Changing the Scope of GSE Loan Guarantees: Estimating Effects on Mortgage Pricing and Availability*

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Abstract

Using a novel combination of mortgage datasets, we analyze the effects of two policy levers influencing the scope of Fannie Mae and Freddie Mac's (Government-Sponsored Enterprises, GSEs) involvement in the U.S. residential mortgage market. First, we find that small changes in mortgage guarantee fees charged by the GSEs were essentially fully passed through to consumers, with limited effects on mortgage demand. This implies that small fee changes are primarily transfers between mortgage consumers and taxpayers while the GSEs remain in federal conservatorship. Second, the data suggest that marginally lowering maximum conforming loan size limits would cause most affected consumers to reduce their loan amounts to the new maximum. Our findings provide new detailed evidence on how GSE policy shapes mortgage availability and contrast the differing effects on consumers of two potential policy levers to reduce (or increase) the scope of GSE lending. Additional survey data indicate that borrowers' shopping behavior and incomplete information may also influence the effects of GSE policy changes.

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1 Introduction

On average, roughly one trillion dollars in new residential mortgage loans are made in the United States each year. In recent years, Fannie Mae and Freddie Mac (the GSEs, government-sponsored enterprises) have guaranteed and securitized over half of these loans, effectively insuring the loan or security holder against losses from consumer defaults. Given their size, even small changes in GSE policy can have large impacts on the pricing and supply of mortgage credit.

The role of the GSEs has been debated for decades, in terms of whether and how much taxpayers should implicitly or explicitly support the residential mortgage market.[1] While officials across presidential administrations have proposed ambitious plans for changing the GSEs, in practice, the changes most consistently implemented have been small adjustments to existing mechanisms defining the scope of GSE loan guarantees. In this paper, we empirically analyze the effects of marginal changes to two of these policy levers: (a) the fees that the GSEs charge for guaranteeing mortgage loans, and (b) the conforming loan limits above which the GSEs are unable to guarantee and securitize loans.[2]

First, using 2015 data on the complete set of rate sheets (price offerings) from several dozen lenders, we find that lenders essentially fully passed through a small, upfront guarantee fee decrease to consumers. Matching these data to loan origination data, we find only limited evidence of demand effects on product choices due to substitution. Our data and empirical approach allow us to more precisely isolate the pass-through of guarantee fees than prior studies, but our findings align with recent suggestive evidence of full pass-through from small guarantee fee increases (Fisher, Fratantoni, Oliner and Peter, 2021; Hogan, 2016). Collectively, this evidence suggests that while the GSEs remain in conservatorship, small guarantee fee changes primarily result in transfers between taxpayers and mortgage consumers.[3]

Second, we find consumers' loan choices are very sensitive to changes in the conforming loan limit, despite small price differences between GSE and non-GSE loans. Bunching just below the conforming loan limit has been documented in the literature; many more consumers choose conforming loans (guaranteed by the GSEs) just below the limit than jumbo loans (not guaranteed by the GSEs) just above it (Adelino, Schoar and Severino, 2012; An and Yao, 2016; DeFusco and Paciorek, 2017; Loutskina and Strahan, 2009; Kaufman, 2014). While the interest rate spread between jumbo and conforming loans could explain such bunching in the pre-crisis data studied in the prior literature, we find that bunching persists in the 2015 data despite small or even negative

[1] Government support became explicit when the GSEs were taken into conservatorship in 2008. The government guarantee operates through a Senior Preferred Stock Purchase Agreement with the U.S. Treasury Department. See `https://www.fhfa.gov/Conservatorship/Pages/History-of-Fannie-Mae--Freddie-Conservatorships.aspx`.

[2] The Congressional Budget Office has also considered and analyzed proposals to "Raise Fannie Mae's and Freddie Mac's Guarantee Fees and Decrease their Eligible Loan Limits" as part of their *Options for Reducing the Deficit*, December 13, 2018, `https://www.cbo.gov/budget-options/2018/54716`. For summaries of recent guarantee fee and loan limit changes, see `https://www.fhfa.gov/PolicyProgramsResearch/Policy/Pages/Guarantee-Fees-History.aspx` and `https://www.fhfa.gov/DataTools/Downloads/Pages/Conforming-Loan-Limits.aspx`.

[3] There is not a guarantee fee increase during the period covered by our data that would allow precisely identified pass-through and demand estimates, but we argue that marginal guarantee fee increases should also be fully passed through, based on theoretical models and on empirical evidence from other industries that cost increases are passed through to consumers more fully and more quickly than price decreases (Peltzman, 2000; Tappata, 2009). Similarly, in time periods and contexts where prior literature has found incomplete pass-through in credit card (Ausubel, 1991), mortgage (Agarwal, Amromin, Chomsisengphet, Landvoigt, Piskorski, Seru and Yao, 2015; Amromin and Kearns, 2014; Fuster, Goodman, Lucca, Madar, Molloy and Willen, 2013), or financial asset markets (Green, Li and Schürhoff, 2010), the effects are typically incomplete pass-through of cost *decreases* attributed to imperfect competition. We acknowledge that large increases in guarantee fees could induce larger credit supply responses, potentially leading to different outcomes.

price differentials—with jumbo loans offered at lower rates than conforming loans.[4]

Using our data on lenders' rate offerings, we show that a substantial share of this bunching can be explained by lenders' unwillingness to extend jumbo loans to consumers with lower credit scores and higher loan-to-value ratios (LTVs).[5] However, many consumers still choose conforming loans even when they appear to be eligible for jumbo loans at comparable or lower interest rates. As a potential explanation, we use survey data to show that limited shopping behavior may leave consumers with incomplete information on the pricing and availability of alternative loan options. Together, our results indicate that reducing the conforming loan limit would cause most consumers to reduce their loan amount to the limit in their county, despite relatively small pricing differences.

In the rest of the Introduction, we provide more details on our empirical strategy, datasets, and contributions to the literature. To establish our first finding, we study the pass-through and demand effects of a September 2015 policy change that decreased one-time, upfront guarantee fees by 25 basis points for borrowers with certain credit scores and LTVs, while fees for others remained constant. We find that in over 80 percent of cases, lenders reduced their upfront fees by exactly 25 basis points for loan types subject to the 25-basis point guarantee fee decrease, suggesting full pass-through may be built into the pricing functions of most lenders. Since mortgage prices are offered to consumers as menus of upfront fee and interest rate pairs (Alexandrov and Koulayev, 2017; Bhutta and Hizmo, 2021), we can calculate how this upfront fee change translates to an interest rate change based on the trade-off between fees and rates inherent in lenders' offered price menus. Holding upfront fees fixed, the policy change resulted in an average offered interest rate decrease of about 5 basis points per year (ongoing for the life of the loan). This trade-off between fees and rates in lenders' offered prices would reflect an expected average mortgage duration of roughly five years, which we confirm is consistent with ex-post data on actual prepayments.

Our finding of full pass-through may be aided by the transparent and uniform nature of the small guarantee fee change we study, which was publicly announced, applied to the most common and standardized products offered by lenders, and occurred during a period of stable economic conditions. In contrast, when prior literature has found evidence of less than full pass-through due to competitive effects, the effects were concentrated in unique crisis-era policy contexts, particularly programs facilitating within-lender refinances for underwater borrowers (Agarwal, Amromin, Chomsisengphet, Landvoigt, Piskorski, Seru and Yao, 2015; Amromin and Kearns, 2014; Fuster, Goodman, Lucca, Madar, Molloy and Willen, 2013).

Given the small size of the guarantee fee change, policymakers expected minimal changes in loan demand, which we confirm with difference-in-differences style demand estimates. Our approach exploits the fact that the guarantee fee changes were announced in April 2015, but were passed through by lenders on different dates, a finding made possible by our use of daily data on offered rates. While not statistically significant, we find some limited evidence of substitution into products with fee decreases, with point estimates indicating a 2.5 percentage point increase in the share of originations subject to a price decrease, from a base of 77 percent.

Our demand results suggest that small guarantee fee-driven price changes may induce some substitution for conforming loan borrowers, but the overall effect on consumer choices is quite small. In particular, our estimated magnitudes for borrower sensitivity to interest rate changes (or differences) are too small to explain the observed bunching at the conforming loan limit.

[4] Our data confirm a limited or negative jumbo-conforming interest rate spread in offered retail rates, echoing the results for rate spreads at closing described in concurrent work by Fisher, Fratantoni, Oliner and Peter (2021) and a number of industry analyses (Freddie Mac, 2015; Pradhan, 2018a,b).

[5] These results provide more detailed evidence on how lenders restrict jumbo loan credit supply, building on Loutskina and Strahan (2009, 2011) which showed reduced lending volumes and acceptance rates above the conforming loan limit.

To reach our second key finding—that loan availability rather than pricing drives consumers' high sensitivity to the conforming loan limit—we analyze daily rate sheets aggregated by Informa Research Services.[6] The rate sheets are effectively a formula for the rate that a consumer would be quoted at a lender's branch or website, conditional on characteristics such as credit score and LTV. These rate sheets reveal that although jumbo loans with LTVs of 80 or below were widely available at comparable or lower rates than conforming loans, jumbo loans with LTVs above 80 were often not offered at all, particularly for borrowers with less than superprime credit scores. Further, jumbo loans in some cases impose additional underwriting requirement, often described as "compensating factors," on dimensions often not observed in standard mortgage datasets, which we examine through a review of underwriting guidelines provided by a set of large mortgage originators. These include limitations on monthly debt-payment-to-income (DTI) ratios (e.g., a maximum of 43 percent), restrictions on first-time homebuyers, and conditions on minimum liquid assets (e.g., 12 months of payments held in cash reserves).[7]

In addition to the differences in pricing and availability between jumbo and conforming mortgages, consumers' shopping behavior also influences mortgage choice. For example, loan choices may reflect the inertia of some consumers or their advisors who believe that they are likely to get a better rate—or have a better chance of approval—if the loan is under the conforming loan limit. A growing literature has documented significant price dispersion in the mortgage market (Allen, Clark and Houde, 2014; Damen and Buyst, 2017; Gurun, Matvos and Seru, 2016; Woodward and Hall, 2012). Recent papers by Alexandrov and Koulayev (2017) and Bhutta, Fuster and Hizmo (2020) supplement evidence of price dispersion with survey data from the National Survey of Mortgage Originations (NSMO), finding that the typical mortgage borrower undertakes limited shopping or price comparison.

We build on this prior work, using the NSMO to assess how consumers obtaining mortgages exactly at the conforming loan limit differ from those just below or above it. We find that borrowers bunching at the loan limit are (a) more likely to have chosen their lender or broker before choosing their loan type, and (b) more likely to have seriously considered only one lender.[8] This suggests that limited shopping may play an important role in bunching at the conforming loan limit.

Finally, to quantify how these patterns shape the effects of loan limit policy changes, we simulate a counterfactual reduction in the conforming loan limit, using the observed bunching at $417,000 in our data and the density of borrowers at amounts nearby. Because the observed bunching is difficult to rationalize with a parametric model of loan choices based on price differences, our partial equilibrium approach uses only the empirical loan choice distributions and thus does not allow for credit supply responses to the limit reduction.[9] The counterfactual suggests that if the loan limit had been lowered from $417,000 to $400,000, then among the affected borrowers whose chosen loan amount would no longer be conforming, 99 percent of those with low credit scores and 77

[6]The data during our study period covers 31 lenders, including many of the largest retail mortgage lenders. A subset of these data are used to populate the Consumer Financial Protection Bureau's "Explore Interest Rates" tool, `https://www.consumerfinance.gov/owning-a-home/explore-rates/`.

[7]For additional discussion of underwriting requirements on non-GSE conventional mortgages during this time period, see Chapters 4 and 5 of "Ability-to-Repay and Qualified Mortgage Rule Assessment Report," Consumer Financial Protection Bureau, January 2019, `https://www.consumerfinance.gov/data-research/research-reports/2013-ability-repay-and-qualified-mortgage-assessment-report/`.

[8]When including broker transactions, we also find borrowers at the loan limit were more likely to have used a mortgage broker. The differences in shopping behavior hold in samples with and without these broker transactions.

[9]Consistent with prior literature (An and Yao, 2016; Loutskina and Strahan, 2009) our data show clear evidence of limited credit supply for jumbo loans relative to conforming loans. However, we argue that lenders are unlikely to meaningfully change their underwriting rules for jumbo loans (e.g., restrictions on lower credit scores and higher LTVs) in response to a small change in the conforming loan limit, and thus the existing restrictions on jumbo credit supply are likely to drive the effects of a loan limit change.

percent of those with high credit scores would have reduced their loan amount—by about $16,000 on average—to below the new loan limit.

While there are ongoing policy debates about the structure of the GSEs as a whole, our data and approach only allow us to make predictions about smaller marginal changes.[10]. Specifically, our paper provides novel evidence on the pass-through of guarantee fees to mortgage rates and on the causes of bunching at the conforming loan limit.

As discussed in more detail in Appendix A.1, our results also provide an update on earlier studies of GSE pricing and the jumbo-conforming rate spread (Hendershott and Shilling, 1989; Lehnert, Passmore and Sherlund, 2008; McKenzie, 2002; Passmore, Sherlund and Burgess, 2005; Passmore, 2005) and contribute to recent literature on consumers' demand and shopping for mortgages (Alexandrov and Koulayev, 2017; Bhutta and Hizmo, 2021; DeFusco and Paciorek, 2017; Fuster and Zafar, 2021), lender underwriting and mortgage availability (Anenberg, Hizmo, Kung and Molloy, 2019; Kaufman, 2014; Laufer and Paciorek, 2016), and how these combined factors influence the effects of GSE and government mortgage policies on consumers (Bhutta and Ringo, 2017; MacDonald, 2019; Park, 2017, 2021). Most directly, our results suggest that a marginal reduction in the conforming loan limit (for example, from $417,000 to $400,000 in most counties) would induce a substantial number of borrowers to reduce the size of their loans, but a marginal change in guarantee fees (for example, by 50 basis points in upfront fees or 10 basis points in the interest rate) would have a comparatively limited impact on consumers' loan choices.

2 Data

We use four datasets for our main analyses, described in detail below. Informa rate sheets are our main source of rate offer information. We employ Home Mortgage Disclosure Act (HMDA) data as our source for market shares. When more detailed characteristics of originated loans are required, we use the CoreLogic Loan Level Market Analytics dataset. For all origination and rate sheet data, we use the full 2015 calendar year, the year of the guarantee fee policy change. Our primary samples of originations and rates are restricted to conventional, first-lien, single-family, 30-year fixed-rate purchase loans, with selected results for refinances included in the Appendix. Finally, we supplement these pricing and origination datasets with survey responses from the National Survey of Mortgage Originations (NSMO).

The Informa data contain daily retail mortgage rate sheets from several dozen lenders starting in mid-2014, including seven of the ten largest lenders by HMDA market share at that time. For the included lenders, these data allow us to calculate retail prices on mortgage options offered to consumers based on credit score, LTV, and state, as well as loan size, type (e.g. conforming-fixed, jumbo-fixed), and purpose (e.g., purchase loans). The data include the offered rates across the full schedule of upfront discount points, where an interest rate offered with x discount points means upfront fees equal to x percent of the loan balance. Pricing is conducted at the state level by each lender, though many lenders offer little to no variation across groups of states, effectively pricing nationally.[11] Since borrowers and lenders can negotiate, these offered rates may vary from

[10]Our paper does not directly address, for example, the role of mortgage policy and the GSEs in the availability of the 30-year fixed rate mortgage (Fuster and Vickery, 2015), cross-subsidization and redistribution (Gete and Zecchetto, 2017; Hurst, Keys, Seru and Vavra, 2016), and interactions with home prices (Adelino, Schoar and Severino, 2012; An and Yao, 2016; Grundl and Kim, 2021; Johnson, 2020)

[11]The general absence of local pricing in the GSE market has been documented in Hurst, Keys, Seru and Vavra (2016). While that study finds evidence of more local price variation in the jumbo loan market, evidence from Loutskina and Strahan (2009, 2011) suggests that this is likely driven by differences in the composition of geographically concentrated lenders in particular markets, rather than localized pricing by national lenders.

transacted prices. As such, these data provide retail offered rates, in contrast to the final rates at closing available in most loan-level datasets.

While not available for all years, the 2015 Informa data contain lender identifiers, which we use to match Informa rates to originations in the HMDA data. To calculate market-share weighted average offered interest rates, we use a matched sample of 31 lenders that appear in both the Informa and agency HMDA datasets. The HMDA data contain loan-level information on essentially all originated mortgages for the covered lenders. These data allow us to calculate market share at a granular level—e.g., a lender's market share during the first week of August for first-lien, conventional purchase loans in California.[12]

For our analysis of loan choices at the conforming loan limit, we use CoreLogic Loan Level Market Analytics data, which contain detailed characteristics at origination for loans serviced by numerous large mortgage servicers. The data include information on credit score and LTV for a large number of originations (roughly 1/3 of HMDA originations). These advantages of the data support our analysis of bunching behavior near the conforming loan limit for narrow borrower subgroups. While these data include the interest rate at closing, neither the lender nor the points and fees that a consumer pays are observed.[13]

Lastly, we use an anonymized administrative version of the National Survey of Mortgage Originations to explore the shopping behavior and loan choices of borrowers at and near the conforming loan limit. In addition to survey responses, the administrative data provide the precise loan amounts, as well as credit characteristics including credit score, LTV, income, debt-to-income ratio, and interest rate spread.[14]

3 Interest Rate Spread and Guarantee Fee Pass-Through

We start this section by calculating the average offered interest rate spread between conforming loans just below the conforming loan limit and jumbo loans just above the limit, weighted by HMDA market shares. In the process, we introduce the Informa rate sheet data used throughout this section.

We then discuss the pass-through and demand effects of the guarantee fee change. We document in the data (without any statistical analyses) that the vast majority of lenders in our sample reduced their upfront fees by 25 basis points (exactly the change in guarantee fees) between the guarantee fee change announcement date and the effective date. To ensure that these changes in upfront fees were not offset by other simultaneous pricing changes (for example, in offered interest rates), we exploit variation in the implementation dates of the fee changes across lenders. We end the section with some limited demand evidence that consumers shifted to loans that became relatively cheaper.

3.1 Average Interest Rates

Throughout our analysis, we focus on conventional, 30-year, fixed rate, one-to-four unit, purchase mortgages in non-high-cost counties. This is the most common purchase mortgage product, offered by nearly all lenders, and is a benchmark in previous studies. Since our focus is on rate differences near the conforming loan limits, we restrict the sample to loan amounts between $350,000 and

[12] For additional details, see Bhutta and Ringo (2015).

[13] We compare our pricing results to averages from the CoreLogic data for robustness, but the price differentials in CoreLogic could result from consumers paying different points and fees.

[14] The NSMO is a quarterly mail survey jointly funded and managed by the Federal Housing Finance Agency (FHFA) and the Consumer Financial Protection Bureau (CFPB). For details, see `https://www.fhfa.gov/DataTools/Downloads/Pages/National-Survey-of-Mortgage-Originations-Public-Use-File.aspx`.

Table 1: Average Offered Retail Interest Rates by Loan Type, 2015

Credit Score	**LTV**	**Conforming, \$350k-\$417k (%)**	**Jumbo, \$418k-\$500k (%)**
750	80	3.96	3.96
710	80	4.10	4.06
670	80	4.43	4.19*
630	80	4.50	4.29**
750	85	3.96	4.05
710	85	4.10	4.14
670	85	4.44	4.19*
630	85	4.55	4.35**
750	90	3.96	4.28*
710	90	4.10	4.39*
670	90	4.34	4.41*
630	90	4.55	4.35**
750	95	3.96	-
710	95	4.10	-
670	95	4.35	-
630	95	4.56	-

* Rates available from fewer than 30% of Informa lenders
** Rates available from fewer than 10% of Informa lenders

Note: Informa retail rate sheets merged to HMDA data on lender name. Average annual offered retail interest rates by Informa lenders in 2015, weighted by HMDA lender market shares within corresponding loan size category (high-cost counties excluded). Offered rates are calculated with zero points. A rate is defined as available if a lender offers loans of that type on their rate sheets. The symbol '-' indicates that no lenders in the Informa data offered rates for this loan type.

\$500,000. Within this narrow mortgage category, lenders' offered interest rates vary based on characteristics including credit score, LTV, and loan amount. Since we observe the full rate curve offered by lenders, we calculate all offered rates with zero points, meaning zero upfront fees.[15]

For each 2015 HMDA origination in our sample, we calculate the offered interest rate in the Informa data based on lender (j), application date (t), state (s), and bins for conforming versus jumbo loan amounts (a).[16] This provides representative average offered jumbo and conforming rates across lender market shares, time, and geography. Since credit score (f) and LTV (l) are not observed in the HMDA sample, for each loan we calculate an offered rate for each of a set of credit score-LTV bins.

Formally, our average offered rates are calculated as

$$\bar{p}_{afl} = \frac{\sum_{jts} p_{jtsafl} n_{jtsa}}{\sum_{jts} n_{jtsa}}$$

where n_{jtsa} is the number of loans originated for each lender-date-state-amount bin combination.

[15] Where lenders do not offer a rate with exactly zero points, we estimate the rate at zero points by linearly interpolating between the two nearest rates offered with points just above and just below zero.

[16] The general pattern of our results is also robust to alternative weighting approaches, including using a subsample of HMDA and CoreLogic originations that can be matched on loan characteristics.

For each of these combinations, offered rates p_{jtsafl} are priced for the following credit scores and LTVs:

$$f = \text{credit score} \in \{630, 670, 710, 750\}$$
$$l = \text{LTV} \in \{80, 85, 90, 95\}$$

Loan availability is an important concern to address when calculating offered rates. Lenders in the Informa dataset offer rates for conforming loans at all combinations of credit score and LTV described above. However, rates for jumbo loans are only consistently available for low LTVs and moderate to high credit scores.[17]

Our calculated average interest rates, shown in Table 1, suggest that the jumbo-conforming offered interest rate spread is small and in fact slightly negative for some commonly chosen loan types. This phenomenon has also been noted for interest rates at closing in recent years (Fisher, Fratantoni, Oliner and Peter, 2021; Pradhan, 2018a,b). For a borrower with a credit score of 710 and an LTV of 80, lenders on average offered a jumbo loan without a government guarantee for 4 basis points less than a guaranteed conforming loan.

Two further analyses confirm the robustness of these pricing and loan availability patterns. First, Appendix Table 11 shows that the negative jumbo-conforming interest rate spread holds not only in a market-share weighted average, but is also common within lender, within state, and within day. For the borrower with a credit score of 710 and an LTV of 80, 34.7 percent of unique lender-state-date combinations in the Informa data had offered jumbo rates below conforming. Second, to ensure that these patterns are not specific to the Informa data, Appendix Table 12 shows a similar pattern for average rates at closing for loans in the CoreLogic data: lower rates on prime jumbo loans, but a limited availability of jumbo loans for those with lower credit scores or higher LTVs.

3.2 Pass-Through of Guarantee Fee Changes

The GSEs' upfront guarantee fees vary along the same loan and borrower characteristics observed in the Informa rate sheets data. The fee changes we study—which were announced on April 17, 2015, and became effective on September 1, 2015—decreased fees for loans with certain LTV and credit score combinations but left others unchanged, allowing us to measure the pass-through of guarantee fee changes to consumers.

3.2.1 Details of 2015 Guarantee Fee Policy Change

Acting as the GSEs' regulator and conservator, the Federal Housing Finance Agency (FHFA) implemented several broad guarantee fee increases from 2009 through 2013.[18] However, the FHFA postponed the next scheduled round of guarantee fee increases and instead issued a request for input on how guarantee fees should be set.[19] Following an extended comment period, the FHFA stated that it

[17] Anecdotally, the same loan types without rates in the Informa data also generate messages stating they are unavailable when entered into rate calculators on lenders' websites.

[18] These changes, studied in Fisher, Fratantoni, Oliner and Peter (2021) and Hogan (2016), generally applied to the GSEs' portfolios as a whole with limited observable variation across loan or borrower types. See "Guarantee Fee History," FHFA, available at `https://www.fhfa.gov/PolicyProgramsResearch/Policy/Pages/Guarantee-Fees-History.aspx`.

[19] See "FHFA Seeks Input on Fannie Mae and Freddie Mac Guarantee Fees," June 5, 2014, available at `https://www.fhfa.gov/Media/PublicAffairs/Pages/FHFA-Seeks-Input-on-Fannie-Mae-and-Freddie-Mac-Guarantee-Fees.aspx`.

Table 2: Net Change in Upfront Guarantee Fees, 2015 Standard Conforming Purchase Loans, in Basis Points

	LTV Ratio							
Credit Score	< 60.00	60.01–70.00	70.01–75.00	75.01–80.00	80.01–85.00	85.01–90.00	90.01–95.00	95.01–97.00
≥740	0	0	0	0	-25	-25	-25	-25
720–739	0	0	0	0	-25	-25	-25	-25
700–719	0	-25	0	0	-25	-25	-25	-25
680–699	-25	-25	-25	-25	-25	-25	-25	-25
660–679	-25	-25	*	*	-25	-25	-25	-25
640–659	-25	-25	*	-25	-25	-25	-25	-25
620–639	-25	-25	-25	-25	-25	-25	-25	-25

Note: Net change in upfront guarantee fees for standard conforming purchase loans, reflecting the combined effects of the removal of the 25-basis point Adverse Market Charge for all LTV and credit score combinations and targeted 25-basis point increases for particular credit score and LTV combinations. Cases where net change in guarantee fees are reported as "*" indicate credit score and LTV combinations for which Freddie Mac loans had a net pricing decrease of 25 basis points, while Fannie Mae loans had no net change.

> *[F]inds no compelling economic reason to change the general level of fees. FHFA, however, is making certain minor and targeted fee adjustments. To implement these decisions, the agency is directing the Enterprises to make changes to their guarantee fees that will slightly reduce, maintain, or increase costs for different categories of loans. Since all of the guarantee fee changes are small, the agency does not expect the adjustments to cause any material changes to the Enterprises' loan volume in any of the loan categories and expects the small changes to be revenue neutral.*[20]

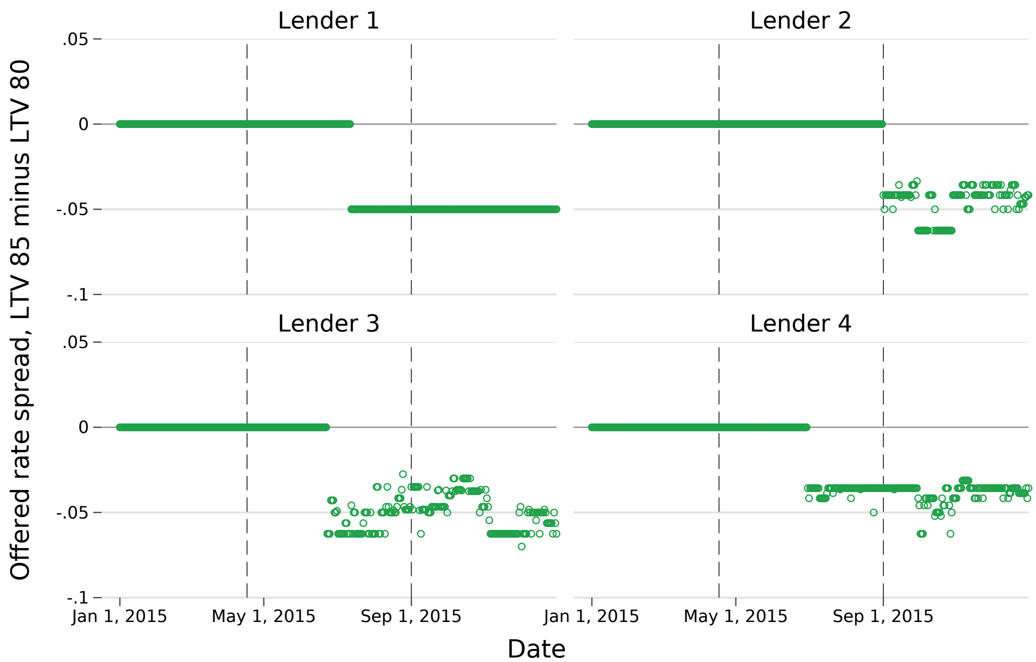
Specifically, the FHFA removed its crisis-era "adverse market charge" for most loans, while implementing targeted increases in upfront one-time guarantee fees by 25 basis points for a subset of loans. Our analysis exploits the net effect of these two changes, shown in Table 2—a net decrease in guarantee fees for some loans and no change for others—to measure the pass-through of guarantee fees. We focus only on standard conforming loans made in non-high-cost counties for several reasons: the adverse market charge was not removed for larger "jumbo-conforming" GSE loans made in high-cost counties, but these loans are made in a limited number of counties, have different rate sheet structures, and have securitization limitations which affect pricing relative to standard conforming mortgages, the last of which is described in Fisher, Fratantoni, Oliner and Peter (2021).

3.2.2 Evidence on Fee Pass-Through

To most directly isolate lenders' responses to the guarantee fee decrease, we first focus only on the upfront fee component of the rate sheet adjustments. Table 3 shows the distribution of observed lender upfront price adjustments across LTV and credit score combinations. Across all combinations, over 80 percent of lenders reduced their upfront fees by exactly 25 basis points for loan types subject to the 25-basis point guarantee fee decrease, while leaving upfront fees unchanged for loan

[20] See "Results of Fannie Mae and Freddie Mac Guarantee Fee Review," FHFA, April 17, 2015, available at `https://www.fhfa.gov/Media/PublicAffairs/Pages/Results-of-Fannie-Mae-and-Freddie-Mac-Guarantee-Fee-Review.aspx`.

Figure 1: Lender-Level Daily Interest Rate Spreads for Four Selected Lenders, LTV of 85 over LTV of 80



Note: Informa retail rate sheets data. Each colored circle represents the interest rate for loans with LTVs of 85 minus the interest rate for loans with LTVs of 80 for a given lender. All rate differences shown are for $416,000 loans in California, with zero points, and a credit score of 750. The vertical line at April 17th indicates the announcement date of the upfront guarantee fee change, while the vertical line at September 1st indicates the effective date. For credit scores of 750, the upfront fee on loans with LTVs of 85 decreased by 25 basis points (0.25 percentage points), while the upfront fee was unchanged for loans with LTVs of 80. Because guarantee fees are paid at the time a loan is securitized (rather than at origination), lenders implement the fee change at varying dates, likely based on operational factors.

types without a guarantee fee change. This suggests that for pricing changes of this magnitude, 100 percent pass-through may be built into the pricing functions of most lenders.

While these upfront fee reductions suggest full pass-through, lenders could have simultaneously adjusted other components of pricing for these loans to offset the fee reductions, such as by raising interest rates. The next analysis controls for this possibility by comparing the full offered rates to consumers, holding upfront fees fixed at zero points.

To demonstrate this idea, Figure 1 plots offered interest rate spreads between otherwise identical loans with LTVs of 85 and 80 and zero upfront fees for four selected lenders. On September 1st, the upfront guarantee fee for loans with LTVs of 85 decreased by 25 basis points, while the fee remained unchanged for loans with LTVs of 80. Nearly all lenders had zero spread between these loans prior to the fee change, meaning they charged the same rate for both loan types.[21] As the effective date approached, lenders lowered their offered rates on loans with zero fees and LTVs of 85 relative to loans with zero fees and LTVs of 80, passing the lower guarantee fee through to consumers. Most lenders decreased spreads by between 3 and 7 basis points.

Interpreting these rate differences depends on how lenders price a 25-basis point change in

[21] While the rates are the same, borrowers with an LTV above 80 are typically required to purchase Private Mortgage Insurance, increasing the cost of their loan.

Table 3: Changes in Upfront Guarantee Fees and Distribution of Resulting Lender Fee Adjustments

		Guarantee Fee	**Number of Lenders Adjusting Fees by:**					
Credit Score Range	**LTV Range**	**Change (bp)**	< -25 bp	-25 bp	-12.5 bp	0 bp	>0 bp	N/A
>740	< 60.00	0	0	2	0	27	1	0
720-739	< 60.00	0	0	3	1	25	1	0
700-719	< 60.00	0	0	3	1	25	1	0
680-699	< 60.00	-25	3	26	0	1	0	0
660-679	< 60.00	-25	2	27	0	1	0	0
640-659	< 60.00	-25	3	25	0	1	0	1
>740	60.01-70.00	0	0	1	0	29	0	0
720-739	60.01-70.00	0	0	1	1	26	2	0
700-719	60.01-70.00	-25	2	27	0	1	0	0
680-699	60.01-70.00	-25	3	26	0	1	0	0
660-679	60.01-70.00	-25	2	27	0	1	0	0
640-659	60.01-70.00	-25	3	24	0	2	0	1
>740	70.01-75.00	0	0	1	0	29	0	0
720-739	70.01-75.00	0	0	1	1	26	2	0
700-719	70.01-75.00	0	0	1	1	27	1	0
680-699	70.01-75.00	-25	3	26	0	1	0	0
660-679	70.01-75.00	*	1	13	1	14	1	0
640-659	70.01-75.00	*	2	11	1	13	2	1
>740	75.01-80.00	0	0	0	0	30	0	0
720-739	75.01-80.00	0	0	1	1	26	2	0
700-719	75.01-80.00	0	0	1	1	27	1	0
680-699	75.01-80.00	-25	3	26	0	1	0	0
660-679	75.01-80.00	*	1	13	1	14	1	0
640-659	75.01-80.00	-25	3	24	0	2	0	1
>740	80.01-85.00	-25	2	26	0	1	0	1
720-739	80.01-85.00	-25	3	24	0	2	0	1
700-719	80.01-85.00	-25	3	25	0	1	0	1
680-699	80.01-85.00	-25	3	25	0	1	0	1
660-679	80.01-85.00	-25	2	25	0	2	0	1
640-659	80.01-85.00	-25	2	22	0	2	0	4
>740	85.01-90.00	-25	2	26	0	1	0	1
720-739	85.01-90.00	-25	3	24	0	2	0	1
700-719	85.01-90.00	-25	3	25	0	1	0	1
680-699	85.01-90.00	-25	4	24	0	1	0	1
660-679	85.01-90.00	-25	3	24	0	2	0	1
640-659	85.01-90.00	-25	4	20	0	2	0	4
>740	90.01-95.00	-25	3	24	0	1	0	2
720-739	90.01-95.00	-25	4	22	0	2	0	2
700-719	90.01-95.00	-25	4	23	0	1	0	2
680-699	90.01-95.00	-25	5	22	0	1	0	2
660-679	90.01-95.00	-25	4	22	0	2	0	2
640-659	90.01-95.00	-25	4	19	0	2	0	5

Note: Informa retail rate sheets data. Lenders' upfront price adjustments observed directly from Informa rate sheets. Cells highlighted in blue correspond to exact full pass through of the September 2015 upfront guarantee fee changes to offered interest rates. Cases where guarantee fee change is reported as "*" indicate credit score and LTV combinations for which Freddie Mac loans had a net pricing decrease of 25 basis points, while Fannie Mae loans had no net change.

upfront fees into an interest rate lasting the life of the mortgage. Mortgage prices offered to consumers consist of a menu of upfront fee and interest rate pairs (Alexandrov and Koulayev, 2017; Bhutta and Hizmo, 2021), where the trade-off between fees and rates in lenders' offered prices reflects in part their expected average mortgage duration, such that lower fees upfront are offset by higher interest earnings over the life of the loan. The examples in Figure 1 suggest that these lenders price mortgages as though a 25-basis point change in upfront fees is approximately equivalent to a 5-basis point change in interest rate. This trade-off is in line with an expected mortgage duration of roughly five years. As a simple example, a 25-basis point upfront fee for a \$250,000 loan equals \$625, while the same loan would require \$629 dollars in extra interest payments over the first five years if the interest rate were increased by 5 basis points from 4.5 to 4.55. Further, ex-post data on actual mortgage durations reveals this expectation to be accurate, as the median time to prepayment (including early payoffs, refinances, and home sales) was 57 months for the 2015 vintage of 30-year purchase GSE loans delivered to Fannie Mae.[22]

As a result—holding upfront fees fixed—we interpret interest rate reductions on the order of 5 basis points as consistent with full pass-through of a 25-basis point upfront fee. The exact translation of upfront fees to interest rates will vary based on lenders' expectations and the composition of their loan portfolios (particularly according to the variation in interest rates and likelihood of prepayment).

For our main results, we estimate the average offered rate change across all lenders and loan types, holding upfront fees fixed at zero. We use two difference-in-differences style regression models on a full set of offered rates for each combination of lender (j), date (t), state (s), credit score bin (f), and LTV bin (l). The first model only uses dates prior to the announcement date of the fee change or after its effective date (pre- and post-periods respectively):

$$r_{jtsfl} = \beta_1 \text{Post}_t \text{T}_{fl} + \beta_2 \text{Post}_t + \beta_3 \text{T}_{fl} + \theta_j + \theta_s + \epsilon_{jtsfl}, \tag{3.2.1}$$

where Post_t indicates dates after the effective date, T_{fl} indicates combinations of credit score and LTV for which fees decreased, and θ_j and θ_s are lender and state fixed effects. The pass-through treatment coefficient of interest is β_1. While this first specification includes only indicators for Post_t and T_{fl}, we also estimate specifications controlling for date fixed effects, interacted credit score and LTV bins, and interacted date-lender indicators allowing for non-parametric lender-specific time trends:

$$r_{jtsfl} = \beta_1 \text{Post}_t \text{T}_{fl} + \theta_j + \theta_t + \theta_{fl} + \theta_s + \epsilon_{jtsfl} \tag{3.2.2}$$

$$r_{jtsfl} = \beta_1 \text{Post}_t \text{T}_{fl} + \theta_{jt} + \theta_{fl} + \theta_s + \epsilon_{jtsfl} \tag{3.2.3}$$

This model can be estimated on rates from all lenders but does not utilize the additional variation in implementation dates across lenders. For 26 of the 31 lenders in the Informa data, we can identify the exact date the fee was implemented and use these dates in the following model specifications:

$$r_{jtsfl} = \beta_1 \text{Post}_{jt} \text{T}_{fl} + \theta_j + \theta_t + \theta_{fl} + \theta_s + \epsilon_{jtsfl} \tag{3.2.4}$$

$$r_{jtsfl} = \beta_1 \text{Post}_{jt} \text{T}_{fl} + \theta_{jt} + \theta_{fl} + \theta_s + \epsilon_{jtsfl}, \tag{3.2.5}$$

where the only change is that Post_{jt} now varies by lender. This specification excludes the five lenders for which we observe many pricing changes between the announcement and effective dates

[22] Authors' calculations from publicly available Fannie Mae Single-Family Loan Performance Data, Data Dynamics online tool, `https://capitalmarkets.fanniemae.com/tools-applications/data-dynamics`, accessed Oct. 13, 2021. Data include fixed-rate, fully documented, fully amortizing loans delivered to Fannie Mae. Additional documentation available here: `https://capitalmarkets.fanniemae.com/media/8921/display`.

(so the fee implementation date cannot be clearly distinguished) or no pricing changes. However, the specification allows us to use all dates in 2015, including those between the announcement and effective dates.

Table 4 shows the estimation results for all five specifications. Across specifications (1)–(3), which use only data from prior to the announcement date and after the effective date, the treatment effect point estimates are quite stable, ranging from -5.1 to -6.7 basis points, becoming slightly more negative with the inclusion of fixed effect controls for the date and interacted credit score-LTV bin. These specifications demonstrate that the offered rate spread between treated and untreated loans widened following the effective date of the fee change, relative to the rate spread earlier in 2015. Specifications (4)–(5) include all dates in 2015, with the lender-specific treatment dates providing identification based on differences in rates on a given day between lenders who had already implemented the fee change and those who had not. The treatment effect estimate from specification (4) is somewhat closer to zero, but the point estimate reaches -5.4 basis points when including controls for lender-specific time trends (θ_{jt}) in specification (5). Collectively, these results show that lenders effectively fully passed through the upfront guarantee fee change without any offsetting change in interest rates.

As a final test of our identification, we estimate the same specifications on a placebo sample of jumbo interest rates, which should be unaffected by the fee decrease. Appendix Table 13 shows some marginally significant evidence of small jumbo rate *increases* in specification (3) which does not take advantage of the lender-specific implementation dates, suggesting possible differential trends for treated versus untreated credit score-LTV bins. However, when lender implementation dates are included in specifications (4) and (5), the estimated treatment effects become statistically indistinguishable from zero. For this reason, we use specifications including lender implementation dates when estimating demand responses in the next section.

3.3 Effect of Guarantee Fee Changes on Loan Demand

The evidence above suggests that the September 1st, 2015 guarantee fee decrease was essentially fully passed through to consumers. We now address whether these decreased prices led to an increase in demand for loans in the treated LTV and credit score bins, relative to those with no fee change. Based on their statement when announcing the small guarantee fee change, the FHFA expected there to be minimal effects on demand.

Our analysis confirms that there were not large demand responses to this fee change. Full details on our model specification, identification assumptions, and additional data sources used are available in Appendix A.2. The share of loans originated in the treated bins was stable through the policy change, and our regression estimates show no statistically significant demand effects. Our point estimates have the expected positive sign for a demand response to a fee decrease, with our preferred specification indicating a 2.5 percentage point increase in the share of originations in treated bins, from a base of 77 percent.

The policy change studied here is well suited for identifying borrowers' substitution between very similar mortgage products offered by a particular lender. Our results do not speak to the effects of much larger changes in guarantee fees, but they suggest that small marginal changes are likely to be fully passed through to consumers, while inducing limited demand effects. In the next section, we contrast these small effects on loan choices with the expected effects of marginal changes to a second GSE policy lever: the maximum loan size eligible for a guarantee.

Table 4: Effect of Guarantee Fee Decrease on Offered Conforming Retail Interest Rates

	(1)	(2)	(3)	(4)	(5)
Post_t x Treated_{fl}	-0.051***	-0.067***	-0.067***		
	[-0.070,-0.031]	[-0.082,-0.052]	[-0.081,-0.052]		
Post_{jt} x Treated_{fl}				-0.038***	-0.054***
				[-0.050,-0.026]	[-0.063,-0.046]
Post Indicator	✓				
Treated Bin Indicator	✓				
Date F.E.		✓		✓	
Date x Lender F.E.			✓		✓
Credit Score x LTV F.E.		✓	✓	✓	✓
Lender F.E.	✓	✓		✓	
State F.E.	✓	✓	✓	✓	✓
N	9184175	9184175	9184175	13058960	13058960
Number of lenders	31	31	31	26	26
Mean of dep. var.	4.12	4.12	4.12	4.17	4.17

Note: Informa retail rate sheets data. Dependent variable is offered retail interest rate for conforming loans at the lender-state-credit score-LTV-date level. Standard errors clustered at lender level, 95 percent confidence intervals shown in brackets. In specifications (1) to (3), the post-period is defined for all lenders as the effective date of the fee change, the pre-period is all dates prior to the announcement of the fee change, and observations between these dates are excluded. In specifications (4) and (5), all dates are included, and lender-specific post-periods are defined by the date each lender implemented the fee change. Lenders where implementation date could not be identified are dropped from specifications (4) and (5).

4 Marginal Changes to Loan Limits

We start this section by analyzing the differences between consumers bunching at or below the conforming loan limit versus those just above it. We document that loan availability (i.e., underwriting restrictions) likely explains some, but not all, of the observed bunching in loan amounts. We also show that consumers that bunch tend to shop less and use brokers more often.

We continue by providing an analysis of a counterfactual reduction in the conforming loan limit. The analysis is based on a simulation—we do not observe such a change in our data. Following the patterns in the data we find that the vast majority of affected consumers would bunch at the new counterfactual conforming loan limit. We end the section by discussing the implications for consumers' LTVs and interest rates in this counterfactual regime.

4.1 Evidence on Loan Choices Near the GSE Conforming Loan Limit

The price that a borrower pays for their home, in combination with the conforming loan limit, determines how much down payment is required while still qualifying for a conforming loan. If borrowers are constrained by their funds available for a down payment, this could contribute to bunching at the conforming loan limit. During the period studied, conforming loans were generally available with LTVs up to 95. Figure 2 shows the LTVs and loan amounts chosen by borrowers in the CoreLogic data for three separate ranges of home purchase prices; those eligible for a conforming loan with a maximum LTV of 95, a maximum LTV between 80 and 95, and a maximum LTV below 80. For the first group the conforming loan limit is not binding, leading many borrowers to choose LTVs up to 95, and we observe no bunching in loan amounts. For the second group, the conforming loan limit binds at some LTV level between 80 and 95. Considerable bunching is observed at the loan limit ($417,000 for non-high-cost counties). The final group—for whom the conforming loan limit binds at an LTV below 80—has a large mass at the loan limit. Very few jumbo borrowers obtained loans with LTVs above 80.

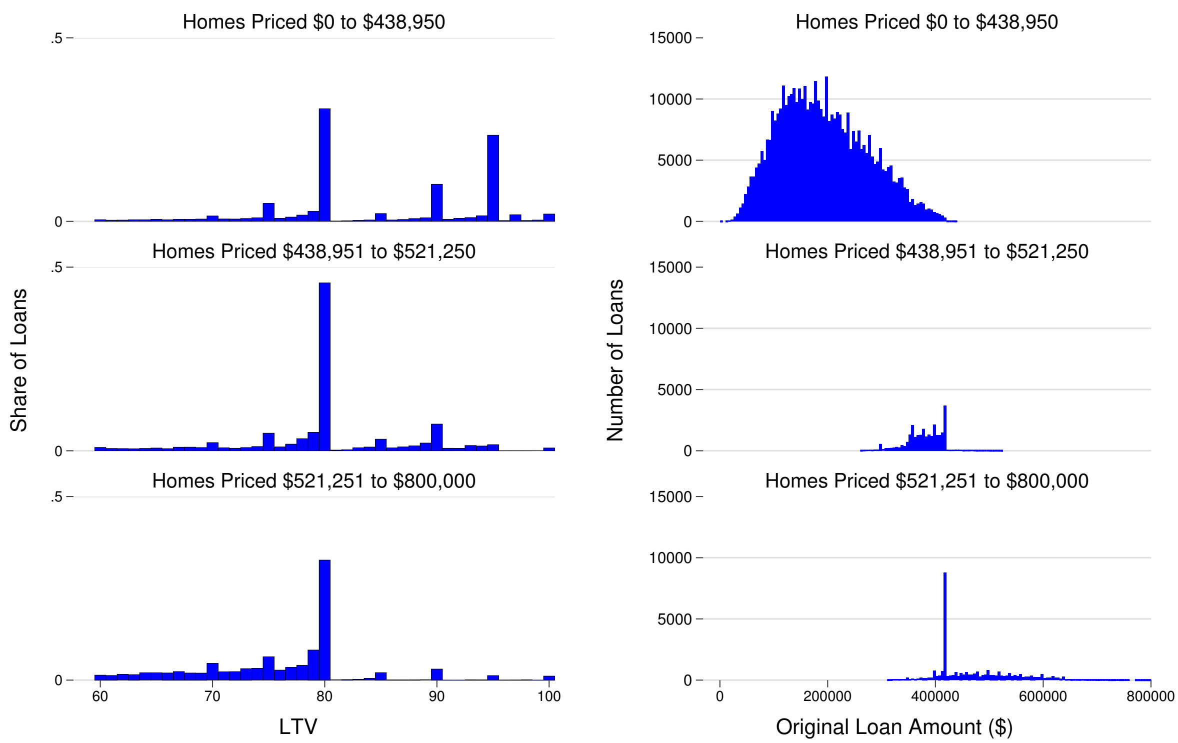
This figure updates and confirms a few intuitions about borrowers' choice of loan amount and the supply of jumbo loan credit that have been noted in pre-crisis data (Adelino, Schoar and Severino, 2012; An and Yao, 2016; Loutskina and Strahan, 2009). The large mass of conforming loans with LTVs over 80 (when available) indicates that higher LTV is a desired characteristic, and some borrowers are likely down payment-constrained.[23] Allowing borrowers to obtain high LTV loans is an important marginal effect of the GSEs. However, even for high-priced homes, many borrowers choose loans at the conforming limit with LTVs below 80, despite the availability of jumbos with higher LTVs and essentially equal interest rates. This suggests that either (a) jumbo loans are not actually available to these borrowers due to unobserved underwriting requirements, or (b) borrowers have imperfect information about the availability or interest rates of jumbo loans.

To assess how borrowers' shopping behavior or other characteristics may influence the decision to choose a mortgage at exactly $417,000, Table 5 shows NSMO survey responses separately for borrowers with mortgages of (a) exactly $417,000, (b) between $350,000 and $416,999, and (c) between $417,001 and $500,000. The table includes survey responses for conventional purchase borrowers from 2013 through 2016 (available years with a $417,000 conforming loan limit) to improve statistical power.

The survey responses indicate that borrowers at the conforming loan limit were much more likely to have used a broker than jumbo loan borrowers (49 percent versus 14 percent) and were much more likely to have seriously considered only one lender or broker (45 percent versus 24 percent).

[23] This large mass of LTVs above 80 is observed even if the sample is restricted to loans near the conforming loan limit.

Figure 2: Original LTV and Loan Amounts by Borrowers' Home Price



Note: 2015 CoreLogic loan origination data in non-high-cost counties (conforming loan limit = $417,000). Each row represents loans originated on homes priced within the specified range. The first column depicts the LTV distribution for the loans within the home price range. The second column depicts the total number of loans originated, in $5,000 bins, for the specified price range. Loans with LTV less than 60 or greater than 100 have been excluded from figures, as have loans for homes priced above $800,000.

Jumbo borrowers were also less likely to report shopping for a lender or broker before choosing their loan type, potentially indicating additional searching or information gathering about loan types and their relative prices. These findings regarding a greater amount of shopping by jumbo loan borrowers hold when restricting the sample to only loans originated through the retail channel, shown in Appendix Table 14. Borrowers at the conforming loan limit look similar to jumbo loan borrowers in terms of other questions of shopping behavior, the information sources used, and their self-reported knowledge of mortgage terms.

Administrative credit data for the survey respondents show that jumbo borrowers had higher credit scores than borrowers at the loan limit (787 versus 759), but comparable income levels and LTV, combined loan-to-value (CLTV), and DTI ratios. The average credit characteristics for these loans suggest that most borrowers would be eligible for prime rates, and this is reflected in the average interest rate spreads over APOR (Average Prime Offer Rate) which are close to zero. However, jumbo borrowers have lower realized rate spreads than those at the loan limit (-0.02 percent versus 0.23 percent), which may reflect a combination of more extensive shopping and their higher credit scores.

Limited shopping by some borrowers could help explain the conforming loan limit's large real effects on mortgage choices despite the small observed rate differences between jumbo and conforming loans. Given that jumbo loans are not as widely available from all lenders as conforming ones, borrowers who engage in limited shopping are more likely to only consider lenders who either do not offer jumbo mortgages or offer them only at high prices. As a result, these borrowers' choices will be unresponsive to the potentially lower jumbo rates offered by alternative lenders, leading a higher share of borrowers to reduce their loan amounts due to bunching than would occur in a market with more shopping.

4.2 Counterfactual Loan Sizes

The evidence presented so far suggests substantial bunching at the conforming loan limits despite small rate differences between conforming and jumbo loans, likely attributable to a combination of limited jumbo loan availability and differences in borrowers' shopping behavior. This motivates our reduced-form, largely non-parametric approach to simulating borrower behavior under a marginally lower counterfactual loan limit. At the household level, bunching imposes an adjustment cost of either raising additional funds for a down payment or choosing a cheaper home. These costs should increase with the loan size reduction required to bunch, and likely vary across borrowers based on observable factors like credit scores and unobservable preferences, beliefs, liquidity constraints, or underwriting requirements. The first key assumption we impose is that conditional on observable credit scores, the distribution of these unobservable factors, and hence the propensity to bunch and the resulting distribution of chosen LTVs, is the same for borrowers near the new counterfactual limit as it is for those near the existing limit.

The second key assumption is that lenders do not change their underwriting rules for conforming or jumbo loans (e.g., restrictions on lower credit scores and higher LTVs) in response to a small change in the conforming loan limit. This partial equilibrium approach assumes that the primary effects of a small loan limit change are likely to be due to the existing restrictions on jumbo loan credit supply, rather than dynamic lender responses.

Our estimation and notation directly follows DeFusco and Paciorek (2017), assuming that in the absence of conforming loan limits, the distribution of loan amounts would be smooth. The data show that bunching at the loan limit is accompanied by a dip in the distribution of loan amounts just above the limit. Full details are included in Appendix A.3.1.

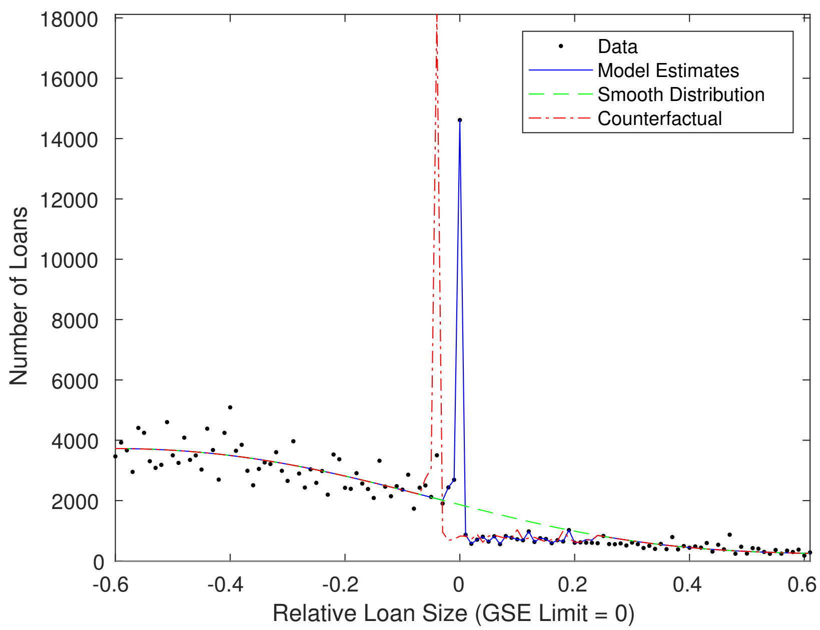
Figure 3 shows the distribution of loan sizes centered around the existing conforming loan

Table 5: NSMO Survey Responses of Conventional Purchase Borrowers at or Near GSE Conforming Loan Limit, 2013-2016

	At loan limit ($417,000)	**Just below ($350,000-$416,999)**	**Just above ($417,001-$500,000)**
Survey responses:			
Used a broker (%)	49.1	41.5	14.1***
Seriously considered only one lender/broker (%)	44.9	38.4	24.4**
What best describes the order of your shopping process?			
Lender/broker first, then loan type (%)	78.0	69.1	57.7**
How much did you use this source of information:			
Lender or broker? (% "A lot")	78.0	72.0	75.6
Open to lender/broker suggestions about different features/terms? (% "Very")	47.5	45.2	38.5
Knowledge questions - How well could you explain?			
ARM vs Fixed (% "Very")	84.8	75.1*	82.1
Prime vs Subprime (% "Very")	41.5	29.4*	41.0
Interest rate vs APR (% "Very")	44.9	35.7	44.9
Administrative data:			
Credit score (mean)	758.5	763.6	786.9***
LTV (mean)	71.0	81.2***	74.3
CLTV (mean)	74.4	81.6***	74.6
DTI (mean)	35.6	34.7	32.5
Income (mean, $ thousands)	195.7	165.4***	207.5
Interest rate (mean, %)	4.07	4.10	3.86
Interest rate spread over APOR (mean, %)	0.23	0.20	−0.02**
Observations	118	378	78

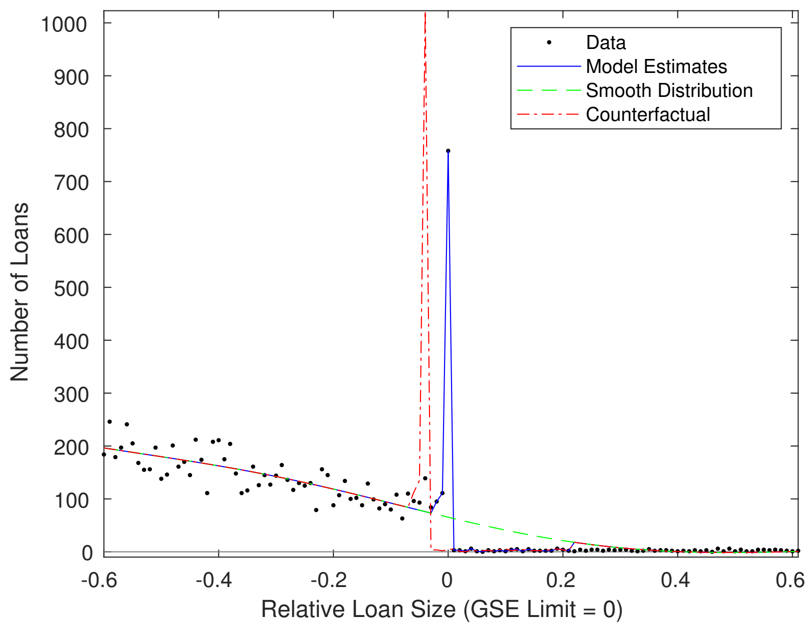
Note: Selected survey responses and administrative data from restricted-use version of the NSMO (National Survey of Mortgage Originations), 2013-2016. Sample includes conventional purchase loan borrowers with loan amounts between $350,000 and $500,000. Asterisks denote statistical significance of t-tests for difference in means relative to borrowers at loan limit, indicated at the 5% (*), 1% (**), and 0.1% (***) levels.

Figure 3: Distribution of Loan Amounts Near GSE Conforming Loan Limit, Full Sample



Note: Data and simulations based on single-family, conventional, 30-year, fixed rate loan originations in 2015 CoreLogic data. All dollar loan amounts are measured in logs and normalized to zero at the conforming loan limit in the county of origination. Bin width is .01 in log thousands of dollars. A polynomial of degree $p = 13$ is used to fit the distribution of loan counts over a range of $J = 150$ bins above and below the limit. Results reflect the sum of separately estimated models for low, medium, and high credit score borrowers. Counterfactual distribution based on loan limit reduction of four bin widths (approximately four percentage points).

Figure 4: Distribution of Loan Amounts Near GSE Conforming Loan Limit, Low Credit Score Borrowers



Note: Data and simulations based on single-family, conventional, 30-year, fixed rate loan originations in 2015 CoreLogic data. Sample restricted to borrowers with credit scores < 680. All dollar loan amounts are measured in logs and normalized to zero at the conforming loan limit in the county of origination. Bin width is .01 in log thousands of dollars. A polynomial of degree $p = 13$ is used to fit the distribution of loan counts over a range of $J = 150$ bins above and below the limit. Counterfactual distribution based on loan limit reduction of four bin widths (approximately four percentage points).

limit, the fitted values of our regression model, the smooth loan size distribution implied by the polynomial coefficients of the model, and finally the counterfactual loan distribution under a new conforming loan limit which has been reduced by four log points (approximately four percentage points, or down to $400,000 from $417,000). The fitted values are the summation of separately estimated models on the groups of low (<680), medium (680–739), and high (≥740) credit score borrowers. Under the assumption that this small marginal change in loan limits does not induce any supply response from lenders, the only borrowers affected by the limit change are those with loan sizes between the old and new limits.[24]

Affected borrowers between the old and new limits have three possible responses. They may continue to borrow a loan amount between the limits and pay jumbo rates instead of conforming. They may bunch below the new limit, reducing their loan amount and continuing to pay conforming rates. Finally, those borrowers who had already reduced their loan amount to bunch at the old limit may now "unbunch," switching to a larger jumbo loan.

Figure 4 shows that jumbo loans were largely unavailable for borrowers with low credit scores. The degree of bunching is more pronounced for these borrowers than for the population as a whole, and 99 percent of those affected by the limit reduction bunch below the new limit in our counterfactual results. Lowering the loan limit would have a substantial effect on these marginal

[24]For borrowers below the new limit, or above the old limit, the counterfactual only removes an unchosen option from their choice set. We ignore the possibility that, given jumbo rates below conforming, the limit reduction could induce some borrowers below the new limit to shift upward.

Table 6: Summary of GSE Conforming Loan Limit Counterfactual, Affected Borrowers

	Low Credit Score, below 680	**Medium Credit Score, 680-739**	**High Credit Score, 740 and up**
Initial Rate	4.40	4.10	3.96
Initial LTV	78.7	78.0	76.6
Choose Conforming			
% Bunching Below New Limit	99%	92%	75%
Interest Rate	4.40	4.10	3.96
LTV	75.8	74.7	73.6
Change in Loan Amount	-$16,000	-$15,800	-$16,300
Switch to Jumbo			
% Remain at Init. Loan Amt.	1%	7%	19%
Interest Rate	4.19	4.07	3.98
LTV	75.9	76.0	76.5
% Unbunching to Larger Jumbo	0%	3%	4%
Change in Loan Amount	-	$40,100	$38,400
Number of Affected Borrowers	1,037	5,654	15,059

Note: Data and simulations based on 2015 CoreLogic originations and average Informa interest rates (weighted by HMDA market shares) from Table 1. Affected borrowers defined as those with loan amounts above the new counterfactual limit, up to and including the existing limit. Percentages may not add to 100 due to rounding and discrete nature of bunching estimation algorithm.

borrowers, requiring thousands of dollars in additional down payment funds or necessitating the purchase of a less expensive home.

For affected borrowers with high credit scores, who make up the majority of borrowers taking out loans near the conforming loan limit, the expected impact of a lower limit is less obvious. Those with LTVs of 80 or below may be able to pay the same or less for a jumbo loan, while those with LTVs of 95 will be forced to adjust. To obtain a fuller picture of the heterogeneous impacts across borrowers and complete our counterfactual exercise, we supplement our counterfactual loan amounts with simulated LTV choices (detailed in the Appendix A.3.2) and interest rates paid. Below we summarize the changes in loan amounts, LTVs, and interest rates paid for the borrowers affected by our counterfactual limit reduction.

4.3 Summary of Loan Limit Counterfactual Results

We summarize our counterfactual's impacts on low, medium, and high credit score borrowers in Table 6. Within each group, we calculate the percentage of affected borrowers taking each of the three possible responses discussed above: remaining at their current loan amount, bunching below the new limit, or "unbunching" to a larger jumbo loan. We use our counterfactual LTV distributions to calculate average interest rates and LTVs for each subset of borrowers.

To calculate the initial rates, we assign the average offered conforming rate for the applicable credit score and LTV (from Table 1) to each affected borrower. As would be expected, rates decline with credit score, such that low credit score borrowers pay 44 basis points more than those with high credit scores.

Our loan amount counterfactual predicts that 99 percent of Low Credit Score affected borrowers and 75 percent of High Credit Score affected borrowers would bunch at the new limit. These borrowers all reduce their loan amounts by about $16,000. Despite reducing loan amounts, these borrowers see essentially no change in rates, though they may face lower required mortgage insurance premiums, leading to reduced monthly payments.

Most of the affected borrowers switching to jumbo loans remain at their current loan amounts between the new and existing limits. These borrowers have lower LTVs than the affected population as a whole and pay essentially the same or lower rates for jumbo loans as they had paid for conforming ones.[25]

Finally, a small number of borrowers who had previously chosen loans right at the limit now switch to larger jumbo loans under our counterfactual. Because we do not explicitly model which affected borrowers from the LTV distribution make this switch, we do not calculate their resulting LTVs or interest rates. However, from the difference between the observed and counterfactual loan amount distributions above the existing limit, we calculate that these borrowers would choose on average $40,100 and $38,400 higher loan amounts for those with Medium and High credit scores, respectively. These large shifts reflect the substantial loan size range over which borrowers bunch in our simulation.

5 Conclusion

Using a novel combination of mortgage datasets, we estimate effects of two key policy levers determining the scope of GSE lending. First, we find that small 2015 changes in GSE guarantee fees were fully passed through to consumers, but the 25-basis point reduction in upfront fees induced a limited substitution response from consumers. Second, analyzing the density of borrowers around the conforming loan limit, we find that marginally lowering the limit (e.g., from $417,000 to $400,000) would cause most of the affected borrowers to reduce their borrowing (by about $16,000 on average) to obtain loans at the new limit. We show that much of this effect—specifically for high-credit score consumers with low LTVs—cannot be explained by the low interest rate spread that we document. Survey responses from borrowers at the loan limit suggest more limited shopping may be a contributing factor, alongside potential unobserved underwriting restrictions faced by these borrowers.

These findings improve our understanding of how marginal changes to the scope of GSE lending can have substantially different effects on consumers, depending on the policy lever used. We believe that there are several avenues for future research. First, future work should further explore the underwriting and informational reasons behind the bunching at the conforming loan limit. Second, fuller models of mortgage choice, which allow for potential substitution between conventional loans and government loan programs (e.g., those from the Federal Housing Administration and Dept. of Veteran Affairs), may improve predictions about consumer responses to market or policy shifts. Finally, the findings from these new analyses could be incorporated into more structural models of the mortgage market, to more effectively evaluate larger-scale policy proposals.[26]

From the near-term policy perspective, our analysis suggests that modest changes in guarantee fees are unlikely to substantially change consumer demand. In contrast, changes to the conforming loan limit would likely have a substantial impact on borrowers considering loans near the limit,

[25] Although our model predicts that Low Credit Score jumbo borrowers pay about 21 basis points less than those who bunch, this reflects an extremely small population and is based on the rates of fewer than ten percent of Informa lenders who offer these loans. The average rate for the High Credit Score borrowers reflects a large number of low LTV borrowers paying essentially equal rates, and a small number with higher LTVs paying significantly more.

[26] Examples from this large literature include Elenev, Landvoigt and Van Nieuwerburgh (2016), Favilukis, Ludvigson and Van Nieuwerburgh (2017), Gete and Zecchetto (2017), and Jeske, Krueger and Mitman (2013).

pushing nearly all of the affected borrowers below the new limit. The biggest effects result for consumers with lower credit scores and those with LTVs over 80. For these consumers, jumbo loans might simply not be available—a market dynamic that highlights the fundamental differences in loan availability for consumers of GSE versus non-GSE loans.

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A Appendix

A.1 Background and Detailed Literature Discussion

A.1.1 GSEs Before the Early 2000s

The federal government took substantial steps during the 1930's to promote homeownership and liquidity in housing finance markets, creating the Federal Home Loan Banking System, the Federal Housing Administration (FHA), and Fannie Mae (Federal National Mortgage Association).[27] Fannie Mae, originally a federal agency created to purchase and sell FHA-insured loans, was eventually fully privatized in 1968 and Freddie Mac was created with a similar private structure in 1970.[28] Changes at this time also allowed Fannie Mae and Freddie Mac to purchase mortgages not secured by the FHA or by any other government agency.[29] These non-FHA loans purchased and securitized by the GSEs are known as "conforming" loans and continue to be used as collateral for mortgage backed securities. In exchange for assuming the credit risk on these loans, the GSEs charge two types of guarantee fees; ongoing monthly fees that are largely fixed at the lender-level, and publicly-posted upfront fees which depend on the risk characteristics of a loan (e.g., credit score and LTV).[30]

Although they were not government agencies, the GSEs' debt was often treated as close to par with the debt of federal agencies, due to a widely held perception that the GSEs were effectively backed by the U.S. government.

As the GSEs' market share grew, there was considerable research into the interest rate spread between conforming and jumbo loans—which were non-conforming due to their size—starting from at least the late 1980s (Hendershott and Shilling, 1989) and continuing through the early 2000s (Congressional Budget Office, 1996; Lehnert, Passmore and Sherlund, 2008; McKenzie, 2002; Passmore, 2005; Passmore, Sherlund and Burgess, 2005). The more recent papers estimated that jumbo loans were priced approximately 15–30 basis points per year above conforming loans during this period.[31]

A.1.2 GSEs From the Early 2000s, and the 2015 Guarantee Fee Changes

The GSEs' role in the housing boom and financial crisis has been analyzed extensively, with large losses leading them to be placed in conservatorship in 2008.[32] The Federal Housing Finance Agency

[27] For a more detailed history of the GSEs, see "A Brief History of the Housing Government Sponsored Enterprises," available at `https://www.fhfaoig.gov/Content/Files/History%20of%20the%20Government%20Sponsored%20Enterprises.pdf`.

[28] The government split off part of Fannie Mae at that time to continue buying and securitizing loans guaranteed by the FHA. That part, Ginnie Mae, remains within the federal government.

[29] The term GSEs sometimes also includes the Federal Home Loan Bank System, which we do not study in this paper.

[30] For additional detail, see "Fannie Mae and Freddie Mac Single-Family Guarantee Fees in 2017," December 2018, available at `https://www.fhfa.gov/AboutUs/Reports/ReportDocuments/GFee-Report_12-10-18.pdf`.

[31] The most applicable data available for studies during this period was often survey-based, including the Mortgage Interest Rate Survey (MIRS) dataset. This monthly survey, administered by the Federal Reserve at the time, asked selected lenders for loan-level information on terms, conditions, and consumer and loan characteristics for loans made on a common set of the days during the month. The methodology used in these early studies often included a regression model fitting observed pricing on a combination of consumer and loan characteristics, at times restricted to a particular state (e.g., California) and a particular loan type (e.g., 30-year fixed) to limit heterogeneity. The models typically included a jumbo indicator (whether the loan amount is above the conforming loan limit) that was the coefficient of interest.

[32] See An and Bostic (2008), Avery and Brevoort (2015), Bhutta (2012), Frame, Gerardi and Willen (2015) for example articles and Acharya, Richardson, Van Nieuwerburgh and White (2011), Angelides, Thomas et al. (2011),

(FHFA) acts as conservator, with the U.S. Treasury Department effectively receiving all GSE profits during conservatorship.

Conservatorship was intended as a temporary arrangement, and early reform proposals aimed to "pave the way for a robust private mortgage market by reducing government support for housing finance and winding down Fannie Mae and Freddie Mac on a responsible timeline" (Treasury Department and HUD, 2011).[33] Two of the four suggested actions were increasing guarantee fees and reducing conforming loan limits.[34]

A.1.3 More Recent Literature on GSEs, Mortgage Pricing, and Loan Limits

More recent research has used applied econometric techniques to measure borrowers' sensitivity to fee changes, rate differences, or loan limit adjustments for mortgages guaranteed by the GSEs or the FHA. DeFusco and Paciorek (2017) use bunching at the GSEs' loan limit to derive the elasticity of mortgage demand to changes in interest rates. The authors estimate a pricing difference between jumbo and non-jumbo loans using the CoreLogic dataset described below, finding a difference of 18 basis points per year—a result consistent with the previous literature, but higher than our estimates on the order of 5 basis points.[35] The difference is likely explained by the time period studied (we analyze 2015, while DeFusco and Paciorek (2017) analyze the early 2000s) and by the differences in data (CoreLogic has interest rates, but neither points nor fees that the consumer paid). Important changes over time are demonstrated by Fisher, Fratantoni, Oliner and Peter (2021), who identify increased bank supply of jumbo loans and higher guarantee fees as direct causes of the reduced jumbo-conforming spread in recent years. Bhutta and Hizmo (2021) highlight the importance of controlling for discount points in pricing comparisons, finding that interest rate differences across racial groups can be explained in part by borrower sorting along pricing menus with trade-offs between interest rates and upfront points paid. By analyzing offered retail interest rates, we provide updated findings on rate spreads and pass-through not possible in prior studies.

Grundl and Kim (2021) study the effects of GSE and FHA loan limit increases in the wake of the financial crisis, finding small effects on overall homeownership levels despite substantial increases in loan volume backed by the federal government. These findings are consistent with related literature studying FHA loan limit changes, indicating that borrowers may respond to such constraints by adjusting home size (Park, 2021) and location (MacDonald, 2019), depending on the availability of alternative—in this case conventional—products (Park, 2017). We find many borrowers are constrained by the conforming loan limits despite small pricing differences, suggesting changes in these limits may substantially shift borrowers' sorting into homes and locations.

Other recent studies have also measured credit availability through a focus on underwriting constraints, rather than pricing. Laufer and Paciorek (2016) and Anenberg, Hizmo, Kung and Molloy (2019) both study the characteristics of observed loan originations to infer the boundary or frontier of credit availability, the former focusing on the role of credit scores and the latter taking a more holistic, multi-variate approach. Both find important roles for lender underwriting restrictions on non-pricing dimensions. This paper complements these approaches, measuring credit availability not just through the boundary of originated loans, but through the boundary of loans offered according to lenders' rate sheets.

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and McLean (2015) for book-length treatment.

[33] See also an earlier report by the Congressional Budget Office (2010) suggesting similar measures.

[34] The other two were increasing private capital and winding down the GSEs' investment portfolio.

[35] In addition to using a semi-parametric function of consumer and loan characteristics, as opposed to the parametric functional forms in the literature described above, the authors use the appraisal value of the house as an instrument for jumbo loan status, as in Kaufman (2014). The bunching technique used follows Kleven and Waseem (2013).

A.2 Demand Model Details and Results

Our demand analysis uses a dataset of Informa rates merged to the Y-14M supervisory loan-level data collected as part of the Federal Reserve's Comprehensive Capital Analysis and Review.[36] The Y-14M data have the benefit of containing both credit scores (unlike HMDA) and also lender identifiers (unlike CoreLogic). We thus use a matched sample of 15 lenders that appear in both the Informa and Y-14M datasets to estimate demand effects from lender-specific changes in relative prices. The Federal Reserve Y-14M data contain information for loans held on portfolio or serviced by large banks and bank holding companies. While not representative of the market as a whole, reporting is mandatory for banks meeting the asset threshold, so the data provide complete portfolio coverage for the matched lenders. Our sample includes all 2015 1-4 unit, conventional purchase loans originated through the retail channel by lenders in our matched Y-14M-Informa sample.

We interpret any changes as likely a demand—rather than supply—response given the evidence of full pass-through and the widespread availability of conforming loans at these credit score and LTV levels (as shown in Table 1).

Figure 5 shows the share of loans in the treated category—those with a guarantee fee decrease—by week of origination. Because LTV is the key choice variable for consumers, treated share is shown separately by credit score bin. The share of loans in the treated category is quite consistent across all weeks, ranging from about 80 percent of sample originations for credit scores between 700 and 719 down to 55 percent for credit scores between 800 and 819.[37] The stability of these shares confirms there were no large demand shifts due to the guarantee fee change.

To more precisely estimate possible demand effects, we estimate regression models mirroring those for our pass-through estimates (equations 3.2.4 and 3.2.5) but where the unit of observation is an originated loan and the outcome is an indicator equal to one for loans within a treated combination of credit score bin and LTV bin.

Identification comes from variation in the implementation date of the fee change across lenders, as shown in Figure 1. We estimate the following model specifications for the 13 lenders in the Y-14M-Informa matched sample where we can identify the exact date the fee change was implemented:

$$y_{i(jtsfl)} = \beta_1 \text{Post}_{jt} + \theta_j + \theta_s + \theta_f + \theta_{w(t)} + \epsilon_i \tag{A.2.1}$$

$$y_{i(jtsfl)} = \beta_1 \text{Post}_{jt} + \theta_j + \theta_s + \theta_{fw} + \epsilon_i \tag{A.2.2}$$

where y_i is an indicator equal to one for loans within a treated combination of credit score (f) and LTV (l) bins, Post_{jt} indicates dates after the fee change implementation by a given lender (j) and fixed effect controls for lender, state (s), credit score bin, and origination week ($w(t)$).[38] The second specification includes credit score bin-week interacted fixed effects θ_{fw}.

The treatment coefficient of interest, β_1, captures changes in the probability that an originated loan falls within a treated bin after the originating lender implements the guarantee fee decrease. Seasonal effects and persistent differences in loan choices are controlled for with week, lender, state, and credit score bin fixed effects. The specifications with interacted credit score bin-week fixed effects (θ_{fw}) control for possible differential time trends among borrowers with high and low credit scores.

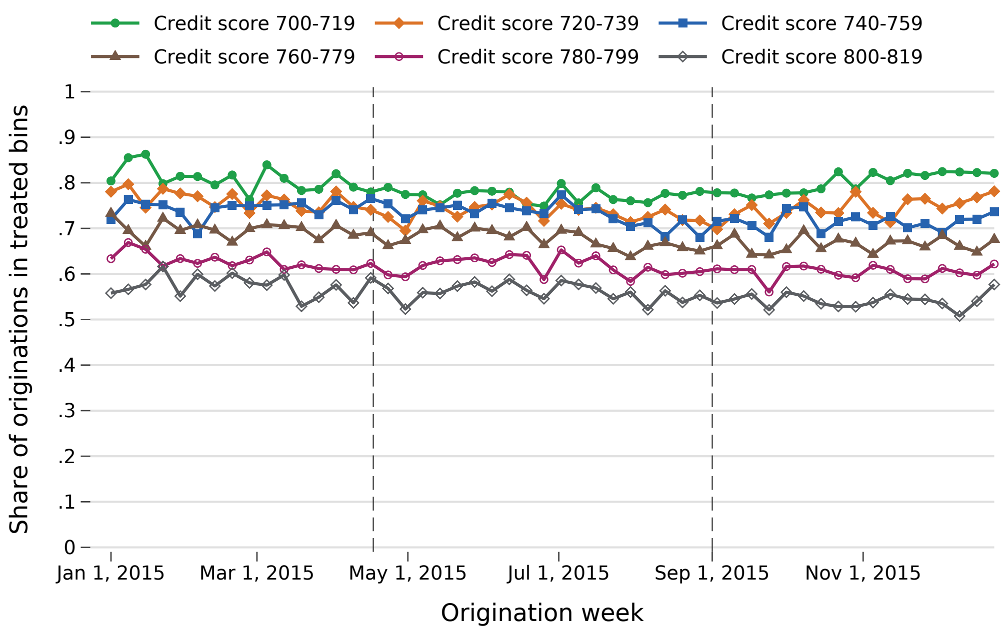
This model assumes all loans originated after the guarantee fee change are subject to the new lower rates. To account for the possibility that some borrowers use rate locks—thereby potentially

[36]The Y-14M data are described at `https://www.federalreserve.gov/apps/reportforms/reportdetail.aspx?sOoYJ+5BzDYnbIw+U9pka3sMtCMopzoV`.

[37]Across all credit scores, the share of loans in the treated category is about 70 percent across all weeks.

[38]While we primarily expect intensive margin adjustments for the small interest rate reductions studied here, the model would also pick up changes in total originations in treated bins relative to untreated bins.

Figure 5: Share of Loans Originated with a Credit Score and LTV Combination that had a Guarantee Fee Decrease in 2015



Note: 2015 Y-14M first-lien, conventional purchase mortgage originations by lenders in the Informa data (identified by lender name). The vertical line at April 17th indicates the announcement date of the upfront guarantee fee change, while the vertical line at September 1st indicates the effective date. Within credit score bin, treated share determined by variation in LTVs. For credit scores below 700, treated share equals 1. See Table 2 for grid of treated credit score and LTV combinations.

choosing their loan prior to the fee decrease coming from the guarantee fee change—we also estimate specifications in which we drop all loans originated within the 45 days following a lender's fee implementation date.[39] We refer to this as the Alternative Post (Alt. Post_{jt}) definition in these specifications:

$$y_{i(jtsfl)} = \beta_1 \text{Alt. Post}_{jt} + \theta_j + \theta_s + \theta_f + \theta_{w(t)} + \epsilon_i \tag{A.2.3}$$

$$y_{i(jtsfl)} = \beta_1 \text{Alt. Post}_{jt} + \theta_j + \theta_s + \theta_{fw} + \epsilon_i \tag{A.2.4}$$

For all specifications, we assume that borrowers do not manipulate their credit score bin in anticipation of or in response to the fee change, and thus the choice variable for consumers is largely restricted to LTV. With the included fixed effects, the identifying variation then comes from changes over time in the distribution of LTVs within lender, state, and credit score bin.

Identification also requires that the implementation date for a given lender is not strategically chosen based on anticipated demand patterns across loan types. In practice, all lenders appear to implement fee changes across all loan types simultaneously, suggesting the timing may be driven by lenders' expected turnaround time to securitize the loans with the GSEs (when the guarantee fee is actually paid, as discussed in Hogan (2016)) or operational constraints.

Appendix Table 7 presents the estimated demand effects of the guarantee fee change on retail purchase originations.[40] For the sample including all originations (columns (1)–(2)), the 95 percent confidence intervals range from a 1-percentage point decrease to a 4-percentage point increase in the probability that an originated loan is made in a treated category. The estimates are larger for the alternative sample which excludes loans originated during the 45 days following the fee change to account for the possible use of rate locks (columns (3)–(4)), with 95 percent confidence intervals encompassing a null effect and a 5-percentage point increase.[41] Stronger effects for this alternative sample would be consistent with rate locks preventing some borrowers from responding to the price decrease.[42]

We find no statistically significant demand effects, but the point estimates have the expected positive sign for a demand response to a fee decrease and imply price sensitivities comparable to those found in prior studies.[43] For our preferred specification which accounts for borrowers' use of rate locks, the point estimates suggest a 2.5 percentage point increase in the share of originations in treated bins, from a base of 77 percent.

[39] Bhutta, Fuster and Hizmo (2020) study data containing the length of rate locks, finding 30 and 45 days to be the most common choices.

[40] Appendix Table 8 shows comparable results for the rate and term refinance loans originated by the same set of lenders.

[41] Appendix Table 9 shows estimates of marginal effects from a logit model, with very similar results to the linear probability model in Appendix Table 7.

[42] Appendix Table 10 presents estimates for the same demand model but adds to the sample loans originated through the correspondent or wholesale channels. Relative to the retail-only estimates, we find slightly stronger effects when excluding originations within 45 days of the fee change. The estimates are statistically significant at the 95 percent level and indicate a 3.3- to 3.5-percentage point increase in the share of loans originated in treated bins. One explanation for these results could be comparable timing and pass-through of guarantee fee changes among loans originated through the correspondent and wholesale channels, with potentially stronger demand effects. However, not all lenders participate in the correspondent and wholesale channels, so these results may also reflect differences in price sensitivity across lenders, products, or other factors.

[43] These include demand estimates focused on the more extensive margins of purchasing a home (Bhutta and Ringo, 2017), willingness to pay for a home (Fuster and Zafar, 2021), or mortgage substitution requiring a change in both loan product and loan amount (DeFusco and Paciorek, 2017).

Table 7: Effect of Guarantee Fee Decrease on Share of Originations in Treated Bins, Retail Channel Only

	(1)	(2)	(3)	(4)
Post_{jt}	0.014	0.014		
	[-0.014,0.042]	[-0.013,0.041]		
Alt. Post_{jt}			0.024	0.025
			[-0.000080,0.048]	[-0.0023,0.053]
Week F.E.	✓		✓	
Lender F.E.	✓	✓	✓	✓
State F.E.	✓	✓	✓	✓
Credit Score F.E.	✓		✓	
Week x Credit Score F.E.		✓		✓
N	151581	151581	126779	126779
Number of lenders	13	13	13	13
Mean of dep. var.	0.77	0.77	0.77	0.77

Note: 2015 Y-14M first-lien, conventional purchase mortgage originations by lenders in the Informa data (identified by lender name). Dependent variable is indicator for loan originated in treated credit score x LTV bin. Standard errors clustered at lender level, 95 percent confidence intervals shown in brackets, statistical significance indicated at the 5% (*), 1% (**), and 0.1% (***) levels. Identification comes from variation across lenders in date of guarantee fee change implementation. To account for possible use of rate locks, alternate post definition (Alt. Post) excludes originations during the 45 days following guarantee fee change implementation.

Table 8: Refinance Loans, Effect of Guarantee Fee Decrease on Share of Originations in Treated Bins, Retail Channel Only

	(1)	(2)	(3)	(4)
Post_{jt}	0.0079	0.0077		
	[-0.013,0.029]	[-0.014,0.029]		
Alt. Post_{jt}			0.010	0.018
			[-0.023,0.043]	[-0.012,0.048]
Week F.E.	✓		✓	
Lender F.E.	✓	✓	✓	✓
State F.E.	✓	✓	✓	✓
Credit Score F.E.	✓		✓	
Week x Credit Score F.E.		✓		✓
N	77298	77298	69232	69232
Number of lenders	13	13	13	13
Mean of dep. var.	0.48	0.48	0.48	0.48

Note: 2015 Y-14M first-lien, conventional refinance mortgage originations by lenders in the Informa data (identified by lender name). Dependent variable is indicator for loan originated in treated credit score x LTV bin. Standard errors clustered at lender level, 95 percent confidence intervals shown in brackets, statistical significance indicated at the 5% (*), 1% (**), and 0.1% (***) levels. Identification comes from variation across lenders in date of g-fee change implementation. To account for possible use of rate locks, alternate post definition (Alt. Post) excludes originations during the 45 days following g-fee change implementation.

Table 9: Effect of Guarantee Fee Decrease on Share of Originations in Treated Bins, Retail Channel Only, Logit Model

	(1)	(2)	(3)	(4)
Post_{jt}	0.015	0.015		
	(0.014)	(0.014)		
Alt. Post_{jt}			0.025*	0.025*
			(0.010)	(0.011)
Week F.E.	✓		✓	
Lender F.E.	✓	✓	✓	✓
State F.E.	✓	✓	✓	✓
Credit Score F.E.	✓		✓	
Week x Credit Score F.E.		✓		✓
N	134319	134318	112269	112266
Number of lenders	13	13	13	13
Mean of dep. var.	0.74	0.74	0.74	0.74

Note: 2015 Y-14M first-lien, conventional purchase mortgage originations by lenders in the Informa data (identified by lender name). Dependent variable is indicator for loan originated in treated credit score x LTV bin. Estimates are average marginal effects from logit regression model. Standard error of marginal effects clustered at lender level, shown in parentheses. Statistical significance indicated at the 5% (*), 1% (**), and 0.1% (***) levels. Identification comes from variation across lenders in date of guarantee fee change implementation. To account for possible use of rate locks, alternate post definition (Alt. Post) excludes originations during the 45 days following guarantee fee change implementation.

Table 10: Effect of Guarantee Fee Decrease on Share of Originations in Treated Bins, Retail, Wholesale, and Correspondent Channels

	(1)	(2)	(3)	(4)
Post_{jt}	0.012	0.012		
	[-0.015,0.040]	[-0.015,0.039]		
Alt. Post_{jt}			0.033*	0.035*
			[0.0024,0.064]	[0.0016,0.069]
Week F.E.	✓		✓	
Lender F.E.	✓	✓	✓	✓
State F.E.	✓	✓	✓	✓
Credit Score F.E.	✓		✓	
Week x Credit Score F.E.		✓		✓
Channel F.E.	✓	✓	✓	✓
N	297538	297538	249828	249828
Number of lenders	13	13	13	13
Mean of dep. var.	0.81	0.81	0.81	0.81

Note: 2015 Y-14M first-lien, conventional purchase mortgage originations by lenders in the Informa data (identified by lender name). Dependent variable is indicator for loan originated in treated credit score x LTV bin. Standard errors clustered at lender level, 95 percent confidence intervals shown in brackets, statistical significance indicated at the 5% (*), 1% (**), and 0.1% (***) levels. Identification comes from variation across lenders in date of guarantee fee change implementation. To account for possible use of rate locks, alternate post definition (Alt. Post) excludes originations during the 45 days following guarantee fee change implementation.

A.3 Conforming Loan Limit Simulation Details

A.3.1 Counterfactual Loan Limits

Our model is estimated to minimize the difference between the missing mass of borrowers just above the limit and the excess mass bunching at the limit.

For our calculations, all dollar loan amounts are measured in logs and normalized to zero at the conforming loan limit in the county of origination. All loans are assigned to bins $j = \{-J, \ldots, L, \ldots, 0, \ldots, U, \ldots, J\}$, reflecting their distance from the loan limit, in intervals of a fixed width. We use a flexible polynomial of degree p to fit the distribution of loan counts n_j within each bin, with additional indicator variables for those bins immediately surrounding the loan limit, $\{m_L, \ldots, m_U\}$, to estimate the amount of bunching relative to the smooth polynomial. The full regression is

$$n_j = \sum_{i=0}^{p} \beta_i (m_j)^i + \sum_{k=L}^{U} \gamma_k \mathbb{1}(m_k = m_j) + \epsilon_j.$$

The estimated polynomial, excluding the indicators, yields the predicted smooth distribution of loan amounts without bunching

$$\hat{n}_j = \sum_{i=0}^{p} \hat{\beta}_i (m_j)^i.$$

Both the missing mass of borrowers above the limit, $\hat{M}$, and the excess mass of borrowers bunching at the limit, $\hat{B}$, are calculated as differences between the borrower counts predicted by the smooth distribution and the data:

$$\hat{M} = \sum_{j=1}^{U} (\hat{n}_j - n_j) = -\sum_{j=1}^{U} \hat{\gamma}_j,$$

and $\hat{B} = \sum_{j=L}^{0} (n_j - \hat{n}_j) = \sum_{j=L}^{0} \hat{\gamma}_j$.

After estimating the above model separately for borrowers with low, medium, and high credit scores, we use the smooth polynomial distribution of loan amounts and the indicator coefficients γ_k to calculate the fraction of borrowers missing from each of the U bins above the limit:

$$f_k = -\frac{\hat{\gamma}_k}{\hat{n}_k}.$$

These fractions trace out the dip in originations above the existing loan limit and form the basis for our counterfactual predictions.

Our counterfactual shifts the loan limit downward by S bins, using f_k to model the number of borrowers bunching at given distances from the new loan limit. We assume that borrowers now bunch from the full range of loan sizes in $\{-S+1, \ldots, U\}$. Given the larger interval of loan sizes covered, we define a wider set of bins $j_c = \{1, \ldots, U\}$ such that it covers the same interval as $j = \{-S+1, \ldots, U\}$, and then apply the fractions f_k to these wider bins. This method traces out our counterfactual dip, and then allocates the total counterfactual mass of missing loans,

$$M_c = \sum_{j_c=1}^{U} f_{j_c} \hat{n}_{j_c},$$

below the new loan limit on the interval from $j = \{L - S, \ldots, -S\}$. Like our estimation algorithm, this counterfactual does not allow for the extensive margin choice to not take out a mortgage.

A.3.2 Simulation Details - Counterfactual LTV Ratios

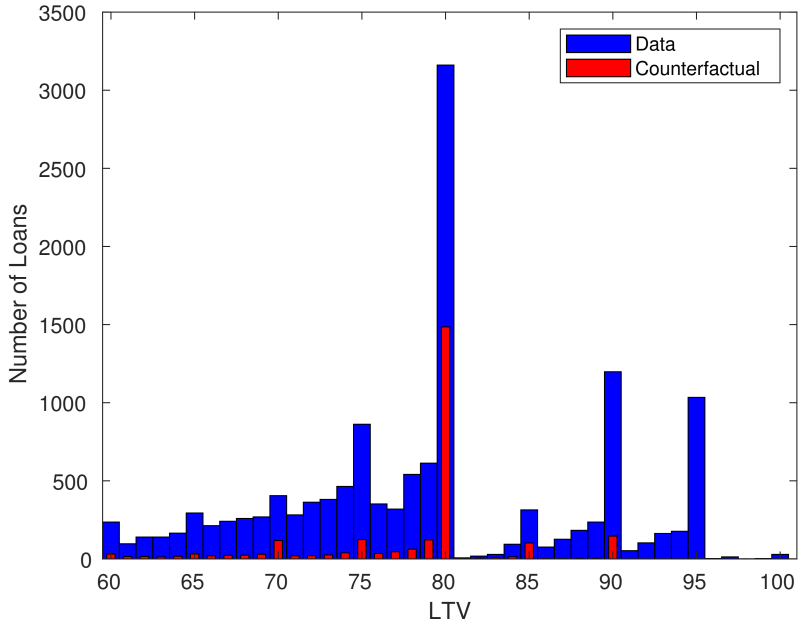
As with the distribution of loan amounts, we assume that the LTV distribution of jumbo loans immediately above the new limit would equal the distribution observed immediately above the existing limit, $f(l, \text{above})$, using observed LTVs for loans from \$417,001 to approximately \$480,000.[44] We similarly assume that the LTV distribution of conforming loans below the new limit would equal the observed distribution below the existing limit, $f(l, \text{below})$, using observed LTVs for loans from approximately \$404,000 to \$417,000. While this method does not model loan choice at the borrower level, it provides an aggregate sense of where borrowers are switching from and switching to relative to the observed data.

Consider the high credit score borrowers observed choosing loan amounts between the new and existing loan limits. In our counterfactual, 19 percent of these borrowers remain between the limits after the simulated policy change. We allocate these borrowers according to $f(l, \text{above})$, as shown in Figure 6 alongside the observed distribution. In this simulation, 75 percent of borrowers with an LTV of 80 or less would adjust their loan amounts as a result of the shift, compared to 95 percent of those with higher LTVs. Among borrowers with good credit, the GSEs have a larger effect on the availability of high LTV loans. However, many borrowers at lower LTVs adjust as well, suggesting that unobserved factors like stricter underwriting or incomplete information are economically important even for those with good credit.

To see what loans switching borrowers obtain, we apply the same method to assign LTVs to all borrowers bunching below the new limit in our counterfactual, based on the distribution observed just below the existing limit, $f(l, \text{below})$. Note that if the purchase price of homes is held constant, our counterfactual limit reduction of four percentage points would force any bunching borrowers to reduce their loan amount (and hence LTV) by at most four percentage points. Figure 7 shows that the counterfactual distribution has less pronounced peaks at the focal values of 80 and 95, and increased mass elsewhere. The regions where the number of counterfactual loans exceeds that in the data are suggestive of the LTVs that bunching borrowers would choose. First, the simulation shows an increase in loans taken out with LTV above 80, but below 95. This would be expected from the population of borrowers who preferred high LTV conforming loans near the old limit, and now must marginally reduce their loan amount to maintain conforming status. The second region where we observe substantial numbers of bunching borrowers is at LTVs below 80. This would reflect many of the borrowers already bunching at the old limit, who would reduce their loan size even further. Based on credit score and LTV, these borrowers are eligible for jumbo loans priced at or below conforming rates.

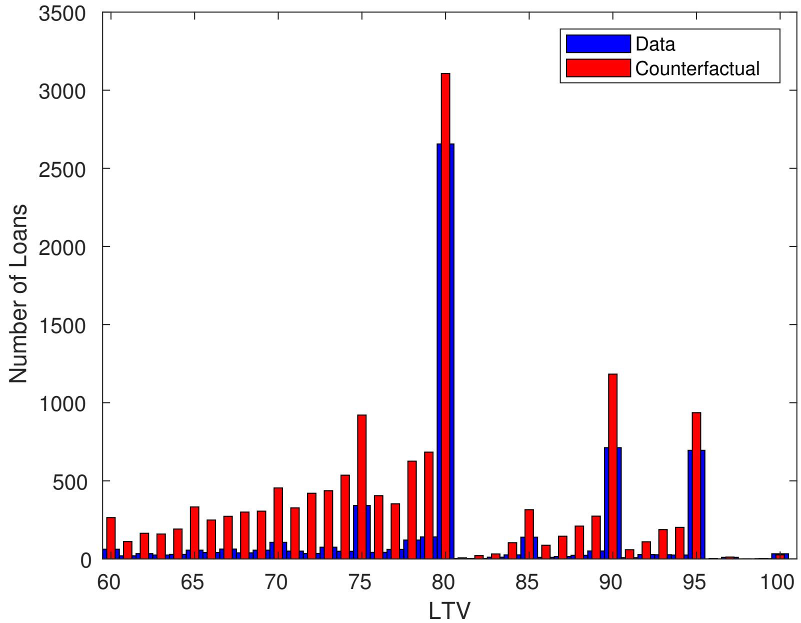
[44] We round LTVs, l, up to the nearest whole number, and additionally impose that borrowers cannot choose loans for which we observe no rates in the Informa data. This results in only a small change relative to the empirical distribution of LTVs and allows us to calculate counterfactual rates.

Figure 6: LTV Distribution for Borrowers Between Counterfactual and Existing GSE Conforming Loan Limits, High Credit Score Borrowers



Note: Data and simulations based on single-family, conventional, 30-year, fixed rate loan originations in 2015 CoreLogic data. Sample restricted to high credit score borrowers below existing conforming loan limit, and above new, counterfactual loan limit. For counterfactual, total number of borrowers is the model prediction from loan amount counterfactual, distributed according to the observed LTV distribution of jumbo loans above the existing loan limit.

Figure 7: LTV Distribution for Borrowers Below New Counterfactual GSE Conforming Loan Limit, High Credit Score Borrowers



Note: Data and simulations based on single-family, conventional, 30-year, fixed rate loan originations in 2015 CoreLogic data. Sample restricted to high credit score borrowers immediately below new, counterfactual conforming loan limit. For counterfactual, total number of borrowers is the model prediction from loan amount counterfactual, distributed according to the observed LTV distribution of conforming loans immediately below the existing loan limit.

A.4 Tables and Figures

Table 11: Percent of Lender-State-Date Combinations with Offered Retail Jumbo Rates Priced Below Conforming, 2015

Credit Score	**LTV**	**Lender-State-Date with Jumbo < Conforming**
750	80	32.4%
710	80	34.7%
670	80	38.7%*
630	80	30.7%**
750	85	21.2%
710	85	26.4%
670	85	15.1%*
630	85	7.2%**
750	90	13.4%*
710	90	16.6%*
670	90	14.0%*
630	90	7.2%**
750	95	-
710	95	-
670	95	-
630	95	-

* Rates available from fewer than 30% of Informa lenders
** Rates available from fewer than 10% of Informa lenders

Note: Informa retail rate sheets data. Percentage of lender-state-date combinations where lenders offered retail jumbo rates priced below conforming rates in 2015 among Informa lenders. Offered rates are calculated with zero points. A rate is defined as available if a lender offers loans of that type on their rate sheets. The symbol '-' indicates that no lenders in the Informa data offered jumbo rates for credit score and LTV combination.

Table 12: Average Interest Rates by Loan Type, 2015 CoreLogic data

Credit Score	**LTV**	**Conforming, $350k-$417k (%)**	**Jumbo, $418k-$500k (%)**
>= 730	<= 80	3.91	3.73
[690, 730)	<= 80	4.06	3.95
[650, 690)	<= 80	4.25	4.30*
< 650	<= 80	4.49	-
>= 730	(80, 85]	3.97	3.81
[690, 730)	(80, 85]	4.08	-
[650, 690)	(80, 85]	4.30	-
< 650	(80, 85]	4.62**	-
>= 730	(85, 90]	3.98	3.95
[690, 730)	(85, 90]	4.14	4.04**
[650, 690)	(85, 90]	4.32	-
< 650	(85, 90]	4.51	-
>= 730	> 90	4.05	4.15
[690, 730)	> 90	4.20	4.15**
[650, 690)	> 90	4.32	-
< 650	> 90	4.42	-

* Fewer than 100 originations with this credit score-LTV combination
** Fewer than 50 originations with this credit score-LTV combination

Note: Average 2015 interest rates among CoreLogic 30-year fixed rate purchase originations. The symbol '-' indicates that the CoreLogic data contain fewer than 10 originations of this type.

Table 13: Effect of Guarantee Fee Decrease on Offered Jumbo Retail Interest Rates (Placebo Test)

	(1)	(2)	(3)	(4)	(5)
Post(t) x Treated(fl)	0.064	0.021	0.028*		
	[-0.0026,0.13]	[-0.026,0.069]	[0.0027,0.053]		
Post(jt) x Treated(fl)				0.019	0.021
				[-0.024,0.063]	[-0.0058,0.049]
Post Indicator	✓				
Treated Bin Indicator	✓				
Date F.E.		✓		✓	
Date x Lender F.E.			✓		✓
Credit Score x LTV F.E.		✓	✓	✓	✓
Lender F.E.	✓	✓		✓	
State F.E.	✓	✓	✓	✓	✓
N	3012888	3012888	3012888	4183207	4183207
Number of lenders	25	25	25	20	20
Mean of dep. var.	4.08	4.08	4.08	4.14	4.14

Note: Dependent variable is offered retail interest rate on jumbo loans at the lender-state-credit score-LTV-date level. Standard errors clustered at lender level, 95 percent confidence intervals shown in brackets, statistical significance indicated at the 5% (*), 1% (**), and 0.1% (***) levels. In specifications (1) to (3), the post-period is defined for all lenders as the effective date of the fee change, the pre-period is all dates prior to the announcement of the fee change, and observations between these dates are excluded. In specifications (4) to (5), all dates are included, and lender-specific post-periods are defined by the date each lender implemented the fee change. Lenders where implementation date could not be identified are dropped from specifications (4) to (5).

Table 14: NSMO Survey Responses of Conventional Purchase Borrowers at or Near GSE Conforming Loan Limit, 2013-2016. Retail Channel Only

	At loan limit ($417,000)	**Just below ($350,000-$416,999)**	**Just above ($417,001-$500,000)**
Survey responses:			
Used a broker (%)	0.0	0.0	0.0
Seriously considered only one lender/broker (%)	50.0	36.9	22.4**
What best describes the order of your shopping process?			
Lender/broker first, then loan type (%)	82.8	62.7**	53.7***
How much did you use this source of information:			
Lender or broker? (% "A lot")	72.4	65.0	74.6
Open to lender/broker suggestions about different features/terms? (% "Very")	44.8	38.7	37.3
Knowledge questions - How well could you explain?			
ARM vs Fixed (% "Very")	86.2	75.6	82.1
Prime vs Subprime (% "Very")	43.1	28.1*	41.8
Interest rate vs APR (% "Very")	46.6	35.0	47.8
Administrative data:			
Credit score (mean)	754.1	768.7	786.3***
LTV (mean)	71.6	81.4***	74.6
CLTV (mean)	75.4	81.8***	75.0
DTI (mean)	36.1	34.1	32.2
Income (mean, $ thousands)	197.1	165.4**	210.0
Interest rate (mean, %)	3.95	4.02	3.86
Interest rate spread over APOR (mean, %)	0.15	0.14	−0.01
Observations	58	217	67

Note: Selected survey responses and administrative data from restricted-use version of the NSMO (National Survey of Mortgage Originations), 2013-2016. Sample includes conventional purchase loan borrowers with loan amounts between $350,000 and $500,000 made through the retail channel. Asterisks denote statistical significance of t-tests for difference in means relative to borrowers at loan limit, indicated at the 5% (*), 1% (**), and 0.1% (***) levels.