
Notes: Figures depict the process by which a dealer can borrow and lend funds via the tri-party and bilateral repurchase market respectively, using the same underlying private-label mortgage collateral provided by the cash borrower for both contracts. Figure (a) depicts the "first round" of lending from the dealer to the IMC before BAPCPA and Figure (b) depicts the proposed "second round" of lending enabled by BAPCPA.

FIGURE 2: DEALER BORROWING BACKED BY PRIVATE-LABEL VS. AGENCY MORTGAGE COLLATERAL

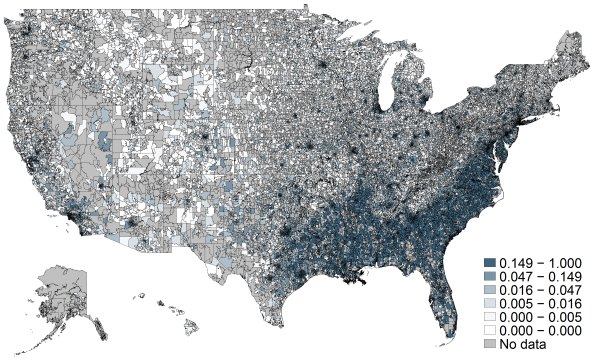


Notes: Figure plots the fraction of total primary dealer securities out that was made up of private-label MBS versus agency MBS pre and post BAPCPA. The variable corporate securities in the FR 2004 proxies for private-label MBS. Agency MBS is comprised of Federal Agency and GSE MBS in the FR 2004 data. Directly after BAPCPA, private-label MBS as a fraction of securities began to increase significantly relative to agency MBS. The evidence is consistent with dealers increasing their use of private-label mortgage collateral to borrow funds following BAPCPA.

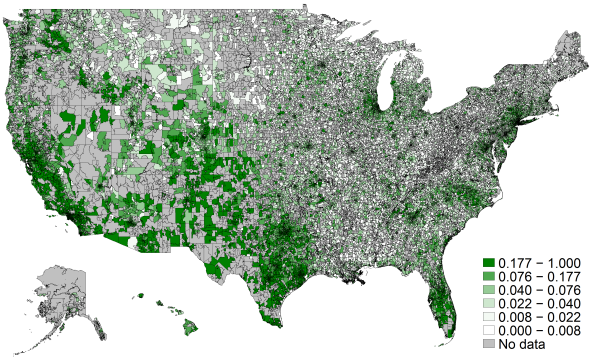
FIGURE 3: HEATMAPS



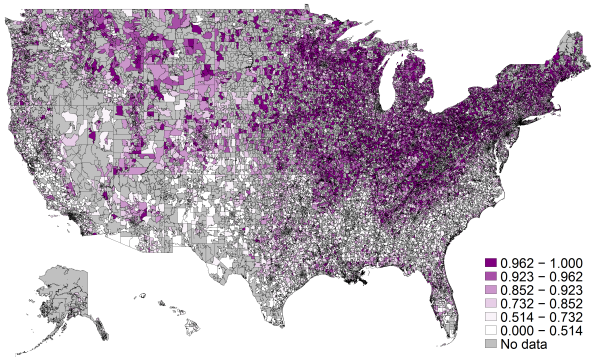
(a) Independent Mortgage Company (IMC) Market Share



(b) Population of Black Inhabitants



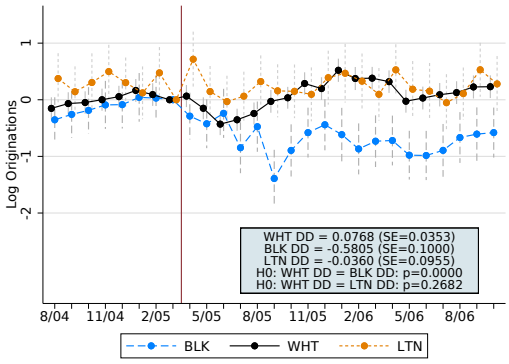
(c) Population of Latino Inhabitants



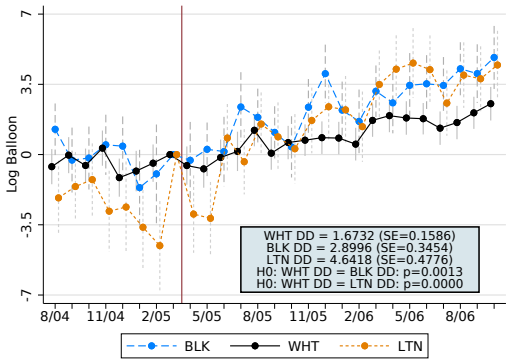
(d) Population of White Inhabitants

Notes: Panel (a) The figure depicts the zip-code-level market share of all IMCs reported in 2004. The market shares are calculated using the 2004 HMDA data. Panels (b)-(d) depict the zip-code-level population of inhabitants by race. The calculation utilizes the American Community Survey (ACS) 5-year estimates for race from IPUMS National Historical Geographic Information System NHGIS.

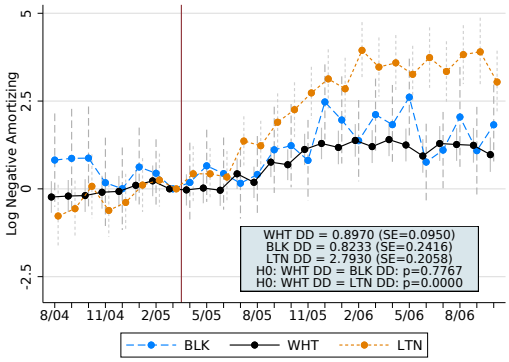
FIGURE 4: DIFFERENCE-IN-DIFFERENCES (DID) BY RACE SUBCATEGORIES - ORIGINATIONS & MORTGAGE PRODUCTS



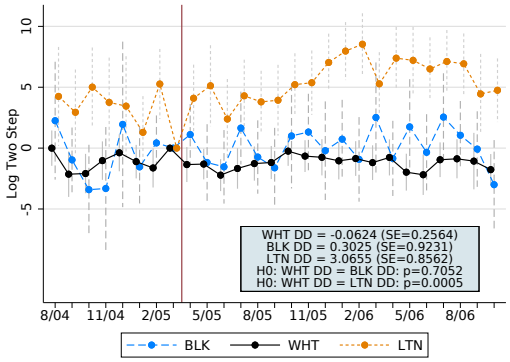
(a) Originations



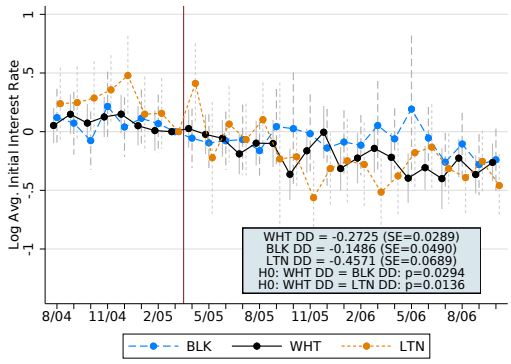
(b) Balloon



(c) Negative Amortizing



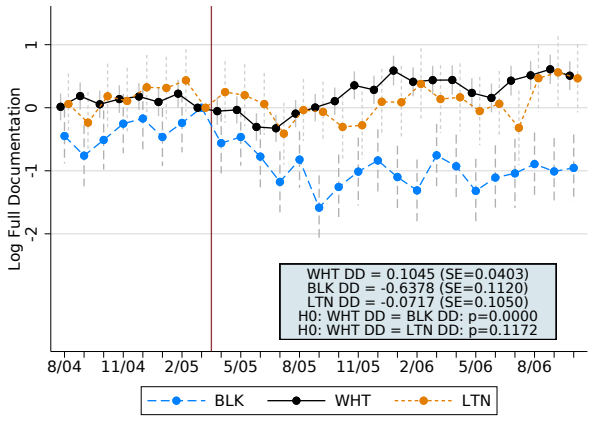
(d) Two-Step



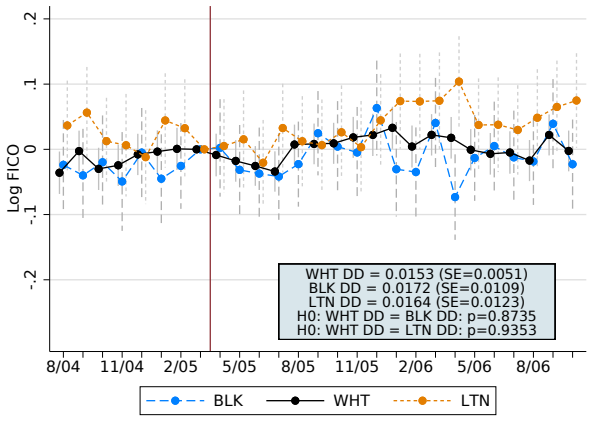
(e) Initial Interest Rate

Notes: Figure plots the dynamic response of the coefficient of interest β_T from the Equation 5 by subcategory.

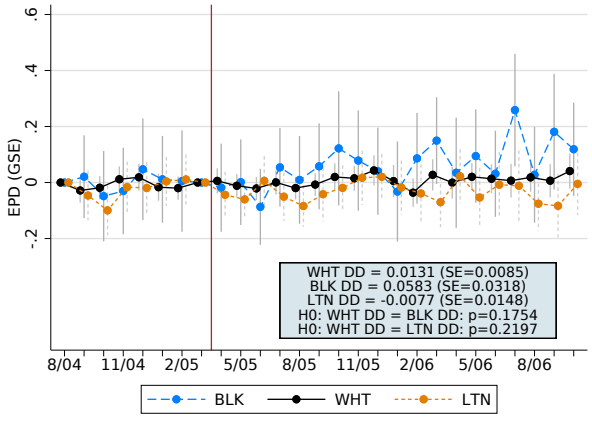
FIGURE 5: DIFFERENCE-IN-DIFFERENCES (DID) BY RACE SUBCATEGORIES - BORROWER CHARACTERISTICS



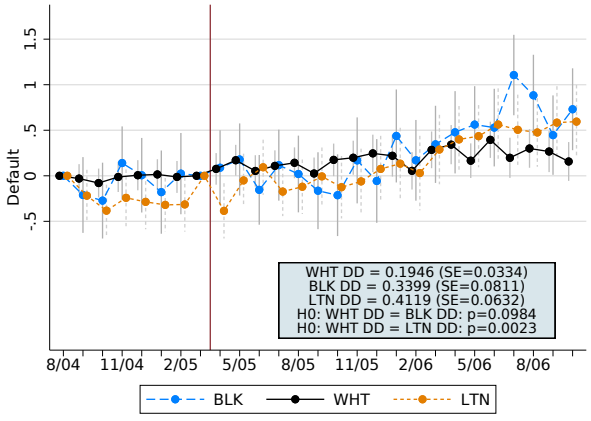
(a) Full Documentation



(b) Credit Score



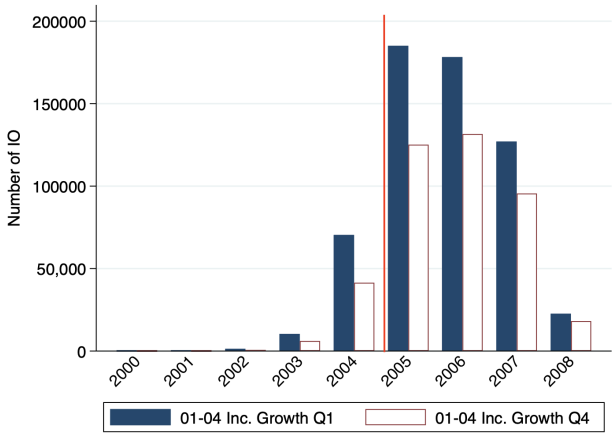
(c) Early Payment Default



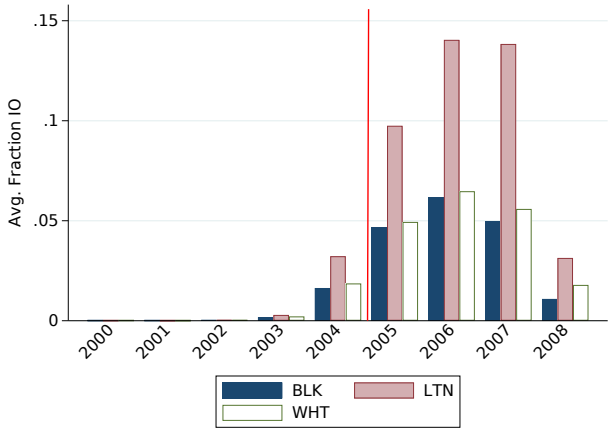
(d) Total Default

Notes: Panels a and b plot the dynamic response of the coefficient of interest β_T from Equation 5 by subcategory. Panels c and d plot the dynamic response of the coefficient of interest β_T from Equation 7 by subcategory.

FIGURE 6: INTEREST ONLY MORTGAGES BY ZIP CODE INCOME QUARTILE AND RACE



(a) Num. Interest Only (IO) – Income Quartile



(b) Frac. Interest Only (IO) – Race

Notes: The figure depicts mortgage originations by product type. The panel by income growth quartile depicts the total number of mortgages originated each year for a given product type in zip codes that are in the lowest quartile (Q1) and the highest quartile (Q4) of 2001 to 2004 income growth. The panel by racial subgroup depicts the fraction of mortgages originated each year for a given product type in zip codes that are defined as Black (BLK), Latino (LTN), and white (WHT).

Figure 7: County Loan Applications

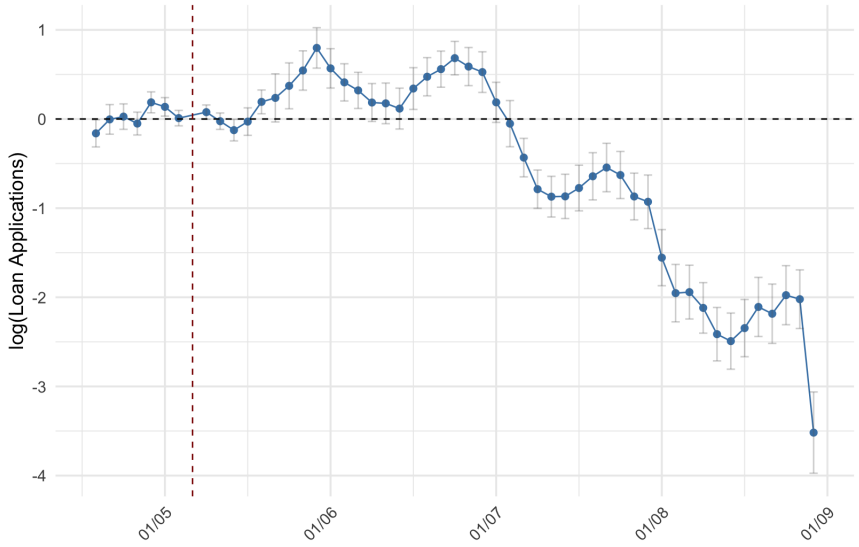
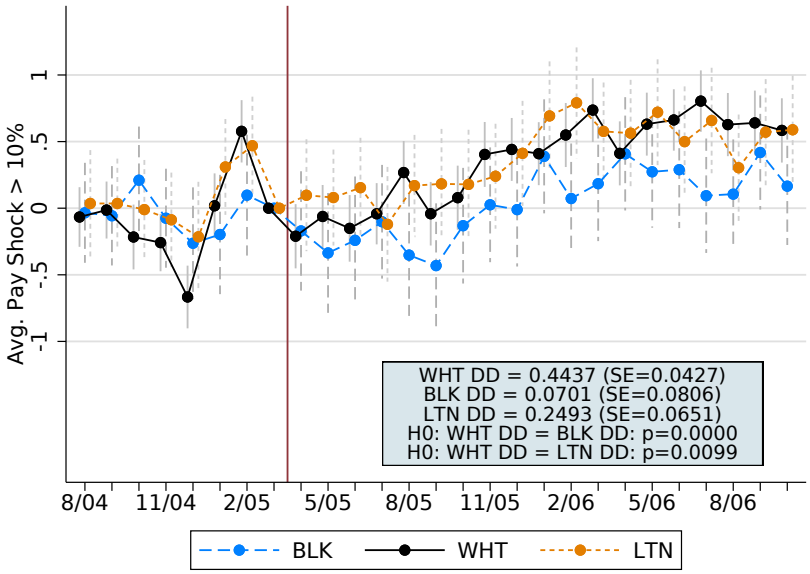


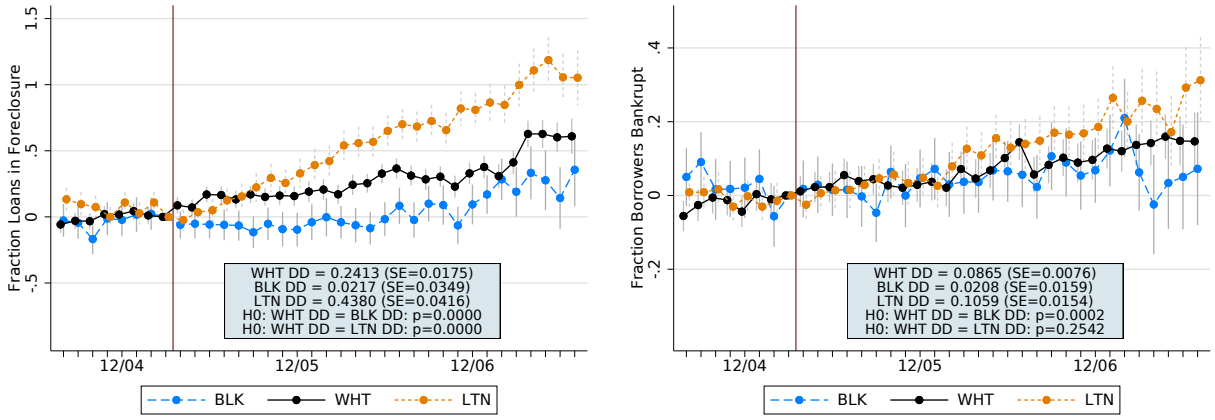
Figure 8: 10% Pay Shock



Racial Subgroups

Notes: The figure depicts the likelihood of pay shocks for mortgages originated in zip codes with higher IMC market share pre- versus post-BAPCPA in each subgroup. The data are limited to mortgages that experience a payment reset.

FIGURE 9: FORECLOSURE & BANKRUPTCY IN PRIVATE-LABEL DATA

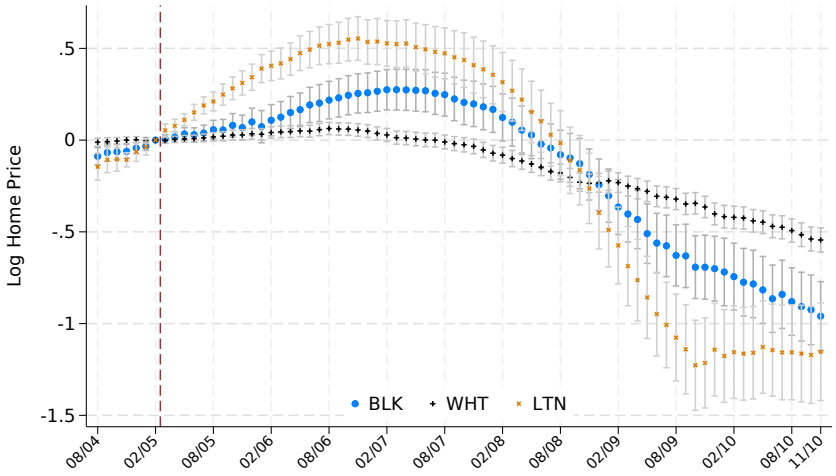


(a) Foreclosure-Race

(b) Bankruptcy-Race

Notes: Figure plots the dynamic response of the coefficient of interest β_t from Equation 11 by subcategory.

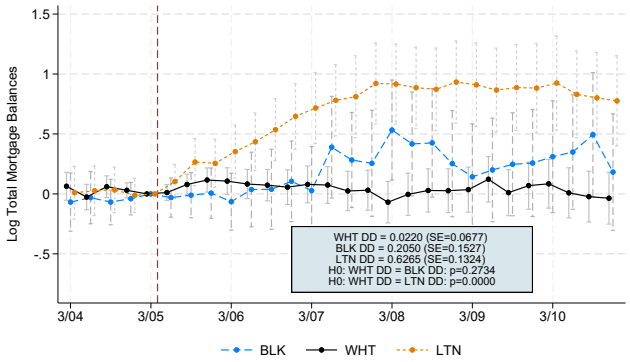
FIGURE 10: DIFFERENCE-IN-DIFFERENCES BY RACE SUBCATEGORIES - HOME PRICES



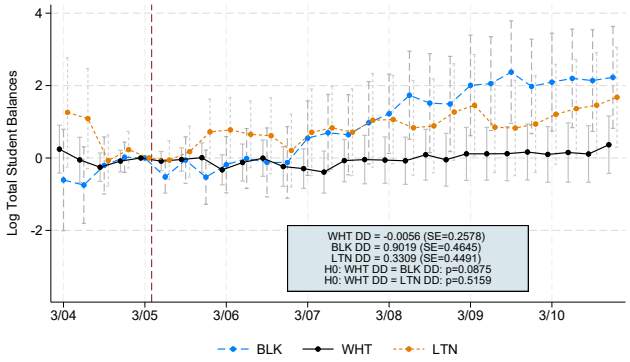
(a) Racial Subgroups

Notes: Figure plots the dynamic response of the coefficient of interest β_t from Equation 5 by subcategory. These plots utilize the LLMA mortgage origination data and Zillow's ZHVI home price data.

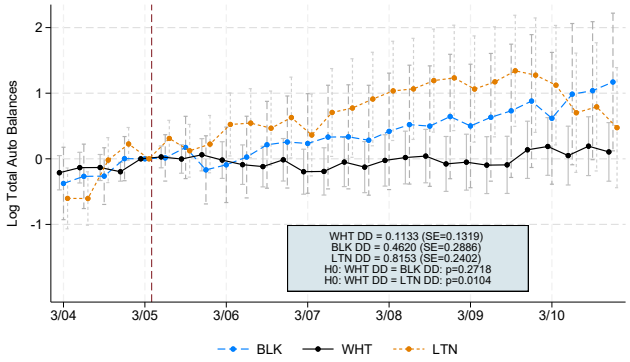
FIGURE 11: DIFFERENCE-IN-DIFFERENCES BY RACE SUBCATEGORIES - CREDIT OUTCOMES



(a) Mortgage Loan



(b) Student Loan



(c) Auto Loan

Notes: Figure plots the dynamic response of the coefficient of interest β_t from Equation 12 by subcategory.

Table 1: Dealer Secured Borrowing using PLS Collateral

	(1) Fraction of Total Securities Out	(2) log(Securities Out)
Post	0.018***	0.423***
	(0.001)	(0.014)
PLS	-0.126***	-1.063***
	(0.001)	(0.020)
Post × PLS	0.004**	0.186***
	(0.002)	(0.027)
r2	0.9788	0.9172
N	582	582

Notes: Table reports the results from Equation 2. Regression is run on the FR 2004 data data from January 1, 2002 through July 31, 2007, where April 15, 2005 and after is considered the post period.

Table 2: Summary Statistics

	All	Above Median IMCMktShr	Below Median IMCMktShr
	(1)	(2)	(3)
Numbers of ZIP codes	36,092	18,046	18,046
Income	37,690	36,351	39,079
	(16,852)	(14,710)	(18,720)
%IncomeGrowth(01-04)	7.79	7.41	8.20
	(8.43)	(8.53)	(8.30)
AverageHousingPrice	193,942	171,506	220,487
	(162,749)	(96,960)	(213,088)
%HousingPriceGrowth(01-04)	25.99	28.51	22.99
	(19.73)	(20.87)	(17.80)
%CollegeEducated	7.91	7.18	8.63
	(6.00)	(5.01)	(6.78)
%Unemployed	2.71	2.86	2.55
	(2.51)	(2.48)	(2.54)
%Black	7.23	10.00	4.46
	(15.76)	(18.83)	(11.28)
%Hispanic	6.69	9.37	4.02
	(14.56)	(16.47)	(11.76)
%White	81.54	75.72	87.35
	(23.85)	(26.36)	(19.37)

Notes: Table reports the results using data from the IRS Statistics of Income (income), Zillow (house prices), and the US Census (education, employment, and demographics). ZIP codes with higher IMC market share have slightly more Black and Hispanic residents. However, subgroup analysis shows pre-period parallel trends across majority Black, White, and Hispanic ZIP codes, suggesting racial composition does not drive trend differences.

TABLE 3: Originations by Race

WHT

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	log(Orig)		log(Balloon)		log(NegAm)		log(TwoStep)		log(InitInterest)	
Post × IMCMktShr$_{z,04}$	-0.003	0.077**	2.111***	1.673***	0.851***	0.897***	0.708***	-0.062	-0.196***	-0.273***
	(0.030)	(0.035)	(0.154)	(0.159)	(0.087)	(0.095)	(0.273)	(0.256)	(0.024)	(0.029)
StatexMonthFE	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
ZipFE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
r2$_a$	0.91	0.91	0.36	0.49	0.78	0.80	0.13	0.31	0.21	0.25
N	416940	416857	45357	45112	104275	104141	7794	7344	269954	269839

BLK

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	log(Orig)		log(Balloon)		log(NegAm)		log(TwoStep)		log(InitInterest)	
Post × IMCMktShr$_{z,04}$	0.054*	-0.580***	1.981***	2.900***	0.835***	0.823***	0.272	0.303	-0.206***	-0.149***
	(0.029)	(0.100)	(0.123)	(0.345)	(0.083)	(0.242)	(0.199)	(0.923)	(0.018)	(0.049)
StatexMonthFE	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
ZipFE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
r2$_a$	0.90	0.91	0.22	0.34	0.67	0.70	-0.01	0.08	0.21	0.24
N	430659	430627	43223	42997	98067	97930	5658	5047	276548	276512

LTN

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	log(Orig)		log(Balloon)		log(NegAm)		log(TwoStep)		log(InitInterest)	
Post × IMCMktShr$_{z,04}$	0.034	-0.036	3.170***	4.642***	1.526***	2.793***	1.324***	3.066***	-0.293***	-0.457***
	(0.026)	(0.096)	(0.141)	(0.478)	(0.074)	(0.206)	(0.238)	(0.856)	(0.019)	(0.069)
StatexMonthFE	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
ZipFE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
r2$_a$	0.91	0.91	0.36	0.49	0.78	0.80	0.13	0.31	0.21	0.25
N	416940	416857	45357	45112	104275	104141	7794	7344	269954	269839

Notes: Table reports the coefficient of interest in each subgroup for Equation 6.

TABLE 4: Characteristics and Performance by Race

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	log(FullDoc)		log(FICO)		loanEPDgse		loanDefault	
WHT								
Post × IMCMktShr$_{z,04}$	-0.139***	0.104***	0.025***	0.015***	0.020***	0.014	0.333***	0.190***
	(0.034)	(0.040)	(0.004)	(0.005)	(0.007)	(0.009)	(0.029)	(0.033)
StatexMonthFE	No	Yes	No	Yes	No	Yes	No	Yes
ZipFE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
r2$_a$	0.86	0.87	0.20	0.20	0.02	0.02	0.10	0.11
N	352299	352198	401052	400963	416895	416780	416895	416780
BLK								
Post × IMCMktShr$_{z,04}$	-0.099***	-0.638***	0.031***	0.017	0.027***	0.059*	0.354***	0.332***
	(0.032)	(0.112)	(0.003)	(0.011)	(0.007)	(0.032)	(0.027)	(0.080)
StatexMonthFE	No	Yes	No	Yes	No	Yes	No	Yes
ZipFE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
r2$_a$	0.85	0.87	0.23	0.23	0.02	0.02	0.10	0.11
N	363105	363067	413467	413433	416895	416780	416895	416780
LTN								
Post × IMCMktShr$_{z,04}$	-0.309***	-0.072	0.024***	0.016	0.020***	-0.002	0.495***	0.380***
	(0.031)	(0.105)	(0.003)	(0.012)	(0.006)	(0.015)	(0.023)	(0.062)
StatexMonthFE	No	Yes	No	Yes	No	Yes	No	Yes
ZipFE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
r2$_a$	0.86	0.87	0.20	0.20	0.02	0.02	0.10	0.11
N	352299	352198	401052	400963	416895	416780	416895	416780

Notes: Table columns 1 through 4 report the coefficient of interest in each subgroup for Equation 6. Columns 5 through 8 report the coefficient of interest in each subgroup for Equation 8.

Table 5: Subprime vs Alt-A Payment/Balance April 2005 - Dec. 2007

	Mean (Subprime)	Mean (Alt-A)	Difference	T-Stat	P-Value
MtgPayment / Balance	0.0077	0.0053	.0024	763.42	0.0000
	(0.0018)	(.0072)			
N	5858178	3054048			

Notes: Table presents a balance test between mortgage payments scaled by original balance for Alt-A versus subprime loans originated between April 2005 and December 2007. The loans are defined as Alt-A versus subprime using the following algorithm: loans with "@", which serves as collateral identifier for Alt-A, at the end of the name field were classified as Alt-A. Corelogic "MBS" loans without an "@" at the end of their name were classified as neither Alt-A nor subprime. Corelogic "ABS" loans without an "@" at the end of the name were classified as subprime, and the "GRADE_LP" variable was referenced, when populated, to confirm subprime in this group. The outcome variable for both Alt-A and subprime loans is windsorized at the 1% level.

Table 6: FHA Share of Mortgage Originations

	(1) WHT	(1) BLK	(1) LTN
Post × IMCMktShr$_{z,04}$	-0.035***	-0.030*	-0.076***
	(0.007)	(0.018)	(0.020)
StatexMonthFE	Yes	Yes	Yes
ZipFE	Yes	Yes	Yes
r2$_a$	0.32	0.30	0.32
N	270454	277156	270454

Notes: Table reports the response of FHA origination rates in a given zip as a function of the interaction term between 2004 market share of independent mortgage companies (IMCs) × the post period, by racial subgroup.

Appendix

A Census Data Collection and Variables

Data Collection Method: The population data was downloaded from the 2000 Census of Population using the Census Data API (website: https://www.census.gov/data/developers/data-sets/decennial-census.2000.html) with the R programming language. The Census dataset was selected because it contains data specifically from the year 2000, while the NHGIS database only provides data from the 2012-2016 period.

Variables Used: The data used in this analysis is from the year 2000, corresponding to ZIP Code Tabulation Areas (ZCTAs). The following variables were used:

From '/data/2000/dec/sf1/variables':

- Total population (P004001)
- Hispanic or Latino population (P004002)
- White population (P004005)
- Black or African American population (P004006)

From '/data/2000/dec/sf3/variables':

- Population with a Bachelor's degree, male (P037015) and female (P037032)
- Unemployed population, male (P043007) and female (P043014)

B HomeBanc Discussion of Alternative Mortgages

Independent mortgage company, HomeBanc, states in its 2005 annual report that the primary attraction of alternative mortgage products is that they have initial monthly payments that are significantly lower than those on traditional mortgages. This feature allows borrowers to be approved for larger mortgages because many originators determine the amount that a borrower can afford based on the initial scheduled monthly payment, not on the payment once the mortgage resets to its market rate. See excerpt below:

> "Mortgage loans that are referred to generally as ARMs may include any of the following types of loans: ... hybrid, interest-only, negative amortization, option ARMs."

"The primary attraction to borrowers of these adjustable-rate mortgage loan products is that **initial monthly mortgage loan payments** can be **significantly lower** than fixed-rate or level-pay mortgage loans under which the borrower pays both principal and interest at an interest rate fixed for the life of the mortgage loan. As a result, many borrowers are able to incur substantially **greater mortgage debt** using one of these adjustable-rate mortgage loan products"

"When evaluating a mortgage loan application from a prospective borrower, ... many mortgage originators determine the amount of loan that the **borrower can afford** based on the borrower's **initial scheduled monthly payments** ... rather than based on the adjusted monthly payments as of future mortgage interest reset dates"

"Borrowers who intend to avoid increased monthly payments by refinancing their mortgage loans may find that lenders may not in the future be willing or able to offer these adjustable-rate mortgage loan products... . A decline in housing prices generally or in certain regions of the United States could also leave borrowers with insufficient equity in their homes to permit them to refinance. In addition, if the recent rapid increase in house prices ceases or housing prices decline, borrowers who intend to sell their properties on or before the expiration of the fixed-rate periods or interest-only periods on their mortgage loans may find that they cannot sell their properties for an amount equal to or greater than the unpaid principal balance of their loans, especially in the case of negative amortization mortgage loans. These events could cause borrowers to default on their mortgage loans."
-HomeBanc 2005 Annual Report p. 55-56.

C Stylized Facts

C.1 The Rise of Alternative Mortgage Products

I establish stylized facts about mortgage originations leading up to the GFC.

Fact 1: *The expansion of alternative mortgages accelerated rapidly, beginning in 2005, and crashed in 2008.*

Fact 2: *The expansion of these alternative mortgages was more prominent among borrowers with low rates of income growth and those in minority-dominant zip codes.*

In Figure 12, I plot the fraction of negative amortizing mortgages (a type of alternative mortgage products) originated, relative to all originations, in majority Black, Latino, and white zip codes.[33] The figure shows that the number of negative amortizing mortgages in low income growth areas almost doubled from 2004 to 2005 and that these mortgages were disproportionately common in minority zip codes. The volume of these mortgages remained elevated from 2005 through 2007, and then crashed in 2008. The dynamics of the plot are consistent with BAPCPA driving these originations, which were originated in an unsustainable way, contributing to the Global Financial Crisis – at which time the market for these crashed.

[FIGURE 12 about here.]

C.2 The Rise of Default Rates

Fact 3: *Early payment defaults and total defaults increased following 2005, and more than doubled from their pre-2005 levels leading up to the Global Financial Crisis.*

Fact 4: *The increase in default rates was more prominent among borrowers with low rates of income growth and those in minority-dominant zip codes.*

In Figure 13 panel (a), I plot early payment defaults (EPD) from 2000 to 2008. Early payment defaults are reported using the Government Sponsored Entity (GSE) methodology, which flags whether a loan enters 90 day delinquency within the first 12 months since origination.[34] Historically, mortgages that are underwritten well are unlikely to default in the first year of origination (Mayer, Pence and Sherlund (2009)). Figure 13 shows that approximately 0.7% of loans in both the lowest and highest quartile of income growth experienced early payment default during 2000 to 2004. Following 2005, the early payment defaults increased at a faster rate for borrowers in the lowest quartile of income growth. By 2007, this number more than tripled such that nearly 3.0% of loans originated entered early payment default.

[33] I plot negative amortizing mortgages as a fraction of all originations in a zip code, rather than the total number of these originations. Black and Latino households have lower homeownership rates than white households, thus for these descriptive plots, plotting the fraction of alternative mortgages better captures the disproportionate exposure that minority zip codes had to alternative mortgage products.

[34] Early payment defaults reported using the Federal Housing Administration (FHA) methodology flags whether a loan enters 60 day delinquency within the first six months since origination. Results using the FHA measure are consistent with the GSE measure.

In panel (b), I plot the fraction of total defaults by income growth quartile. Total defaults also increased dramatically following 2005. The fraction of mortgages that defaulted by year of origination hovered around 6% of mortgages from 2000 to 2004. By 2007, this number almost quadrupled, such that nearly 30% of mortgages that originated in 2007 defaulted. Both the highest and lowest income growth quartiles experienced growth in total defaults by origination year, however the lowest income growth quartile experienced the highest fraction of defaults.

In panel (c), I explore the fraction of early payment defaults experienced by majority Black, Latino, and white zip codes. Majority Black zip codes endured the largest growth in the fraction of loans that experienced early payment default post 2005. EPDs in Black zip codes hovered around 1.5% during 2000 to 2004. EPDs in Black zip codes outpaced Latino and white zip codes in all years post-2005 and peaked in 2007 at 4.5% of originated loans experiencing early payment default in majority Black zip codes. In majority Latino zip codes, the percent of EPDs remained close to 1% of originations during 2000 to 2004 and peaked in 2007 at almost 3% of originations. White zip codes experienced an average EPD rate of about 0.4% during 2000 to 2004 and their EPD rate peaked in 2008 at 1.8% of mortgages originated in 2007 experiencing early payment default.

In panel (d), I explore the fraction of total defaults experienced by majority Black, Latino, and white zip codes. Similar to panel (b), this measure looks at the number of originations that ever experience a default by origination year.[35] Following 2005, growth in total defaults in majority Black and Latino zip codes outpaced defaults in majority white zip codes. Prior to 2005, majority Black zip codes experienced default rates near 10%. Following 2005, the default rate for these zip codes averaged around 20% and peaked at almost 35% in 2007. Prior to 2005, majority Latino zip codes experienced default rates near 7%, while following 2005, the default rate in these zip codes averaged around 17% and peaked in 2007 at close to 30%. Prior to 2005, majority white zip codes experienced a default rate close to 5%, while following 2005 the default rate in these zip codes averaged around 14% and peaked in 2007 at 17%. The large increase in total default rate in majority Black and Latino zip codes relative to majority white zip codes is consistent with the increase in risky alternative products that these zip codes received, as shown in Figure 6.

[FIGURE 13 about here.]

[35]The final year in the performance data sample that I have is 2016. Therefore my measure indicates the fraction of loans that experience default in or before 2016.

D Continuous Difference-in-Differences

IMC Market Share Callaway, Goodman-Bacon and Sant'Anna (2021) note that bias in the continuous difference-in-differences setting can arise when the weights of treatment doses used in the estimator are not similar to the actual treatment dose distribution in the population. Theorem 3.4 of the paper states that under the strong parallel trends assumption, when the distribution of the treatment dose in the population is symmetric and closer to normal, the two-way fixed effect (TWFE) estimand can be close to or even identical to weighting average causal response (ACR(d)) parameters by the distribution of the treatment dose, the natural target parameter (population average treatment effect on the treated (ATT)). In the continuous (Cont) or multivalued (MV) treatment case, the TWFE estimator can be decomposed as follows:

$$\beta^{twfe} = \int_{d_L}^{d_U} w_1(l) ACR(l) dl + w_0 \frac{ATE(d_L)}{d_L}, \qquad (Cont)$$

$$\beta^{twfe} = \sum_{d_j \in D_+} w_l(d_j) \frac{ACR(d_j)}{d_j - d_{j-1}}, \qquad (MV)$$

Where the weights are equal to

$$w_1(l) := \frac{(\mathbb{E}[D|D \geq l] - \mathbb{E}[D])P(D \geq l)}{var(D)} \; and \; w_0 := \frac{(\mathbb{E}[D|D > 0] - \mathbb{E}[D])P(D > 0)d_L}{var(D)}$$

I calculate a histogram of the treatment doses of $IMCMktShr_{z,04}$ for the counties used in the regression analysis. I find that $IMCMktShr_{z,04}$ is symmetric and close to normally distributed. I then calculate the weights used in the TWFE estimator and find that the weights closely track the population distribution of treatment. Under the strong parallel trends assumption, this indicates that the TWFE estimand found in the regression analysis will be a close approximation of the desired weighted average causal response of treatment on the treated (ATT).

[Figure 14 about here.]

If strong parallel trends does not hold and "selection bias" was likely to be higher at higher treatment levels, even having the population weights that are similar to the TWFE will not eliminate bias. This is because there still may be bias in the treatment response at each dose. In this setting the bias is likely to be small. The Fannie Mae and Freddie Mac fraud cases, which placed limits on Fannie/Freddie debt levels and limited their ability to fund mortgages, plausibly exogenously lowered barriers for entry for IMCs to enter zip

codes, driving variation in the IMC market share. This growth in IMCs was concentrated in 2003 and stabilized by 2004. I calculate the treatment measure in 2004. Treatment is also well distributed across the United States. IMC populated areas are similar in the pre-period income levels and home prices after taking out $State \times Month$ and $County$ fixed effects. This alleviates worries that the areas were significantly different along dimensions that would bias the results. I conduct the regression analysis over a relatively short window, ten months post treatment, to help ensure that the post-period is a valid counterfactual for the pre-period.

2001-2004 Income Growth I also include the income growth distribution plotted against the two way fixed effects weights used in the estimation command. The distribution of income growth is relatively similar to the weights used in the TWFE command, which demonstrates that the interpretation of the beta coefficient calculated is the average treatment effect of the treated (ATT).

[FIGURE 15 about here.]

E Difference-in-Differences Results for All Zip Codes

I estimate the treatment intensity research design in Equation 5 for all mortgages in the Corelogic LLMA data in a single regression. This analysis acts as a foundation for the analyses that study distributional differences in the impact of these mortgages on different borrowers.

I estimate the regression for the following $Y_{z,t}$ variables: $\log(PurchaseOriginations_{z,t})$, $\log(Balloon_{z,t})$, $\log(NegAm_{z,t})$, $\log(TwoStep_{z,t})$, $\log(InitialInterestRate_{z,t})$, and $\log(AvgFICO_{z,t})$ in zip code z, at month t, log is the natural logarithm. [36] γ_z denotes Zip level fixed effects, and $\eta_{s,t}$ denotes $State \times Month$ fixed effects. $IMCMktShr_{z,04} \times \mathbb{1}_{t=T}$ is the interaction term between the market share variable and an indicator variable for month of origination. β_T is the coefficient on the interaction term that measures the effect of a one unit increase in IMC market share on the dependent variable in each month relative to March 2005, the month prior to the passage of BAPCPA. Standard errors are clustered at the zip code level.

Figure 16 reports the regression results. As shown in Figure 16 panel (a), the total number of purchase mortgage originations increased statistically significantly following BAPCPA for zip codes with high IMC exposure. These purchase originations first decrease and then begin

[36] While county level $\log(PurchaseOriginations)$, $FracBalloon$, $FracNegAm$, and $\log(InitialInterestRate)$ were touched on in Lewis (2023), they are explored at the more granular zip code level here and $TwoStep_{z,t}$ and $AvgFICO_{z,t}$ are new to this analysis. I study these variables to establish that there is an overall increase in alternative mortgages at the zip code level and study differences in demographic groups in the body of the paper.

to increase following the shock. This initial decrease is likely due to lenders transitioning into alternative products, which had not been originated as prolifically prior to BAPCPA. Figure 16 panel (b) shows that a 10% increase in pre-period IMC market share leads balloon originations to increase by 22%, panel (c) shows that the same increase in IMC market share leads negative amortizing originations to increase by 10.6%, and panel (d) shows that it leads two-step originations to increase by 16.6%. Two-step mortgages offered a fixed initial interest rate for an agreed-upon introductory period, typically for 5-7 years, and then reset once to a fixed rate at the prevailing market rate. Option ARM products are included in negative amortizing products since CoreLogic does not report Option ARMs separately.

Figure 16 panel (e) shows that a 10% increase in IMC market share in 2004 in a given zip code leads to a statistically significant 0.8% average decrease in the introductory interest rate directly following BAPCPA. The actual interest rate that adjustable rate mortgages were pegged to was the twelve month Treasury rate. The Treasury rate was monotonically increasing during this time period, as the Federal Reserve was in a monetary tightening regime. The decrease in the initial interest rate is consistent with an increase in alternative products, which allow the borrower to pay an initial introductory payment that is less than the fully amortizing interest and principal payment accruing on the mortgage.

In Figure 16 panel (f), I plot the credit score at the zip code level pre- versus post-BAPCPA. I find that the credit score increased following the policy change in areas that were more exposed to the IMCs. Prior to the policy change, there was no statistically significant increase in the credit score between more- versus less-treated zip codes. Following the policy change, a 10% increase in pre-period IMC market share led to a persistent 0.17% increase in credit score of new mortgage originations in the zip code. This increase in credit scores is consistent with an increase in mortgage originations from the extensive margin, as the model suggests, rather than the intensive margin.[37] This is because, if IMCs were increasing the number of mortgages that they originated but lending to their existing stock of borrowers, the credit score associated with these mortgages would begin to fall. Originating multiple new purchase mortgages to the same borrower would increase the borrowers' leverage ratio and lower their credit score. Additionally, I find that refinance mortgages were falling over this time period, as were second home purchases. The increasing credit score is also consistent with the increase in alternative mortgage products with riskier amortization structures; lenders likely compensated for increased income volatility and low down-payments by increasing borrower credit scores on these products.

[Figure 16 about here.]

[37]For IMCs, this could have been cannibalizing FHA originations, and not be completely new borrowers who otherwise would not have received mortgages.

F Difference-in-Differences Results for Private-Label MBS IMC Market Share

In Table 7, I estimate the Equation 6, however I replace $IMCMktShr_{z,04}$ with a treatment measure comprised of the market share of 2004 IMC originations that list purchaser as "Private Securitization" in HMDA. This robustness analysis further tests the proposed mechanism. Since the policy change only affected private-label mortgage originations, in this robustness test, I utilize exposure to the IMCs who had previously been selling their mortgages to private-securitization prior to the shock. The underlying assumption is that these areas that were more heavily exposed to private label mortgages made by IMCs in the pre-period would continue to do more originations of private-label mortgages. Therefore, I would expect these results to yield results similar in size and significance to the results in the main draft, since private-label mortgages are driving the result. This measure is more noisy than the IMC market share because it is smaller than the IMC market share. Additionally, since PLS originations began to accelerate in 2003 and stabilized in 2004, this measure is more affected by the fact that loans originated in later months are not sold until the following year, and thus will not appear in the numerator of the already smaller treatment measure. Furthermore, some IMCs that began selling mortgages into PLS in late 2004 and early 2005 will not be captured by this treatment measure, even though the IMCs were funded by dealers affected in the repo markets. For these reasons, this measure is not the measure used in the primary analyses in the main draft of the paper.

[Table 7 about here.]

I find that this alternate measure yields similar results to the results in the main draft in magnitude and significance. The minimum market share of IMC originations sold to private securitization in a zip code is 0% and the maximum is 16.7%. A one standard deviation increase in IMC PLS market share is .7%, so to simplify the exposition, I explain changes in the dependent variable in response to a 1% increase in IMC market share, which is close to a one standard deviation increase in IMC market share. I find that a 1% increase in IMC market share leads to a -1.6% decrease in originations for white, -1.3% decrease for Black, and -2.9% decrease in Latino zip codes. The decreases in originations are statistically significant for majority white and Latino zip codes. Using the IMC market share (and not just IMC market share sold into private securitization in 2004) leads to an increase in originations in white zip codes, however a decrease in originations in Black and Latino zip codes. The same change in treatment leads to a highly statistically significant increase in balloon mortgages of 6.5% in white, 28.6% in Black, and 22.8% in Latino zip codes. It also leads to an insignificant -.46% decrease in negative amortization mortgages in white zip

codes, but a highly significant 14.9% increase in Black, and 10.7% increase in Latino zip codes.

A 1% increase in IMC market share leads to insignificant changes in two step originations in white and Black zip codes, but a highly significant increase of 25.8% in Latino zip codes. The same change in treatment leads to a 0.26% decrease in introductory interest rates in majority white zip codes, a 1.64% decrease in Black zip codes, and a 1.82% decrease in Latino zip codes. For white zip codes, this decrease is not significant but for Black and Latino zip codes, these decreases are significant at the 10% level.

A 1% increase in IMC PLS market share increases credit score insignificantly for white and Latino zip codes, but significantly by 0.39% for Black zip codes. It also drives a highly significant decrease in full documentation by 2.47% for white zip codes, by 6.18% for Black zip codes, and by 8.9% for Latino zip codes. The 1% increase in treatment increases FHA early payment default (EPD) by .31 pp in white zip codes and leads to insignificant changes in Black and Latino zip codes. The same increase in treatment leads to insignificant changes in GSE EPD. The change in treatment drives a highly significant increase in total loan default by 1.2 pp in white zip codes and 3.8 pp in Latino zip codes, and it drives an increase of 2.2 pp in Black zip codes, which is significant at the 85% level.

G Effects by Income Growth

In this section, I test whether the mortgage originations following BAPCPA were concentrated among borrowers with relatively lower income growth, or higher income volatility. I estimate Equation 5 separately for zip codes in the top (Quartile 4) versus bottom (Quartile 1) quartile of income growth, where $IncGrowth_z$ is the income growth in a zip code from 2001 to 2004. I study whether areas with higher exposure to BAPCPA, or higher $IMCMktShr_{z,04}$, began originating differentially more alternative mortgages to high income variability borrowers post BAPCPA. All variables are defined the same and standard errors are clustered as in Equation 5 and the same $Y_{z,t}$ variables are estimated.

Table 8 and Figure 17 panel (a) report the coefficient that measures the effect of the pre-period IMC market share on $\log(Originations_{z,t})$ each month relative to March 2005. In the pre-period, there was no differential change in lending between more and less treated zip codes for either subgroup. Following the policy change, a 10% increase in pre-period IMC market share leads to a statistically significant 1.5% decrease in originations in the lowest income growth quartile and a 2.0% increase in originations in the highest income growth quartile. Theses results are statistically significantly different from each other and from zero.

To understand the role that BAPCPA played in the disproportionate expansion of alternative mortgage products in these subgroups, in Table 8 and Figure 17, I report balloon (panel (b)), negative amortizing (panel (c)), and two-step mortgages (panel (d)) as outcome variables. In panel (b), a 10% increase in pre-period IMC market share leads to a 31% increase in balloon mortgages in the lowest income growth quartile and a 30% increase in the highest income growth quartile. In panel (c), a 10% increase in pre-period IMC market share leads to an 11% increase in negative amortizing mortgages in the lowest income growth quartile and a 17% increase in the highest income growth quartile. In panel (d), a 10% increase in pre-period IMC market share leads to a 6% increase in two-step mortgages in the lowest income growth quartile and a 21% increase in the highest income growth quartile. All but the increase in two-step originations in the lowest income growth quartile are highly statistically significant, and the results are significantly different between low- and high-income-growth zip codes for negative amortizing and two-step originations.

The results in Table 8 and Figure 17 show that although low income growth, high income variability, borrowers receive a decrease in overall mortgage originations, they receive an increase, comparable to high income growth zip codes, in alternative mortgages. This indicates that low income growth borrowers receive a higher fraction of alternative mortgage products following the passage of BAPCPA. In the appendix, Table 10 estimates a triple difference and shows that areas with higher pre-period IMC market share interacted with lower income growth experience a statistically significant increase in the fraction of negative amortizing and balloon mortgages in the post-period. The fraction of two-step originations also increased in zip codes with lower income growth, however not statistically significantly. These results indicate that in low income growth, or high income volatility, areas IMCs were originating a disproportionately high fraction of alternative mortgages, which gave borrowers artificially low initial mortgage payments.

Figure 17 panel (e) documents the dynamic coefficients for $\log(InitialInterestRate_{z,t})$ on adjustable rate mortgages. The results show that the initial interest rate falls statistically significantly for both the highest- and lowest-income-growth zip codes following the policy change. A 10% increase in pre-period treatment drove the initial interest rate to fall 1.9% in the lowest and 3.3% in the highest income growth zip codes. These falling initial interest rates are consistent with originators lowering initial interest rates to increase affordability of mortgages, amidst the Federal Reserve's tightening cycle, and indicate that borrowers would face large payment shocks when their mortgage payments reset to the market rate.

[Figure 17 about here.]

[Table 8 about here.]

In Figure 18 panel (a), I plot the results for $\log(FullDoc_{z,t})$ and report the static coefficients in Table 9. Prior to the policy change, both subgroups move in parallel to each other. Post policy change, a 10% increase in pre-period IMC market share leads to a 2.0% increase in full documentation mortgages for the highest and a 2.9% decrease for the lowest income growth zip codes. These results are both statistically significantly different from zero and from each other, consistent with low income growth zip codes receiving disproportionately fewer full documentation mortgages.

In Figure 18 panel (b) I plot the results for $\log(CreditScore_{z,t})$ and report the static coefficients in Table 9. Prior to the policy change, there was no statistically significant increase in credit scores between more- versus less-treated zip codes for either subgroup. Post policy change, a 10% increase in pre-period IMC market share leads to a significant 0.22% increase in credit score for low and 0.29% for high income growth zip codes. These results are statistically significantly different from zero, however not from each other. As in the previous section, the increase in credit score is consistent with lenders attempting to compensate for increased risk of alternative amortization structures and lack of full documentation by requiring higher credit scores, however, this increase in credit score was likely too modest to sustain the increased risk of these mortgage products.

To study the consequences of these alternative products on borrowers, I use Equation 7 to study early payment default (EPD_i) and total loan default by subgroups for the top and bottom income growth quartile, utilizing the same variable definitions as in the previous section. Standard errors are clustered at the zip code level. I plot the results in Figure 18 panels (c) and (d) and report the static coefficients in Table 9. Studying early payment default in Figure 18 panel (c), I find that a 10% increase in pre-period IMC market share leads to statistically significant increases in early payment default of 0.32 pp for the lowest income growth quartile zip codes and 0.28 pp for the highest income growth quartile zip codes. Studying total loan default in panel (d), a 10% increase in pre-period IMC market share leads to statistically significant increases in total default of 4.0 pp for the lowest income growth quartile and 3.7 pp for the highest income growth quartile.

[Figure 18 about here.]

[Table 9 about here.]

In Figure 19 (panels a and b) I plot the dynamic coefficients representing the effect of increased IMC market share on foreclosure and bankruptcy likelihood by income growth quartile subgroups. I find that both the lowest and highest income growth quartiles experience an increase in foreclosure and bankruptcy likelihood by month of origination. However,

the highest income growth quartile, IG4, experiences a higher increase in both foreclosures and bankruptcies by month of origination. A 10% increase in pre-period IMC market share leads to a 5 pp increase in fraction of loans in foreclosure following the policy change. While for the lowest income growth quartile, a 10% increase in IMC market share leads to a 2.5 pp increase in fraction of loans in foreclosure. A 10% increase in pre-period IMC market share leads to a 1 pp increase in likelihood of bankruptcy in the highest income growth quartile and to a 0.5 pp increase in the lowest income growth quartile zip codes.

[FIGURE 19 about here.]

Figure 20 shows the dynamic response of home prices to the 2004 market share of IMCs in that zip code. Prior to BAPCPA, IMC market share in 2004 was not associated with a differential change in home prices, as demonstrated by relatively flat and parallel pre-period coefficients. The figure shows that areas more exposed to the IMC market share experienced a statistically significant increase in home price between April 2005 and end of 2006, followed by a steep and significant decline in home prices beginning in 2008 through 2010. While the boom and bust are statistically and economically significant, the bust is the most pronounced in the lowest income growth quartile (IG1). This is consistent with alternative mortgage products with lower documentation rates in lower income growth zip codes playing a "financial accelerator role" and amplifying both the increase in the price of capital in the boom and its decrease in the bust. In the highest income growth zip codes, a 10% increase in pre-period IMC market share leads to a 1.8% increase in home prices in the boom and 1.8% decline in the bust. However, among the lowest income growth quartile (IG4) a 10% increase in IMC market share leads to a 1.1% increase in home prices in the boom and a 5.6% decline in the bust. This evidence indicates that the boom and but are relatively symmetric for the highest income growth quartile, however the bust is amplified more than the boom in lower income growth quartiles – suggesting that the GFC had larger wealth effects for the lower income growth zip codes.

[FIGURE 20 about here.]

H Borrower Credit Outcomes

Figure 21 (panel a) plots the effect of pre-period IMC market share on borrowers' mortgage balances from 2004 to 2010 for borrowers who have a mortgage, for the highest (IG4) and lowest (IG1) income growth quartiles. In the highest income growth quartile, a 10% increase in 2004 IMC market share leads to a 5% increase in reported mortgage balance in the post period. Conversely, in lowest income growth quartile there is no statistically significant

increase in mortgage balances. These results are consistent with borrowers in the lower income growth quartile receiving a larger fraction of alternative mortgages and being less able to make debt payments that fully amortized the mortgage.

In Figure 21 (panel b), I plot the effect on student loan balances separately for the highest and lowest income growth quartiles. The increase in student loan balance is not statistically different from zero in the post-period relative to the pre-period for either the highest or lowest income growth quartile. This lack of significance indicates that the differential increase observed in Figure 11 (panel a) for the racial subgroups is not solely driven by income growth quartiles, proxying for income volatility.

In Figure 21 (panel c), I plot the effect on auto loan balances separately for the highest and lowest income growth quartiles. In the highest income growth quartile, a 10% higher IMC market share leads to an 8% increase in auto loan balances. Borrowers in the lowest income growth quartile do not see a statistically significant increase in auto loan balances following the policy change. The results are consistent with borrowers in the highest income growth quartile, in areas with more exposure to alternative mortgage products, increasing the balance carried on their auto loans, indicating higher levels of financial stress.

The story shows a few more nuances when I look at the credit panel data. These data show that it is IG4, or the highest income growth quartile, that is revolving more debt in the post-period.[38] Combined with the race results, the evidence is consistent with higher income growth zip codes, among the minority zip codes, revolving more debt.

[FIGURE 21 about here.]

H.1 Continuous Income Growth Results

The results in Table 10 show that low-income growth, high-income variability, borrowers are statistically significantly more likely to receive alternative mortgage products following the passage of BAPCPA.

Table 10 shows that for a zip code with 100% market share of IMCs, post policy change, a 10% decrease in income growth would increase the fraction of negative amortizing originations by 1.1 pp and the fraction of balloon originations by 0.48 pp. The fraction of two-step originations also increased 0.13 pp more in zip codes with lower income growth, however not statistically significantly at the 95% level. The results also show that total mortgage originations increased as income growth increased, indicating that IMCs were also increasing mortgage originations in high-income growth areas. This is consistent with the relative

[38] The income growth quartiles are defined using the same cutoffs as used in the CoreLogic LLMA regressions.

decrease in total originations for minority areas, found in the main draft. However, in low-income growth, or high-income volatility, areas IMCs were disproportionately originating alternative mortgages, which gave borrowers artificially low initial mortgage payments.

[TABLE 10 about here.]

In Figure 22, I estimate the payment shock regression by income growth quartiles. I find that pay shocks are more likely in zip codes with higher pre-period IMC market share for both the highest and lowest income growth quartiles. A 10% increase in treatment leads to a 3.4 pp increase in pay shock likelihood, which is not statistically different between the high- and low-income-growth zip codes. In Figure 17, I document that the initial interest rate on adjustable rate mortgages decreases disproportionately in zip codes with high IMC market share, which is consistent with high IMC zip codes experiencing larger payment shocks when interest rates reset. While the pay-shock-probability increase is relatively similar across subgroups, the low-income-growth zip codes have a larger fraction of total mortgages that are exposed to these types of resetting mortgages, and lower levels of full documentation, making them especially vulnerable to these pay shocks.

[FIGURE 22 about here.]

I Triple Difference by IMC Market Share and Income Growth

By setting up a triple difference regression specification, I test for evidence consistent with BAPCPA driving an expansion of originations among borrowers with higher income volatility. I study whether areas with higher exposure to BAPCPA began originating differentially more alternative mortgages to high income variability borrowers post BAPCPA. I estimate the following specification:

$$\begin{aligned} Y_{z,t} &= \mu\ IMCMktShr_{z,04} \times Post_t \\ &+ \nu\ IMCMktShr_{z,04} \times IncGrowth_z + \tau\ IncGrowth_z \times Post_t \\ &+ \beta\ IMCMktShr_{z,04} \times IncGrowth_z \times Post_t \\ &+ \gamma_z + \eta_{s,t} + \epsilon_{z,t}. \end{aligned} \tag{13}$$

Where $Y_{z,t}$ is $\log(Originations_{z,t})$, $FracBalloon_{z,t}$, $FracNegAm_{z,t}$, $FracTwoStep_{z,t}$, $FracInterestOnly_{z,t}$. log is the natural logarithm of a number and $Frac$ represents the fraction that a given mortgage product makes up of all mortgage originations in a region.

For each zip code z in month t, $Originations_{z,t}$ is the total number of originations. The continuous treatment variable, $IMCMktShr_{z,04}$ is the market share of IMCs in a zip code z in 2004. $Post_t$ is an indicator variable that equals one for April 2005 and later and zero otherwise. $IncGrowth_z$ is the income growth in a zip code from 2001 to 2004. β is the coefficient on the interaction term, $Post_t \times IMCMktShr_{z,04} \times IncGrowth_z$. β measures how lower values of $IncomeGrowth_z$ affect mortgage originations in the post-period relative to the pre-period, holding constant the IMC market share in 2004 in each zip code. The triple difference measures the differential effect on mortgage originations of moving from 0% to 100% IMC market share, post- versus pre-shock, for zip codes with high versus low levels of income growth. γ_z represents Zip level fixed effects and $\eta_{s,t}$ represents $State \times Month$ fixed effects. Standard errors are clustered at the zip code level.

The insight behind this regression specification is that zip codes that have a higher market share of IMCs should increase their alternative mortgage originations at a faster rate following BAPCPA relative to zip codes that have a higher market share of banks. Moreover, borrowers may value products that offer the ability to delay principal and interest payments at a time when their income is low and repay the amount owed at a time when their income may be higher. Alternative mortgage products achieved this payment flexibility by lowering introductory monthly payments and delaying the fully amortizing principal and interest payments to a later point in the life of the loan. This made these products appear affordable at the peak of the housing boom when the Federal Reserve was raising interest rates and home prices were near peak. If high income volatility borrowers valued alternative products, these mortgages would be disproportionately originated among higher- relative to lower-income-volatility zip codes and the β coefficient on the triple interaction term would be negative since high income volatility is proxied for by low income growth. BAPCPA should drive a larger increase in mortgage originations in zip codes that have both a high IMC market share and low income growth.

The IMC market share variable is a continuous measure. However, to understand the insight of the regression, imagine that zip codes were made up of either 100% banks or 100% IMCs. The regression calculates the difference between IMC lending in high versus low income growth zip codes between the pre-period as well as in the post-period. It then calculates the difference between the pre-period versus the post-period and compares it to the analogous difference for bank lending. In Appendix D, I show that the population weighted doses of income growth are close to normally distributed and thus the TWFE estimator closely approximates the population weights, making any bias in the regression small.

J Mortgage Acceptance Rates

To test whether the trends in origination of mortgage products are reflected in mortgage acceptance rates, I use loan-level HMDA data to identify the differential effect of BAPCPA on mortgage approval rates by race. I utilize a triple difference empirical specification. The first difference is the pre- versus post- BAPCPA period. The second difference is IMC lender versus non-IMC (i.e. banks, affiliated mortgage companies, and other traditional lenders). The third difference is the race of a borrower.

Since the IMCs were funded heavily by warehouse repurchase agreements from dealers, the empirical design utilizes IMC lenders to causally identify the effect of BAPCPA's strengthening of repo creditor rights. The applicant race reported in the data allows the research design to identify whether a borrower received a differential increase (decrease) in mortgage approval rate from IMC lenders versus non-IMCs lenders post policy change by race. I estimate the following regression:

$$\begin{aligned} Accepted_b = \alpha post_t + \delta IMC_b + \lambda RACE_b \\ +\rho IMC_b \times post_t + \zeta IMC_b \times RACE_b + \xi post_b \times RACE_b \\ +\beta IMC_b \times \%Race_b \times Post_t \\ +\gamma_c + \eta_{s,t} + \epsilon_b. \end{aligned} \tag{14}$$

Where $Accepted_b$ is an indicator variable, for borrower b, equal to one if the mortgage application is approved. The public HMDA data is only available at the annual frequency. $Post_b$ is an indicator variable set equal to one for 2005 and later. IMC_b is an indicator variable set equal to one if an application is received by an IMC lender. $RACE_b$ is an indicator for whether an applicant identifies as Black, Latino, or white. I iterate through specifying one race and including the other two in the control group. γ_c represents county level fixed effects and $\eta_{s,t}$ represents the $state \times year$ fixed effects. β represents the change in the application acceptance rate post-BAPCPA relative to pre-BAPCPA when the application is received by an IMC lender and the borrower identifies as a given race.

Table 11 presents the results of Equation 14. Relative to other racial groups, Black and Latino borrowers experienced significant declines in mortgage acceptance rates by 5.5% and 6.6% respectively. White borrowers experienced a significant relative increase in mortgage acceptance rate by 3%. This is consistent with white borrowers receiving more subprime mortgages, which were fully amortizing but required lower credit scores, and therefore slackened the credit score constraint. While minority borrowers received more alt-A products, which required higher credit scores but had riskier amortization structures, and therefore

slackened the wealth/income constraint.

The acceptance rates are consistent with IMCs originating relatively more alternate-A paper products in minority zip codes and relatively more subprime products in white zip codes. The alt-A products required modestly higher credit standards, consistent with the relatively lower approval rates in minority zip codes in the post-period. The Survey of Consumer Finances indicates that by 2016, the median net worth of white families was $171,000, while the median for Black families was $17,600, almost ten times lower (Bricker et al. (2017)). Given the stark wealth gap (Derenoncourt et al. (Forthcoming)) and income volatility gaps (Morduch et al. (2018)), the down payment and documentation requirements were likely much more binding for minority households than for white households, conistent with the higher originations of alt-A products depicted in Figure 4.

[Table 11 about here.]

K Discussion of Prime and Subprime Originations by Racial Subgroup

I estimate the same regression in Equation 5, where $Y_{z,t}$ is the fraction of prime and subprime mortgages originated in a zip code pre- versus post-BAPCPA, by racial subgroup.

Figure 23 plots the results. Following the policy change, relative to white zip codes, a larger fraction of prime mortgages were originated in majority Latino zip codes. This is consistent with a larger fraction of alternative originations in Latino zip codes, since these alternative mortgages were recorded as prime in CoreLogic. Consistently, the fraction of subprime originations decreased post-BAPCPA, however it decreased less steeply for white zip codes relative to Latino zip codes. Combined with the relatively larger increase in total originations in white zip codes, this evidence suggests that white zip codes were receiving a larger fraction of subprime mortgages, which were below 660 credit score but fully amortizing mortgages.

Relative to white zip codes, Black zip codes received an increase in fraction of subprime mortgages for about five months following the policy change. After five months following BAPCPA, the fraction of subprime "vanilla" mortgages began to fall and the fraction of prime alternative mortgages began to rise in Black zip codes. Due to the initial drop in the fraction of prime mortgages, it took about 8 months for Black zip codes to catch up to the fraction of prime mortgages originated in white zip codes.

[Figure 23 about here.]

L Poisson Regressions

In this section, I estimate the Poisson regressions of the form:

$$Y_{z,t} = \gamma_z + \eta_{s,t} + IMCMktShr_{z,04} \times Post_t + \epsilon_{z,t} \tag{15}$$

Where $Y_{z,t}$ is the number of balloon, negative amortizing, and two-step mortgages originated in a given zip code in a given month. γ_z are zip code fixed effects and $\eta_{s,t}$ are state $\times$ origination month fixed effects. $IMCMktShr_{z,04}$ is the market share of independent mortgage companies operating in a given zip code in 2004 and $Post_t$ is an indicator equal to 1 in April 2005 and after, and equal to zero otherwise.

I estimate each of these regressions separately by racial subgroup. I estimate a difference-in-differences research design within each racial subgroup. This means that the coefficient of interest is capturing the differential increase in mortgage originations of a given product type in the post-period, over and above the pre-period level within zip codes of a different racial subgroup. In the following results, I find that the number of alternative products originated in minority zip codes outpaced the number of originations in white zip codes.

[Table 12 about here.]

M Matching the CoreLogic NARMBS Originators to HMDA

Independent mortgage companies are identified in the CoreLogic NARMBS data by merging the NARMBS data with the HMDA data using a name match. The name match is broadly designed to do two things. First, it keeps the top five ranked matches, second it matches origination year to the year an originator is seen active in the Avery crosswalk. The data then use HMDA's definition of an IMC. A detailed description of the matching process is below.

The matching process for originators in CoreLogic NARMBS and HMDA used an algorithm that generated best matches based on name similarity and the years in which each entity operated. The matching utilized the crosswalk maintained by Robert Avery, which matches subsidiaries operating in the HMDA data to their parent. Year an entity operated was determined using the year the mortgage was originated in CoreLogic and matching it to the year an entity operated in the Avery file. Matching was performed in several rounds: first on the originator name in CoreLogic to the HMDA NAME column in the Avery file, then the HMDA NAMES column for any unmatched CoreLogic orignators, and then using the HMDA NAMEOR column etc. After all rounds were completed, a manual check was conducted.

The matching algorithm for each round proceeds as follows. First, all originator names from both NARMBS and HMDA were capitalized. Then the `matchit` command in Stata was used to compile a list of possible matches between each originator name in NARMBS and the corresponding column in HMDA (either NAME, NAMES, NAMEOR or PARENT). For these possible matches (multiple HMDA originators could be matched to a single NARMBS originator), matches were dropped if the first word of the NARMBS originator name did not match the first word of the HMDA originator name, if the years in which the matched originators operated differed more than 3 years, and if the second word for the originator names did not match for cases where there were over 200 HMDA orginators matched to one NARMBS originator. Matches were marked for later manual checks at this round if there was only 1 word in the NARMBS originator name and there were more than 99 HMDA matches. Then, matches were further filtered through if the name was an exact match, if the second word matched, or if the match was one of the top 5 matches based on the metric produced by `matchit`, similscore. Finally, if there was an exact name match available, the exact name closest to the NARMBS origination year was used. If there was no exact name match available, the match closest to the NARMBS origination year with the highest similscore was used.

After all the rounds of matching were completed, the matches generated by the algorithm were inspected by hand. Matches were dropped if the names differed significantly (for example "Associated Mortgage Center, Inc" and "Associated Mortgage, Inc") or if the NARMBS originator name was too ambiguous or common to link it to another entity in HMDA (for example "First Bank"). After this final manual inspection, 2,148 originators in NARMBS were matched to an originator in HMDA. This represents 10.3% of the originators in NARMBS.

Using the NAMRBS data, I estimate the following regression by racial subgroups:

$$Y_l = \gamma_z + \eta_{s,t} + \mu IMCoriginator_l + \sum_T \beta_T IMCoriginator_l \times \mathbb{1}_{t=T} + \epsilon_l \tag{16}$$

Where Y_l represents an indicator variable equal to one if the mortgage is a balloon mortgage or a negative amortizing mortgage. I find that both balloon and negative amortizing mortgage originations increase disproportionately post BAPCPA if the mortgage was originated by an IMC. The effects are strongest in minority-dominant zip codes.

[Figure 24 about here.]

N Controlling for Income Growth Quartile in the Racial Subgroup Regressions

As a robustness to Equation 5, I estimate the following DiD specification comparing zip codes with high- versus low-2004 market share of IMCs pre- versus post-policy change including a control for income growth of a zip code from 2001 to 2004 interacted with the post period. I estimate the regression separately for each racial subgroup:

$$Y_{z,t} = \gamma_z + \eta_{s,t} + \beta Post_t \times IMCMktShr_{z,04} + \delta Post_t \times IncGrowth_z + \epsilon_{z,t}. \quad (17)$$

Where all variables are defined as in the main draft. I interact $Post_t$ with $IncGrowth_z$ to allow areas with high- versus low-income-growth to behave differently following the policy change. I estimate the regression separately in the majority WHT, BLK, and LTN zip codes and report the results in Table 13 and Table 14. I find that majority BLK and LTN zip codes still disproportionately experience a statistically significant increase in alternative mortgages, credit score, and default rates, and a decrease in full documentation, even controlling for income growth (proxying for income volatility). These results are consistent with racial makeup of a zip code differentially affecting the types of mortgages originated post BAPCPA, which cannot be explained by income volatility alone.

[Table 13 about here.]

[Table 14 about here.]

[Table 15 about here.]

[Table 16 about here.]

O Model

To explain the mechanism through which an increase in secondary market collateral value stimulates lending of new mortgage contract types in the primary market, I propose a stylized model. The model features a competitive lender who lends to high-income-variability and less than fully documented borrowers. The high-income-variability, low-documentation borrowers borrow alternative mortgages (as in Piskorski and Tchistyi (2010)) in the private-label-mortgage market. This setup is consistent with the private-label market becoming a substitute for the FHA/VA market, which funded borrowers who often could not qualify for conforming loans. The model represents the nonbank funding market, where a dealer-bank

funds mortgage originations by providing warehouse lines of credit, takes collateral ownership of the mortgages originated, and repledges the collateral (borrows against the collateral) to lower its funding costs. As a simplification of this nonbank funding structure, I model the dealer-bank lender as originating and controlling the mortgages directly.

Lenders value a mortgage that they create both for the interest income it generates and because it serves as collateral for them to borrow against in the repo market. When BAPCPA strengthens the creditor rights on private-label mortgage collateral, it increases dealers' ability to borrow against the collateral and thus decreases dealers' cost of capital. When the dealers' cost of capital required to originate mortgages decreases, they lower the interest rate that they charge borrowers on private-label mortgages. This implies that the price offered on the alternative, private-label, contract would fall. Imagine that the price in the private-label market pre-BAPCPA was above borrowers' reservation price. Post-BAPCPA, if the price falls below the borrowers' reservation price, the lender expands into the market for high-income-variability and less than fully documented borrowers using a mortgage product that had not previously been offered. Consistently in Figure 16, I find that following BAPCPA, IMCs differentially lower their initial interest rates. This mechanism helps to explain why, although alternative mortgage products had existed since the 1980s, we had not seen them originated at the scale they reached just prior to the GFC.

O.1 Model Set-up

I develop a model of mortgage lending for private-label (PL) mortgage borrowers. The borrowers in this market do not consider mortgages of the other types (i.e. conforming mortgages); they are not mobile across markets. This setup is consistent with the private-label market becoming a substitute for the FHA/VA market, which funded borrowers who often could not qualify for conforming loans.

I shut down frictions between the dealer and the IMC. The IMCs can be thought of as originating mortgages on behalf of the dealers. Thus I call the dealers "dealer-banks" to denote that they function both as dealers operating in the repo market and as mortgage originators.[39] The model investigates how the shock to dealer cost of capital caused by BAPCPA is passed on to households and assumes that the shock is frictionlessly passed from the dealers to the IMCs that they fund.

The market for private-label mortgages indicates alternative, or alternate-A mortgage

[39]Mortgages are funded via a repo warehouse line of credit from the dealer to the IMC. Dealers can repledge the collateral. The interest that the dealer receives on the line of credit is the interest rate that it charges the IMC on a repo loan. The IMC passes this rate to the borrower as the interest rate. However, to simplify the model, dealers lend directly to the mortgage borrowers and then pledge mortgage collateral created from the mortgages.

products, to study the increase in alt-A mortgage products following BAPCPA. The borrowers in the alt-A market can be thought of as borrowers who fulfill lower documentation requirements to verify income and assets, have more volatile income, and a higher cost of repaying their mortgage payment (θ). I utilize the insight from Piskorski and Tchistyi (2010) that the optimal mortgage product for borrowers with more volatile income and pricier mortgage to income ratios is the option-arm, or similar, mortgage product. In the theory, alt-A mortgages are optimal for high income volatility borrowers because they allow borrowers to delay mortgage payments when their income may be low and repay them at a later date when their income may be higher.

I use the model to study the impact of increasing the value that dealers receive by repledging private-label mortgage collateral (c^{PL}) and its effect on the interest rate dealers charge to the private-label borrowers, r^{PL}. The value that the dealer-bank receives from repledging collateral (c^{PL}) is exogenous. I consider a one-period model of a mortgage lender and a borrower. The borrower, of type θ, receives utility from housing ($h_\theta \in \{0,1\}$), where the choice $h_\theta = 1$ means the purchase of a home, whereas $h_\theta = 0$ means no purchase. θ reflects creditworthiness, in the sense that higher θ indicates borrowers for whom it is less costly to repay the mortgage payment. The borrower has quasi-linear utility. He derives utility from owning a home $v(1)$. The purchase of the home requires a mortgage at dollar value M and requires no down payment. The borrower dislikes paying the mortgage payment required on the mortgage at interest rate (r^{PL} where $r^{PL} \geq 0$),

$$u = v(h_\theta) - \frac{1}{\theta}(1 + r^{PL})M \times h_\theta, \quad h_\theta \in \{0,1\}. \tag{18}$$

Since $v(0)$ and $v(1)$ are constant, the household maximizes utility by choosing between $v(0)$ and $v(1) - (1+r^{PL})M$, therefore he chooses between housing $h_\theta = \{0,1\}$. Given h_θ, the value of $v(1)$ and $v(0)$ and M are fixed. Choosing $h_\theta = 1$ requires that the borrower take out a fixed mortgage amount, M, at interest rate, r^{PL}. In other words, the borrower takes out a mortgage if the utility he derives from purchasing a home minus the mortgage payment is greater than his utility from not purchasing a home. I assume that $v(0)$ is the utility that the borrower receives from renting a home. $v(1) - v(0)$ is the incremental value that the borrower receives from owning a home relative to renting a home. There is a distribution over how costly mortgage repayment is, θ. The cost of borrowing is captured by $\frac{1}{\theta}$,

$$\theta \sim F \quad \text{on} \quad [\underline{\theta}, \overline{\theta}]. \tag{19}$$

Borrowers choose $h_\theta = 1$ if

$$v(1) - \frac{1}{\theta}(1 + r^{PL})M > v(0). \tag{20}$$

For every mortgage originated, the lender gains utility from the mortgage payment received, inflated by the shadow value of collateral, c^{PL}, generated by repledging the mortgage as collateral. A feature of the model is the choice to model the value of repledging collateral as analogous to the interest earned on the collateral. This construct is motivated by the fact that securities dealers offer their debtors a lower interest rate if the dealer has permission to repledge the collateral, consistent with dealers having an interest rate valuation for the repledgeability of collateral. p is the dealer-bank's fixed, exogenous, funding cost to provide the money necessary for the mortgage. Thus the dealer-bank's total cost of originating a mortgage varies linearly with the value of M. The risk profile of borrowers is subsumed in the interest rate, r^{PL}. The lender is competitive and therefore chooses to originate the value of mortgages that sets marginal cost equal to marginal revenue. The lender sets the price of the mortgage accordingly and meets demand based on that interest rate:

$$u = (1 + r^{PL})(1 + c^{PL})M - pM = 0. \tag{21}$$

O.2 Model Results

The lender's break even condition gives:

$$r^{PL} = \frac{p}{1 + c^{PL}} - 1. \tag{22}$$

The main result follows from this break even condition:

Proposition 1 *The interest rate decreases when the shadow value of collateral increases:*

$$\frac{\partial r^{PL}}{\partial c^{PL}} < 0. \tag{23}$$

Ceteris paribus, taking a comparative static of r^{PL} with respect to c^{PL}, as c^{PL} increases, r^{PL} falls. From the borrower's problem, there is a threshold borrower type – everyone with $\theta > \theta^*(r^{PL*})$ will borrow:

$$\theta^*(r^{PL*}) = \frac{(1 + r^{PL*})M}{v(1) - v(0)}. \tag{24}$$

θ^* gives a break even point such that $v(1) - \frac{1}{\theta^*}(1 + r^{PL})M = v(0)$. Types with $\theta > \theta^*$ will always choose to buy a home. This yields an interest rate threshold value, which I denote by r^{PL*},

$$r^{PL*} := \frac{\theta^* \times (v(1) - v(0))}{M} - 1. \tag{25}$$

This yields the following comparative statistics:

Lemma 2 *The threshold interest rate at which a borrower is willing to take out a mortgage, r^{PL*}, is*

1. *increasing in $v(1) - v(0)$*
2. *increasing in θ*
3. *decreasing in M*

The interest rate threshold at which the borrower is willing to borrow is equal to the borrower's relative utility from buying a home, over and above renting, per unit of mortgage value M, and scaled up by a measure reflecting the borrower's creditworthiness θ. Ceteris paribus, Lemma 2 indicates the following: the threshold interest rate is increasing when the relative benefit of owning a home is higher, when the cost of borrowing $\frac{1}{\theta}$ is lower, and when the value of the mortgage M is lower.

When the interest rate (r^{PL}) set by the lender requires a θ^* that is higher than $\overline{\theta}$, the upper bound of the support, the interest rate charged is higher than any interest rate that borrowers are willing to pay. This can be seen from Equation 25, holding fixed $v(1)$, $v(0)$, and M. This can occur when the collateral c^{PL} is low, as can be seen by combining Equation 22 and Equation 25:

$$\theta^*(r^{PL*}) = \frac{(1 + r^{PL})M}{v(1) - v(0)} = \frac{p}{1 + c^{PL}} \times \frac{M}{v(1) - v(0)}. \tag{26}$$

When the value of c^{PL} increases[40], the value of the interest rate set by the lender will fall. If the new interest rate, $r^{PL'}$ falls, then the threshold type θ^* will fall. If θ^* falls lower than $\overline{\theta}$, it will open up a new market of borrowers. This is because now, the interest rate that lenders are willing to charge will be low enough that some borrowers in this market

[40]The collateral value increases following BAPCPA because the policy change increases the recovery value of the collateral to a repo lender if a counterparty defaults, increasing its ability to be repledged.

choose to take out a mortgage. From the empirical analysis, the treated zip codes' increase in credit score and decrease in the introductory interest rate on adjustable rate mortgages (balloon ARM, negative amortizing, two-step, etc.), shown in Figure 16 in the appendix, are consistent with the model's prediction.

O.3 Model Discussion

θ reflects the borrower's creditworthiness. The interest rate that the lender is willing to charge the borrower for alternate-A products with low documentation is based on the lender's break even condition. The interest rate determines the threshold value of borrowers who would take on the mortgage, which implicitly sets the average credit risk of borrowers who receive private-label mortgages (i.e. borrowers with $\theta \in [\theta^*, \overline{\theta}]$), given the distribution of θ in the economy. The p in the model can be thought of as capturing credit risk in the economy. Since the market is competitive, other dealer-banks will have priced in the cost of originating mortgages given the distribution of θ and credit risk in the economy.

The lender's cost of capital (or value of rehypothecating collateral) offsets the borrowers' creditworthiness in pricing the mortgage. To see this, consider that Equation 22 shows that once BAPCPA exogenously increases the value from repledging the collateral (c^{PL}), the interest rate that the dealer levies on a borrower decreases, while the average creditworthiness of the borrowers and the cost (p) associated with originating the mortgage do not change. Feeding the interest rate back into Equation 24 shows that the decrease in interest rate decreases the threshold value θ^*, at which borrowers will take out an alt-A mortgage.

Imagine for example, prior to BAPCPA, p and c^{PL} were such that the dealer-bank would charge a 6% interest rate, and only borrowers with a 750 credit score and above would take out the mortgage, such that $h_{750} = 1$. Note, here credit score indicates willingness to pay which reflects borrowers' ability to make mortgage payments. Post-BAPCPA, p, the cost of originating a mortgage, does not change[41], however c^{PL} increases, which lowers the interest rate that dealer-banks charge to 4%. At 4%, both the 750 and 690 credit score borrowers are willing to take out the mortgage ($h_\theta = 1$).

Mortgage Price and Demand by Credit Score

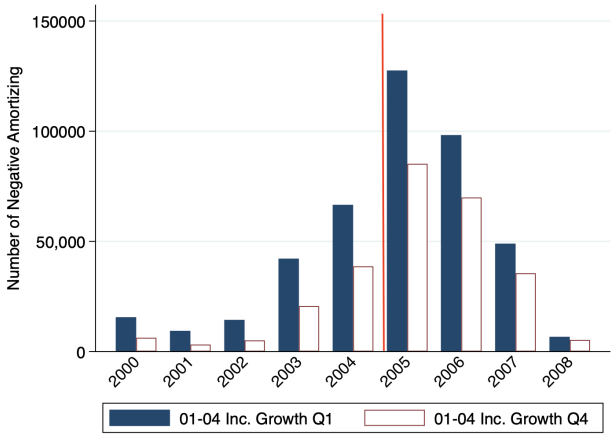
	750	h_{750}	690	h_{690}
$BeforeBAPCPA$	6%	1	6%	0
$AfterBAPCPA$	4%	1	4%	1

[41] p does not adjust because dealers do not have time to learn about the default rate at a lower threshold $\theta^{*'}$, which brings new borrowers into the market. The dealer-banks do not have time to learn due to the speed of credit supply increase caused by the explosiveness of the repo money multiplier in Lewis (2023).

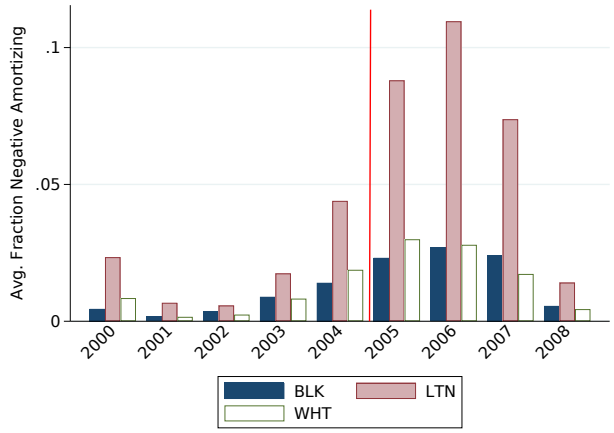
If, in the economy, $\overline{\theta} = 700$, then prior to BAPCPA, no borrowers would demand this product. Following the policy change, when the interest rate drops to 4%, all borrowers with a 690 to 700 credit score will demand the mortgage. This creates a demand stimulating mechanism that appears as if the dealer-bank is lending a new product (alt-A) mortgages to high income volatility, low documentation borrowers. However, according to the model, these alternative products always existed, however the price at which dealer-banks were willing to originate them was above borrowers' reservation price.

As borrowers enter the alt-A market, the fraction of borrowers with an alt-A mortgage increases relative to borrowers with a conforming mortgage. As a result, the average credit score in the economy increases, consistent with panel b in Figure 5 and Figure 18. However, the credit score required post-BAPCPA would have been even higher if p adjusted to account for increased credit risk, meaning higher default rates among these new borrowers. However, the price p did not have time to reflect the new default rate from the new support of θ, which entered the market after the increase in c^{PL} decreased the interest rate. This is the sense in which the observed increase in credit scores was likely too modest to account for the increased risk in alternative products, which were originated to borrowers with low documentation in minority-dominant low-income-growth zip codes. If p had increased endogenously when c^{PL} increased, the required interest rate may not have dropped as low as it did.

FIGURE 12: NEGATIVE AMORTIZING MORTGAGE PRODUCTS BY ZIP CODE INCOME QUARTILE AND RACE



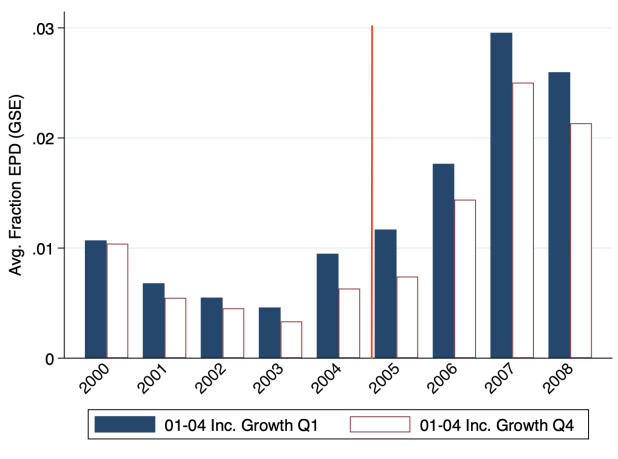
(a) Num. Negative Amortizing – Income Quartile



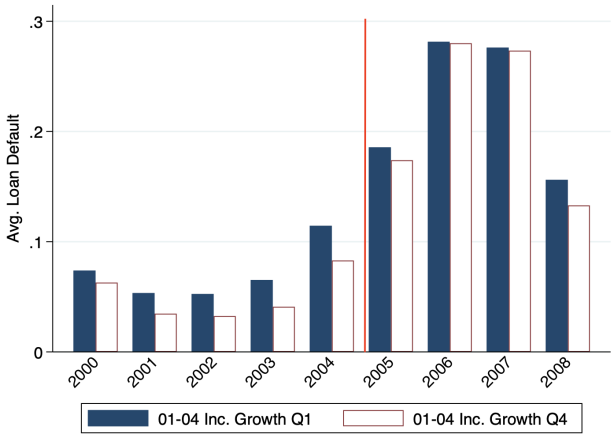
(b) Frac. Negative Amortizing – Race

Notes: The figure depicts mortgage originations by product type. The panel by income growth quartile depicts the total number of mortgages originated each year for a given product type in zip codes that are in the lowest quartile (Q1) and the highest quartile (Q4) of 2001 to 2004 income growth. The panel by racial subgroup depicts the fraction of mortgages originated each year for a given product type in zip codes that are defined as Black (BLK), Latino (LTN), and white (WHT).

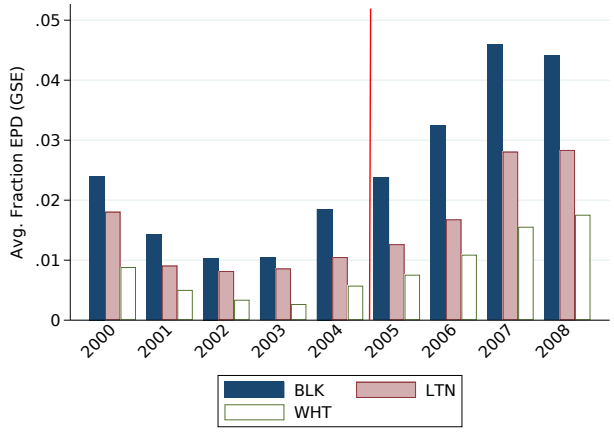
FIGURE 13: MORTGAGE DEFAULTS BY ZIP CODE INCOME QUARTILE AND RACE



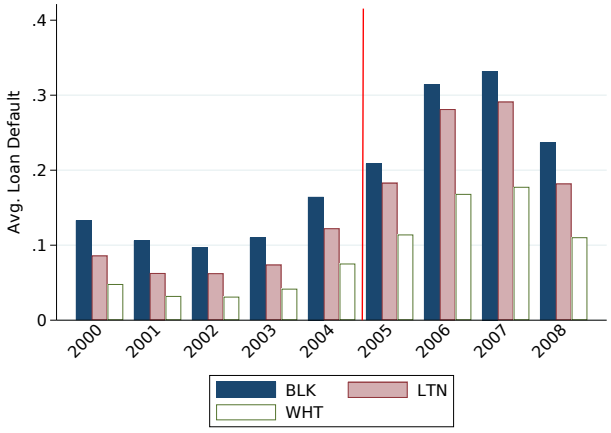
(a) EPD (GSE Measure) – By Income Quartile



(b) Total Defaults – By Income Quartile



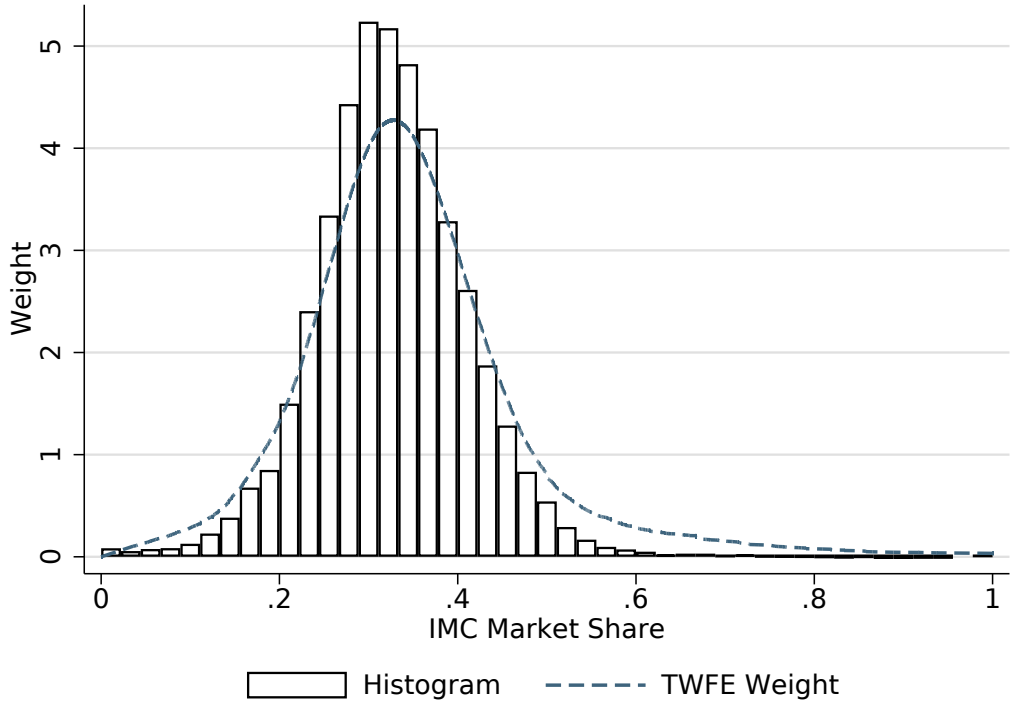
(c) EPD (GSE Measure) – By Race



(d) Total Defaults – By Race

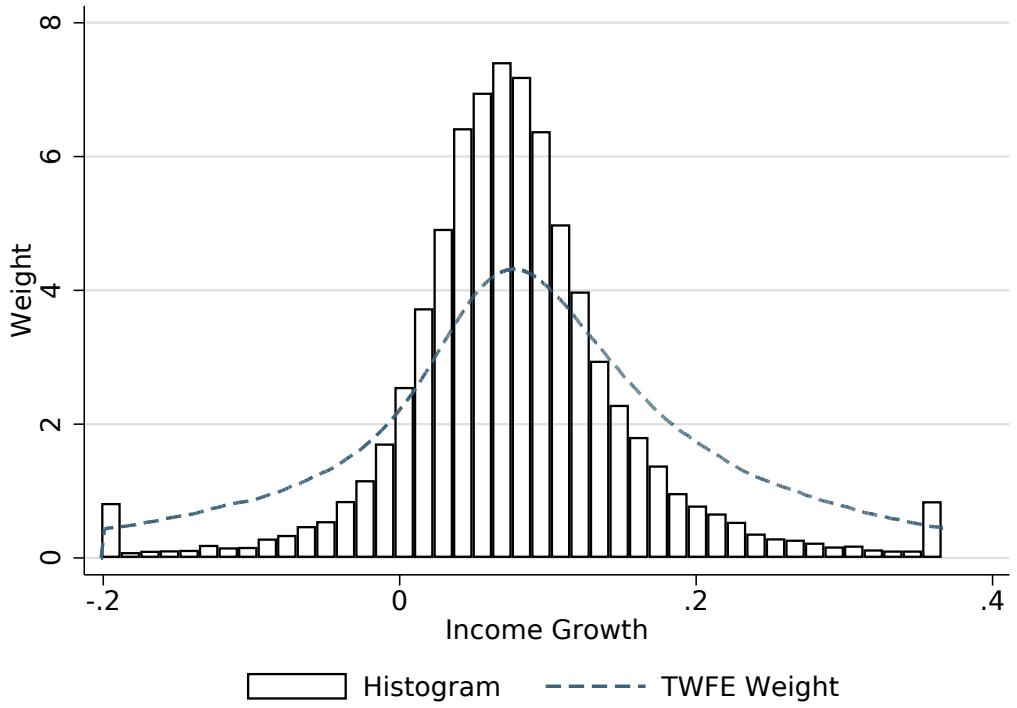
Notes: The figure depicts the fraction of Early Payment Defaults (EPD) and total defaults by year of mortgage origination. The figure depicts the fraction of defaults for the lowest quartile (Q1) and the highest quartile (Q4) of income growth between 2001 to 2004 in panels (a) and (b). In panels (c) and (d) the figure depicts the fraction of defaults in zip codes that are defined as Black (BLK), Latino (LTN), and white (WHT).

FIGURE 14: CONTINUOUS DID WEIGHTS - IMC MARKET SHARE



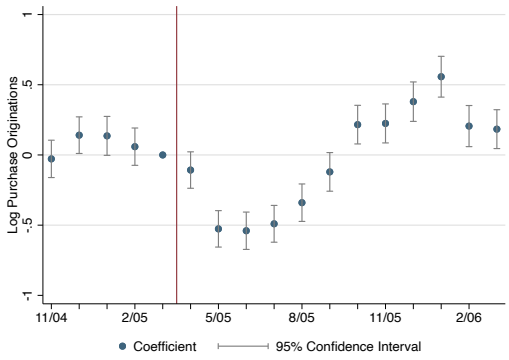
Notes: The figure plots the distribution of the actual treatment variable, $IMCMktShr_{z,04}$ against the weights applied in the continuous difference-in-differences or two-way fixed effects specification.

Figure 15: Continuous DID Weights - Income Growth

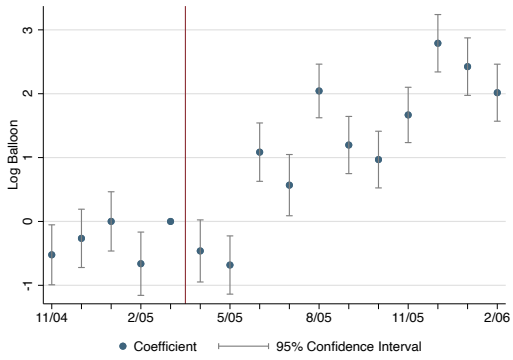


Notes: The figure plots the distribution of the actual treatment variable, income growth in a zip code from 2001 to 2004 ($IncGrowth_z$) against the weights applied in the continuous difference-in-differences or two-way fixed effects specification.

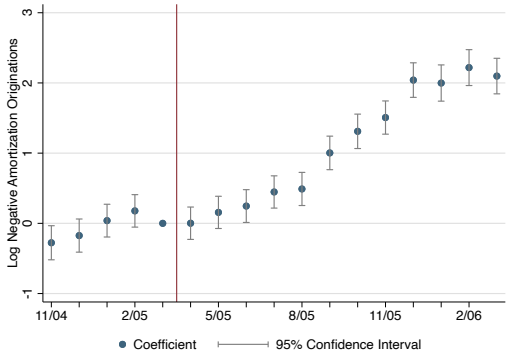
FIGURE 16: ZIP IMC MARKET SHARE EFFECT ON MORTGAGE ORIGINATIONS



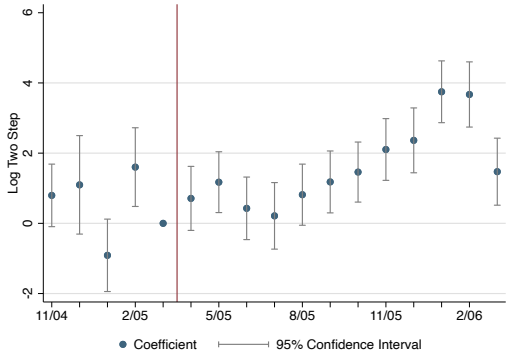
(a) Total Purchase Originations



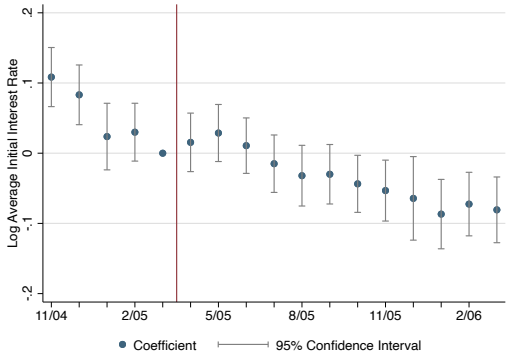
(b) Balloon Originations



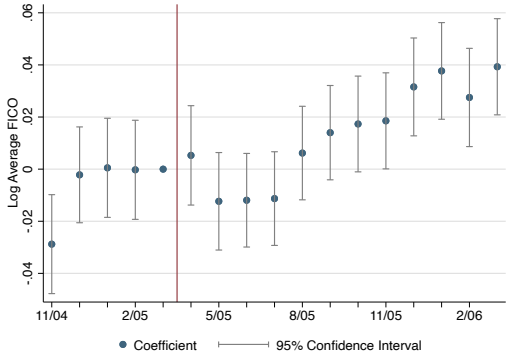
(c) Negative Amortizing Originations



(d) Two-Step Originations



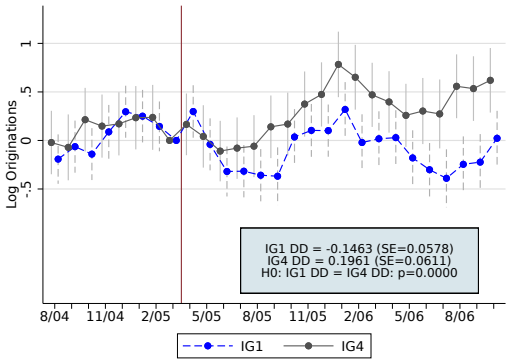
(e) Initial Interest Rate



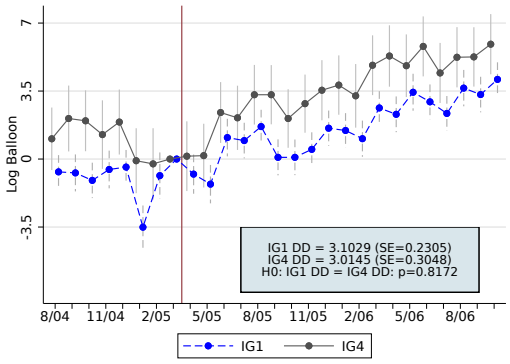
(f) Average Credit Score

Notes: Figure plots the dynamic response of the dependent variable to the 2004 market share of independent mortgage companies (IMCs) in a zip code. I estimate Equation 5 on the entire sample, not by racial or income growth subgroup. β_T is the coefficient on the indicator variable that interacts $IMCMktShr_{z,04}$ with an indicator for each month pre and post the shock. I use the public HMDA data to compute the 2004 zip-code-level IMC market share and CoreLogic data to study originations. The figure indicates that following BAPCPA, regions more exposed to the policy change significantly increased the number of mortgages that they originated and shifted toward alternative mortgage products with higher credit score and lower initial interest rate, relative to less exposed regions.

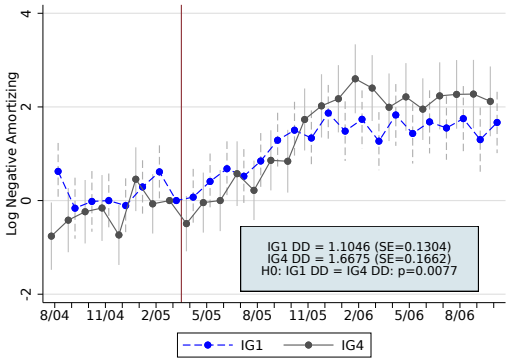
FIGURE 17: DIFFERENCE-IN-DIFFERENCES (DID) BY INCOME GROWTH SUBCATEGORIES - ORIGINATIONS & MORTGAGE PRODUCTS



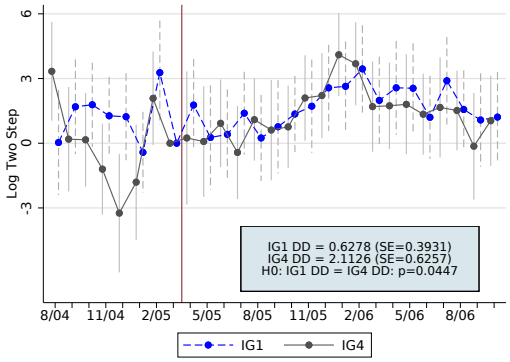
(a) Originations



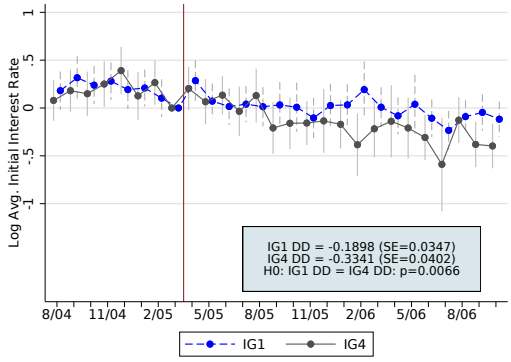
(b) Balloon



(c) Negative Amortizing



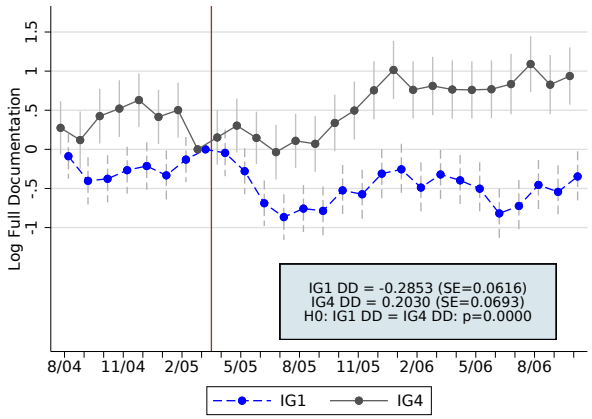
(d) Two-Step



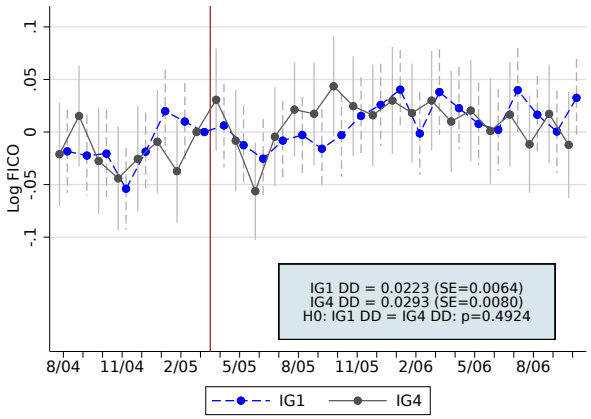
(e) Initial Interest Rate

Notes: Figure plots the dynamic response of the coefficient of interest β_T from the Equation 5 by subcategory.

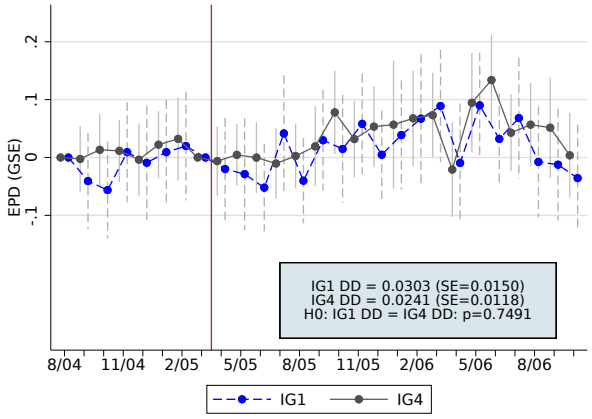
FIGURE 18: DIFFERENCE-IN-DIFFERENCES (DID) BY INCOME GROWTH SUBCATEGORIES - BORROWER CHARACTERISTICS



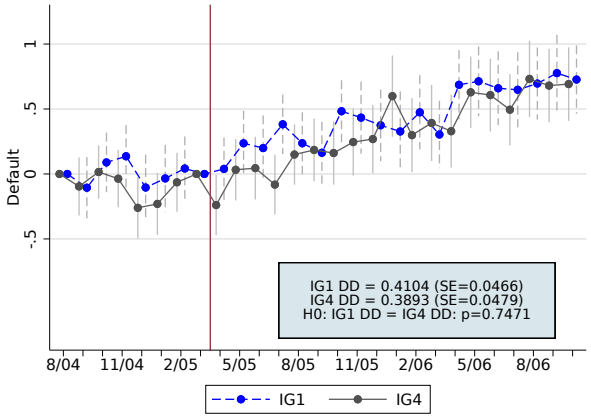
(a) Full Documentation



(b) Credit Score



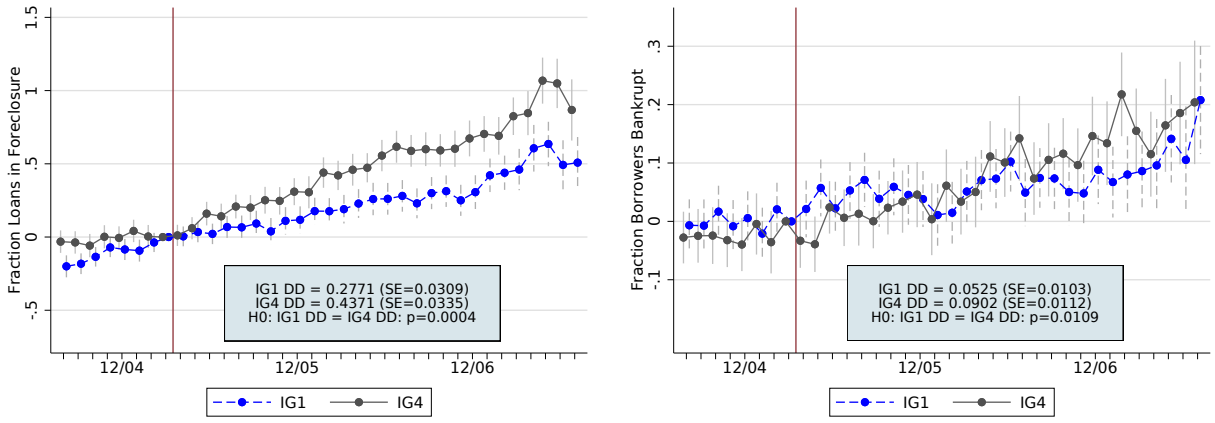
(c) Early Payment Default



(d) Total Default

Notes: Panels a and b plot the dynamic response of the coefficient of interest β_T from Equation 5 by subcategory. Panels c and d plot the dynamic response of the coefficient of interest β_T from Equation 7 by subcategory.

Figure 19: Foreclosure & Bankruptcy in Private-Label Data

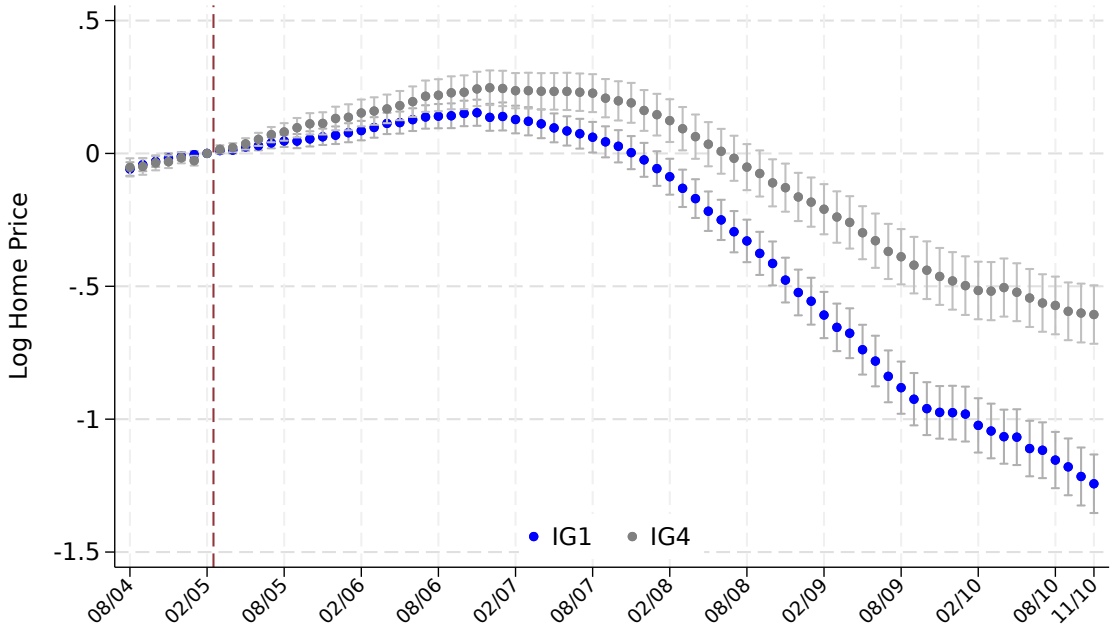


(a) Foreclosure-Income Growth

(b) Bankruptcy-Income Growth

Notes: Figure plots the dynamic response of the coefficient of interest β_t from Equation 11 by subcategory.

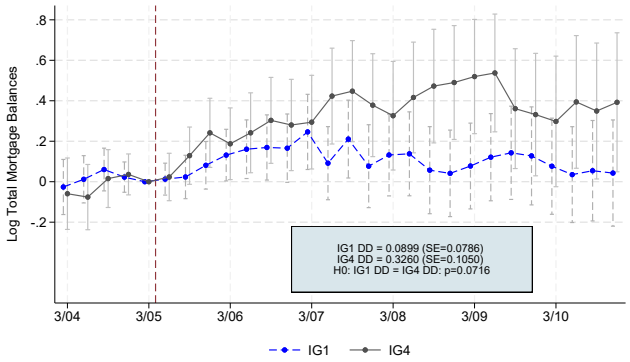
Figure 20: Difference-in-Differences by Income Growth Quartiles - Home Prices



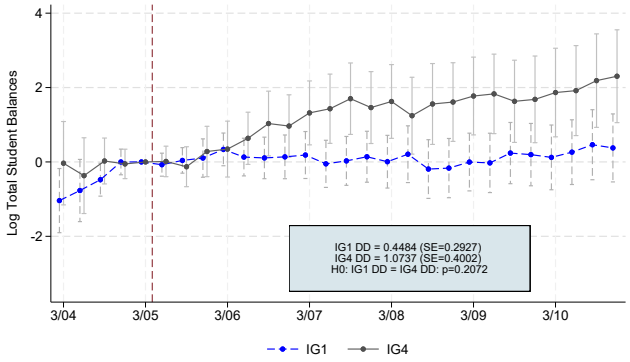
(a) Racial Subgroups

Notes: Figure plots the dynamic response of the coefficient of interest β_t from Equation 5 by subcategory. These plots utilize the LLMA mortgage origination data and Zillow's ZHVI home price data.

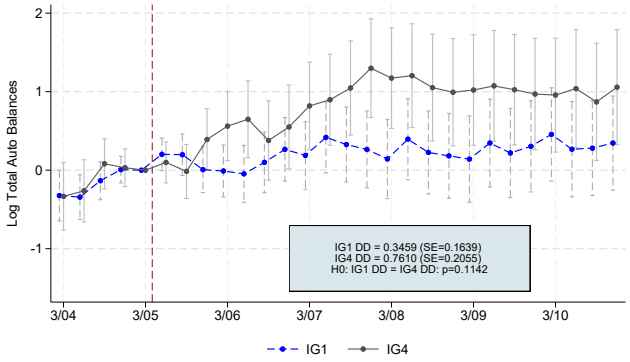
FIGURE 21: DIFFERENCE-IN-DIFFERENCES BY INCOME GROWTH QUARTILES - CREDIT OUTCOMES



(a) Mortgage Loan



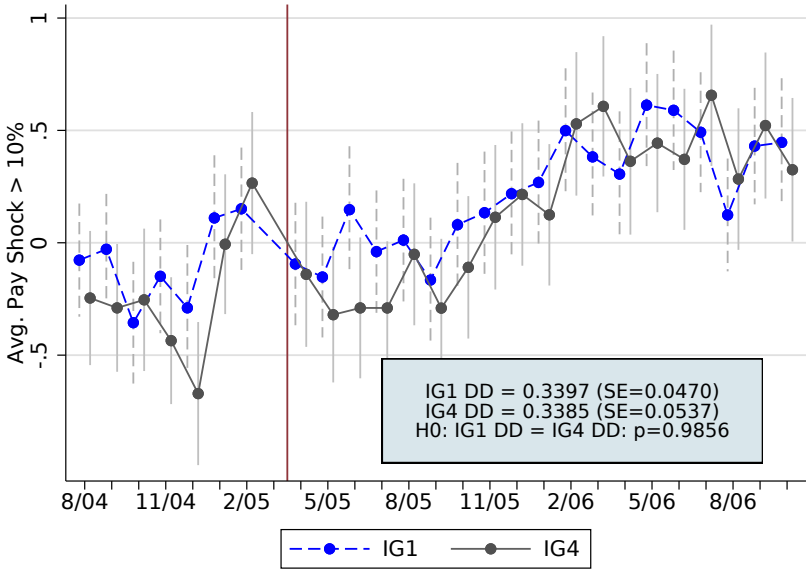
(b) Student Loan



(c) Auto Loan

Notes: Figure plots the dynamic response of the coefficient of interest β_t from Equation 12 by subcategory.

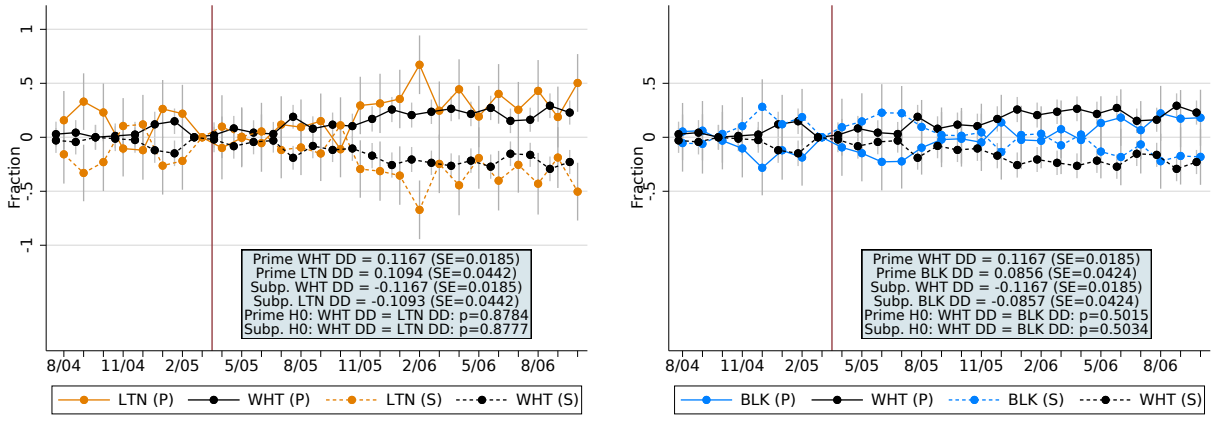
FIGURE 22: 10% PAY SHOCK



Income Growth Quartiles

Notes: The figure depicts the likelihood of pay shocks for mortgages originated in zip codes with higher IMC market share pre- versus post-BAPCPA in each subgroup. The data are limited to mortgages that experience a payment reset.

FIGURE 23: DIFFERENCE-IN-DIFFERENCES (DID) BY RACE SUBCATEGORIES - PRIME VS SUBPRIME

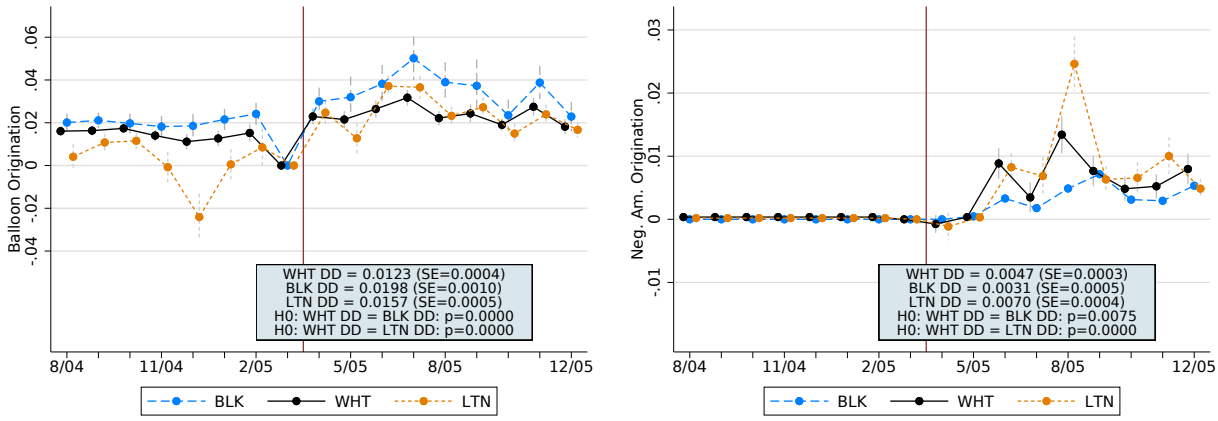


(a) Latino vs white zip codes

(b) Black vs white zip codes

Notes: Panels a and b plot the dynamic response of the coefficient of interest β_T from Equation 5 by race subcategory.

FIGURE 24: LOAN LEVEL DID BY RACE SUBCATEGORIES - BORROWER CHARACTERISTICS



(a) Balloon

(b) Negative Amortizing

Notes: Figure plots the dynamic response of the coefficient of interest β_T from the following equation by race subcategory.

$$Y_l = \gamma_z + \eta_{s,t} + \mu IMCoriginator_l + \sum_T \beta_T IMCoriginator_l \times \mathbb{1}_{t=T} + \epsilon_l. \tag{27}$$

Table 7: PLS-IMC Market Share Robustness

WHT

	(1) log(Orig)	(2) log(Balloon)	(3) log(NegAm)	(4) log(TwoStep)	(5) log(IntRate)	(6) log(FullDoc)	(7) log(FICO)	(8) loanEPDgse	(9) loanEPDfha	(10) loanDefault
Post × $PLS_{z,04}$	-1.598***	6.561***	-0.459	5.872	-0.260	-2.470***	0.147	0.188	0.274**	1.275**
	(0.604)	(2.398)	(1.472)	(4.229)	(0.428)	(0.739)	(0.108)	(0.153)	(0.123)	(0.573)
StatexMonthFE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
ZipFE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
$r2_a$	0.88	0.48	0.79	0.30	0.24	0.79	0.32	0.02	0.01	0.11
N	270454	45168	103729	7367	269839	210762	258237	417252	417252	417252

BLK

	(1) log(Orig)	(2) log(Balloon)	(3) log(NegAm)	(4) log(TwoStep)	(5) log(IntRate)	(6) log(FullDoc)	(7) log(FICO)	(8) loanEPDgse	(9) loanEPDfha	(10) loanDefault
Post × $PLS_{z,04}$	-1.319	28.560***	14.886***	-5.579	-1.644*	-6.184***	0.392	-0.069	0.339	2.443
	(1.574)	(7.256)	(4.482)	(11.342)	(0.849)	(2.082)	(0.245)	(0.527)	(0.467)	(1.498)
StatexMonthFE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
ZipFE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
$r2_a$	0.86	0.33	0.69	0.08	0.24	0.76	0.33	0.02	0.01	0.11
N	277156	43040	97493	5065	276512	215182	263892	417252	417252	417252

LTN

	(1) log(Orig)	(2) log(Balloon)	(3) log(NegAm)	(4) log(TwoStep)	(5) log(IntRate)	(6) log(FullDoc)	(7) log(FICO)	(8) loanEPDgse	(9) loanEPDfha	(10) loanDefault
Post × $PLS_{z,04}$	-2.865*	22.785***	10.705***	25.829**	-1.824*	-8.946***	0.087	-0.011	-0.124	3.835***
	(1.486)	(7.947)	(3.174)	(12.904)	(0.967)	(2.178)	(0.186)	(0.203)	(0.183)	(0.939)
StatexMonthFE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
ZipFE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
$r2_a$	0.88	0.48	0.79	0.30	0.24	0.79	0.32	0.02	0.01	0.11
N	270454	45168	103729	7367	269839	210762	258237	417252	417252	417252

Notes: Table reports coefficients in robustness regression using the zip code level market share of IMC originations that were sold into private securitization in the HMDA data.

TABLE 8: Originations by Income Growth Subcategories

	Income Quartile 1									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	log(Orig)		log(Balloon)		log(NegAm)		log(TwoStep)		log(InitInterest)	
Post × IMCMktShr$_{z,04}$	-0.036	-0.146**	2.710***	3.103***	1.244***	1.105***	1.138***	0.628	-0.214***	-0.190***
	(0.034)	(0.058)	(0.173)	(0.231)	(0.101)	(0.130)	(0.264)	(0.393)	(0.021)	(0.035)
StatexMonthFE	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
ZipFE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
$r2_a$	0.92	0.93	0.30	0.44	0.77	0.79	0.10	0.24	0.24	0.28
N	246182	246182	38624	38253	80326	80078	6869	6180	179150	179124
	Income Quartile 4									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	log(Orig)		log(Balloon)		log(NegAm)		log(TwoStep)		log(InitInterest)	
Post × IMCMktShr$_{z,04}$	0.125***	0.196***	3.058***	3.015***	1.600***	1.667***	1.398***	2.113***	-0.270***	-0.334***
	(0.036)	(0.061)	(0.188)	(0.305)	(0.104)	(0.166)	(0.278)	(0.626)	(0.023)	(0.040)
StatexMonthFE	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
ZipFE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
$r2_a$	0.92	0.93	0.30	0.44	0.77	0.79	0.10	0.24	0.24	0.28
N	246182	246182	38624	38253	80326	80078	6869	6180	179150	179124

Notes: Table reports the coefficient of interest in each subgroup for Equation 6.

TABLE 9: Characteristics and Performance by Income Growth Subcategories

	Income Quartile 1							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	log(FullDoc)		log(FICO)		loanEPDgse		loanDefault	
Post × IMCMktShr$_{z,04}$	-0.275***	-0.285***	0.030***	0.022***	0.021***	0.032**	0.466***	0.398***
	(0.039)	(0.062)	(0.004)	(0.006)	(0.007)	(0.015)	(0.031)	(0.046)
StatexMonthFE	No	Yes	No	Yes	No	Yes	No	Yes
ZipFE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
r2$_a$	0.88	0.90	0.25	0.26	0.01	0.02	0.09	0.11
N	217937	217935	239706	239706	306630	306580	306630	306580
	Income Quartile 4							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	log(FullDoc)		log(FICO)		loanEPDgse		loanDefault	
Post × IMCMktShr$_{z,04}$	-0.142***	0.203***	0.032***	0.029***	0.029***	0.028**	0.559***	0.372***
	(0.042)	(0.069)	(0.004)	(0.008)	(0.007)	(0.012)	(0.032)	(0.047)
StatexMonthFE	No	Yes	No	Yes	No	Yes	No	Yes
ZipFE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
r2$_a$	0.88	0.90	0.25	0.26	0.01	0.02	0.09	0.11
N	217937	217935	239706	239706	306630	306580	306630	306580

Notes: Table columns 1 through 4 report the coefficient of interest in each subgroup for Equation 6. Columns 5 through 8 report the coefficient of interest in each subgroup for Equation 8.

TABLE 10: Differential Effect of Treatment by Income Growth

	Product Types			
	(1) logorig	(2) fracballoon	(3) fracnegam	(4) fractwostep
Post × $\text{IMCMktShare}_{z,04}$	-0.1596***	0.0450***	0.0467***	0.0031***
	(0.0377)	(0.0023)	(0.0061)	(0.0011)
Post × IncGrowth_z	-0.5505***	0.0093	0.0374*	0.0045
	(0.1110)	(0.0062)	(0.0216)	(0.0036)
Post × $\text{IMCMktShare}_{z,04}$ × IncGrowth_z	1.8982***	-0.0481**	-0.1109*	-0.0130
	(0.3276)	(0.0192)	(0.0649)	(0.0115)
cons	2.4852***	-0.0027***	0.0168***	0.0002
	(0.0091)	(0.0006)	(0.0015)	(0.0002)
ZipFE	Yes	Yes	Yes	Yes
StatexMonthFE	Yes	Yes	Yes	Yes
r2	0.9274	0.0968	0.3896	0.0742
N	491717	491717	491717	491717

Notes: Table reports the response of housing market characteristics in a given zip as a function of the interaction term between 2004 market share of independent mortgage companies (IMCs) × income growth between 2001 and 2004 in that zip × the post period. I estimate the triple difference regression in Equation 13. I use the Public HMDA data to compute the 2004 zip level IMC market share. I use CoreLogic LLMA data to study mortgage product types and characteristics.

TABLE 11: HMDA Mortgage Acceptance Rates by Race

	Acceptance Rate		
	(1)	(2)	(3)
	BLK	LTN	WHT
Race	-0.066***	-0.010*	0.250***
	(0.005)	(0.005)	(0.005)
$IMC_{z,04}$	-0.129***	-0.135***	-0.070***
	(0.006)	(0.005)	(0.004)
$IMC_{z,04}$ × Race	0.079***	0.128***	-0.049***
	(0.006)	(0.005)	(0.004)
Post × Race	0.021***	0.022***	-0.018***
	(0.002)	(0.002)	(0.002)
$IMC_{z,04}$ × Post	0.111***	0.111***	0.073***
	(0.003)	(0.003)	(0.003)
Race × $IMC_{z,04}$ × Post	-0.055***	-0.066***	0.030***
	(0.004)	(0.004)	(0.003)
Constant	0.471***	0.466***	0.315***
	(0.002)	(0.001)	(0.002)
StatexYearFE	Yes	Yes	Yes
CountyFE	Yes	Yes	Yes
$r2_a$	0.02	0.02	0.07
N	185792947	185792947	185792947

Notes: Table reports the response of HMDA loan acceptance rates in a given zip as a function of the interaction term between 2004 market share of independent mortgage companies (IMCs) × an indicator for majority race in that zip × the post period. I estimate the triple difference regression in Equation 14. The coefficients measure the change in the dependent variable if $IMCMktShr_{c,04}$ increased from 0% to 100% in the post period if a zip is considered majority Black (Latino, White). HMDA acceptance rates come from the HDMA Loan Application Register. I also use the Public HMDA data to compute the 2004 zip level IMC market share. Zip-level racial demographics come from the Census.

TABLE 12: Originations by Race (Poisson)

	(1) Negative Amortizing	(2) Balloon	(3) Two Step
	WHT		
Post × IMCMktShr$_{z,04}$	1.441***	6.789***	-2.835***
	(0.126)	(0.333)	(0.833)
StatexMonthFE	Yes	Yes	Yes
ZipFE	Yes	Yes	Yes
r2$_p$	0.62	0.30	0.16
N	236965	217819	80498
	BLK		
Post × IMCMktShr$_{z,04}$	0.784**	5.776***	1.633
	(0.328)	(0.645)	(1.816)
StatexMonthFE	Yes	Yes	Yes
ZipFE	Yes	Yes	Yes
r2$_p$	0.67	0.48	0.24
N	31908	34111	14724
	LTN		
Post × IMCMktShr$_{z,04}$	3.238***	6.129***	1.211
	(0.217)	(0.659)	(1.254)
StatexMonthFE	Yes	Yes	Yes
ZipFE	Yes	Yes	Yes
r2$_p$	0.80	0.57	0.43
N	30236	28446	18689

Notes: Table reports the coefficient of interest in each subgroup for Equation 15.

TABLE 13: Originations by Race (Robustness)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	log(Orig)		log(Balloon)		log(NegAm)		log(TwoStep)		log(InitInterest)	
WHT										
$\text{IncGrowth}_z \times \text{Post}$	0.140***	0.020	0.754***	-0.187	0.648***	0.080	0.324	-0.257	-0.075***	-0.041*
	(0.030)	(0.030)	(0.151)	(0.129)	(0.080)	(0.073)	(0.208)	(0.315)	(0.022)	(0.023)
$\text{Post} \times \text{IMCMktShr}_{z,04}$	-0.028	0.041	2.278***	1.590***	0.826***	0.669***	0.895***	-0.186	-0.159***	-0.211***
	(0.034)	(0.043)	(0.172)	(0.181)	(0.101)	(0.126)	(0.289)	(0.370)	(0.026)	(0.035)
StatexMonthFE	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
ZipFE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
$r2_a$	0.90	0.91	0.37	0.50	0.78	0.80	0.14	0.32	0.19	0.22
N	326681	326547	39176	38905	83271	83120	6678	6207	226041	225917
BLK										
$\text{IncGrowth}_z \times \text{Post}$	0.162***	0.018	0.448***	-0.406***	0.583***	-0.024	0.556***	-0.005	-0.066***	-0.038*
	(0.031)	(0.031)	(0.133)	(0.132)	(0.079)	(0.077)	(0.184)	(0.345)	(0.022)	(0.023)
$\text{Post} \times \text{IMCMktShr}_{z,04}$	0.022	-0.599***	2.044***	2.819***	0.776***	1.017***	0.405*	0.190	-0.172***	-0.154***
	(0.031)	(0.106)	(0.137)	(0.371)	(0.093)	(0.245)	(0.230)	(1.143)	(0.020)	(0.051)
StatexMonthFE	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
ZipFE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
$r2_a$	0.89	0.90	0.23	0.35	0.64	0.67	-0.00	0.08	0.19	0.22
N	341767	341727	37708	37466	78748	78596	4746	4114	234535	234506
LTN										
$\text{IncGrowth}_z \times \text{Post}$	0.140***	0.020	0.754***	-0.187	0.648***	0.080	0.324	-0.257	-0.075***	-0.041*
	(0.030)	(0.030)	(0.151)	(0.129)	(0.080)	(0.073)	(0.208)	(0.315)	(0.022)	(0.023)
$\text{Post} \times \text{IMCMktShr}_{z,04}$	0.009	-0.107	3.311***	4.849***	1.525***	2.874***	1.474***	3.833***	-0.257***	-0.446***
	(0.029)	(0.107)	(0.155)	(0.563)	(0.085)	(0.220)	(0.255)	(0.853)	(0.020)	(0.075)
StatexMonthFE	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
ZipFE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
$r2_a$	0.90	0.91	0.37	0.50	0.78	0.80	0.14	0.32	0.19	0.22
N	326681	326547	39176	38905	83271	83120	6678	6207	226041	225917

Notes: Table reports the coefficient of interest in each subgroup for Equation 17.

TABLE 14: Characteristics and Performance by Race (Robustness)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	log(FullDoc)		log(FICO)		loanEPDgse		loanDefault	
WHT								
$IncGrowth_z \times Post$	0.112***	0.045	0.002	0.004	0.010*	0.003	0.198***	-0.005
	(0.033)	(0.032)	(0.004)	(0.004)	(0.006)	(0.007)	(0.029)	(0.024)
$Post \times IMCMktShr_{z,04}$	-0.204***	0.001	0.028***	0.017***	0.023***	0.013	0.403***	0.160***
	(0.039)	(0.048)	(0.004)	(0.006)	(0.009)	(0.012)	(0.032)	(0.045)
StatexMonthFE	No	Yes	No	Yes	No	Yes	No	Yes
ZipFE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
$r2_a$	0.85	0.87	0.19	0.19	0.02	0.02	0.09	0.11
N	286421	286290	317446	317312	354280	354162	354280	354162
BLK								
$IncGrowth_z \times Post$	0.117***	-0.015	0.002	0.005	0.010*	0.003	0.198***	-0.005
	(0.034)	(0.034)	(0.004)	(0.004)	(0.006)	(0.007)	(0.029)	(0.024)
$Post \times IMCMktShr_{z,04}$	-0.157***	-0.664***	0.031***	0.012	0.031***	0.062*	0.428***	0.293***
	(0.035)	(0.119)	(0.004)	(0.011)	(0.009)	(0.035)	(0.030)	(0.083)
StatexMonthFE	No	Yes	No	Yes	No	Yes	No	Yes
ZipFE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
$r2_a$	0.85	0.86	0.22	0.22	0.02	0.02	0.09	0.11
N	298770	298734	331512	331472	354280	354162	354280	354162
LTN								
$IncGrowth_z \times Post$	0.112***	0.045	0.002	0.004	0.010*	0.003	0.198***	-0.005
	(0.033)	(0.032)	(0.004)	(0.004)	(0.006)	(0.007)	(0.029)	(0.024)
$Post \times IMCMktShr_{z,04}$	-0.371***	-0.159	0.027***	0.021	0.023***	-0.008	0.557***	0.337***
	(0.035)	(0.116)	(0.004)	(0.013)	(0.007)	(0.017)	(0.026)	(0.071)
StatexMonthFE	No	Yes	No	Yes	No	Yes	No	Yes
ZipFE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
$r2_a$	0.85	0.87	0.19	0.19	0.02	0.02	0.09	0.11
N	286421	286290	317446	317312	354280	354162	354280	354162

Notes: Table reports the coefficient of interest in each subgroup for Equation 17.

TABLE 15: Pay Shock $\geq 10\%$ by Race

	(1)	(2)	(3)	(4)	(5)	(6)
	WHT		BLK		LTN	
Post $\times$ IMCMktShr$_{z,04}$	0.140***	0.444***	0.229***	0.070	0.033	0.249***
	(0.035)	(0.043)	(0.029)	(0.081)	(0.028)	(0.065)
StatexMonthFE	No	Yes	No	Yes	No	Yes
ZipFE	Yes	Yes	Yes	Yes	Yes	Yes
$r2_a$	0.15	0.23	0.14	0.23	0.15	0.23
N	177079	176961	179756	179708	177079	176961

Notes: Table reports the coefficient of interest in each subgroup for Equation 10.

TABLE 16: Pay Shock $\geq 10\%$ by Income Group

	(1)	(2)	(3)	(4)
	IG1		IG4	
Post $\times$ IMCMktShr$_{z,04}$	0.204***	0.340***	0.054*	0.339***
	(0.031)	(0.047)	(0.032)	(0.054)
StatexMonthFE	No	Yes	No	Yes
ZipFE	Yes	Yes	Yes	Yes
r2$_a$	0.16	0.25	0.16	0.25
N	128025	127929	128025	127929

Notes: Table reports the coefficient of interest in each subgroup for Equation 10.