Do GSEs Subsidize Mortgage Lending?

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Abstract

A key function of government-sponsored enterprises (GSEs) is to insure mortgage default risk, yet little is known about whether these guarantees are fairly priced. Using a replicating portfolio and market prices of reinsured mortgage default risk to value the net cash flows from guaranteeing $5 trillion mortgages, I show that GSEs shifted from providing a subsidy of 20 basis points (bps) pre-crisis to generating risk-adjusted profits of 30 bps in the post-crisis period. Using a regression discontinuity design around the conforming loan limit, I document that this higher pricing is passed on to borrowers via higher conforming mortgage rates. Following this increase, banks reduce their reliance on GSE securitization but still securitize most mortgages through GSEs despite paying an above-market rate. Overall, these findings imply lenders value using GSEs for reasons other than government-subsidized funding in the post-crisis period.

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A defining feature of the residential mortgage market in the United States is that it heavily involves government intermediation relative to other credit markets. Government-sponsored enterprises (GSEs) purchase and securitize the majority of mortgages in the economy. If selling to GSEs has been the predominant financing mechanism in the United States over the past 30 years, a crucial question is what makes this government-sponsored arrangement optimal relative to private market-based financing. A key function performed by GSEs is that they transform credit-risky mortgages into credit-risk-free mortgage-backed securities (MBS) by guaranteeing the default risk in exchange for a fee from the lender. These entities are widely believed to subsidize homeownership by charging below-market rates for this insurance. How large are these subsidies, if any? Any mispricing provided by the GSEs is important for understanding the moral hazard lenders face when choosing to retain or securitize their mortgages (Elenev, Landvoigt, and Van Nieuwerburgh, 2016). Further, recent policy discussions around the privatization of Fannie Mae and Freddie Mac underscore the need to articulate what valuable function these intermediaries provide relative to private capital markets and intermediaries.[1] Despite the importance of the GSEs in the mortgage market, however, there is little empirical evidence quantifying the credit risk subsidies of their mortgage guarantees.

In this paper, I take a cash flow approach to quantify the credit risk subsidy provided by GSEs on their guarantees of residential mortgages. When loan originators securitize their mortgages through GSEs, they offload the mortgages' credit risk in exchange for paying a negotiated guarantee fee to GSEs, who are then required to forward interest and principal to Mortgage-Backed Security (MBS) bondholders in the event of delinquency or default. To measure the subsidy on their pricing of guarantees, I build a new dataset of the cash flows that Freddie Mac receives for writing these guarantee contracts on single-family fixed-rate mortgages originated from 1999 to 2018. I then apply cash flow based risk-adjustment methodologies to estimate the market value an investor would be willing to pay to purchase these cash flows. GSEs provide a credit subsidy if the risk-adjusted present value of these cash flows is negative, i.e., GSEs do not receive large enough premiums to compensate them

[1]The Trump administration is currently preparing IPO filings for the GSEs (see https://www.wsj.com/finance/regulation/trump-aiming-to-ipo-fannie-mae-and-freddie-mac-later-this-year-13b138cf?mod=WSJ_WNPOD).

for insuring the default risk. In contrast, if the cash flows have zero or even a positive NPV, this means that the GSE premiums are fairly priced or that banks pay an above-market rate to sell loans to GSEs, respectively.

To value the guarantees, I apply two cash-flow–based risk-adjustment methodologies: Risk-Adjusted Profit (RAP) (Gupta and Van Nieuwerburgh, 2021; Flanagan, 2024) and Generalized Public Market Equivalent (GPME) (Korteweg and Nagel, 2016). The key idea of RAP is to build a replicating portfolio for the cash flows of nontraded assets using the cash flows of publicly traded securities with observable market prices. For the replicating portfolio's market value to measure the nontraded asset's value correctly, it must span the relevant cash flow risks. To capture the default risk embedded in GSE guarantees, I follow Flanagan (2024) and use benchmarks shown to successfully replicate and price credit-risky debt cash flows when constructing the replicating portfolio. Further, I specifically include mortgage and real estate specific risk factors to capture risks relevant to the guarantees when building the replicating portfolio benchmarks. Similarly, the GPME estimation involves estimating a pricing function that correctly prices publicly traded benchmarks with similar cash flows and using that function to value the GSE guarantees.

Applying these risk-adjustment methodologies to the guarantee cash flows, I find that the present value of Freddie Mac's guarantees on $5 trillion of fixed-rate, single-family mortgages originated over 1999–2018 is $0.000–$0.002 per $1 of loan guaranteed. This estimate is statistically and economically indistinguishable from zero. This finding indicates that, on average, during this period, Freddie Mac's mortgage guarantees were close to fairly priced rather than subsidized.

Although the overall average is not different from zero, I next document that GSE guarantee valuations differ substantially before and after the Global Financial Crisis (GFC). In the pre-GFC period, Freddie Mac generated a negative, statistically significant risk-adjusted return of –$0.009 per $1 of guaranteed loan, implying an annual subsidy of approximately 20 basis points. This subsidy is consistent with lenders' preference for GSE securitization over balance-sheet retention or private securitization during this period. Conversely, in the post-GFC period, I find that Freddie Mac earns a positive, statistically significant $0.012–$0.020 risk-adjusted profit per $1 of loan guaranteed. On an annualized basis, this figure amounts to

roughly a 30 bps risk-adjusted return, which exceeds Freddie Mac's annual 6–7 bps operating expense (Golding, Goodman, Parrott, and Ryan, 2023).[2] These positive risk-adjusted returns are consistent with an increase in guarantee fees and tightening of underwriting standards at the time. However, these results imply that lenders are willing to pay an above-market rate for GSE guarantees in the post-crisis period.

One concern with the cash flow valuation approach is whether the selected market benchmarks truly replicate the risk profile of the underlying mortgage guarantees. To address this concern, I exploit Freddie Mac's Structured Agency Credit Risk (STACR) program, in which Freddie Mac sells synthetic securitization tranches to reinsure default risk from its guarantee book. In particular, Freddie Mac sells the subordinate tranches, whose market prices are observable, to market participants and retains the most senior tranche of the deal. By estimating the market price of the retained senior tranche, I can compute the total market value of expected losses of the underlying mortgage pool, which is a direct measure of the fair market cost of default insurance. To measure the senior tranche price, I estimate a loan-based structural model of default risk, building on Nagel and Purnanandam (2020), such that the model exactly prices the riskier subordinate tranches correctly. Applying this approach to STACR transactions from 2015 to 2023, I find that market participants require about 29 bps annually to cover the expected losses on a typical Freddie Mac mortgage pool, which is roughly half of Freddie Mac guarantee fees at the same time.

Having established that GSEs earn positive risk-adjusted returns in the post-GFC period, I next examine how this affects mortgage interest rates and bank behavior. First, I examine loan pricing around the conforming loan limit, above which lenders cannot use GSEs to securitize mortgages. It has been previously documented that, in the pre-crisis period, the jumbo–conforming rate spread was positive (e.g., Passmore, Sherlund, and Burgess 2005), meaning that jumbo loans had higher rates than conforming loans, consistent with a GSE subsidy at the time. However, if GSEs began charging above-market fees for insuring credit risk after the crisis, conforming mortgages could become more expensive than jumbo loans.

Using new HMDA data that covers the post-GFC period, I compare loans just above and

[2]This expense ratio is in terms of expense per dollar of Freddie Mac's total assets. The figure would be smaller in terms of expense per dollar of GSE MBS balances outstanding.

below this conforming loan cutoff and find that interest rates are 20 bps lower for jumbo loans just above the GSE conforming loan limit. A potential concern with this comparison, however, is that borrowers can choose the size of the loan they take out and, therefore, whether or not a loan is conforming or jumbo. To address this concern, I follow Kaufman (2014) and instrument jumbo loan status using a regression discontinuity design based on whether the home appraisal value exceeds 125% of the conforming-loan limit. Because appraisal values are exogenous to borrower choice and many lenders impose an 80% LTV constraint on balance sheet loans, loans with appraisals just above 125% are discontinuously more likely to have jumbo status. With this instrument, I confirm that jumbo loans have lower rates than conforming loans in the post-crisis period. Moreover, I show that the negative spread appears only for bank originators, which have the option to retain loans. Nonbanks, which have limited balance-sheet capacity, do not exhibit a negative spread on their mortgages across the conforming loan limit. This evidence indicates that GSEs' above-market guarantee fees are passed on to mortgage borrowing costs.

If Freddie Mac charges an above-market price for mortgage guarantees in the post-crisis period, do banks reduce their loan sales to GSEs in response? A higher price of GSE guarantees could make it relatively more profitable for banks to simply hold the loans on their balance sheet since the market cost of funding is less than what Freddie Mac requires. Consistent with this, banks reduce loan sales to GSEs by 20–30 percentage points relative to nonbanks following the rise in guarantee fees and inversion of the conforming-loan spread. However, bank originators continue to sell the majority of their loans to GSEs despite the above-market price, and their distribution of newly originated loans still exhibits bunching around the conforming loan limit, suggesting that there is still something valuable about using GSEs.

The evidence shows that GSEs price mortgage credit risk insurance above fair market values in the post-GFC period. Further, the market prices of STACR reinsurance notes demonstrate that there are private investors willing to bear this risk at prices below those set by the GSEs. Nonetheless, banks continue to rely on GSE securitization as their primary mortgage-funding channel. Although higher pricing has led banks to reduce their loan sales to GSEs, private-market securitization or balance sheet retention of GSE-eligible mortgages

has not overtaken the standard model of selling these mortgages to GSEs.

These facts suggest that, although recent GSE guarantee fees are no longer subsidized, lenders may still capture net cost advantages by using GSEs to securitize mortgages over other market-based alternatives. At the margin, higher guarantee fees prompt some banks to hold more mortgages on their balance sheets, but other benefits, such as operating cost efficiencies, GSEs' economies of scale, MBS liquidity, QE eligibility, and balance-sheet costs of loan retention, may be sufficiently valuable that banks are willing to pay an above-market rate. Which of these advantages lenders value, and whether they are inherently tied to the GSEs' government-sponsored status, remains an open question for future research.

This paper has important implications for the policy assessment of GSE guarantee subsidies. The Federal Housing Finance Agency (FHFA) and Congressional Budget Office (CBO) estimate GSE guarantee subsidies by using historical default rates of loan categories to project expected losses and discounting them using Treasury rates plus a chosen risk premium (Congressional Budget Office, 2018, 2025; Federal Housing Finance Agency, 2025). Using these methodologies, both the FHFA and CBO find that post-crisis guarantees are underpriced and offer a subsidy relative to their credit risk. In contrast, the cash flow risk-adjustment and Merton-style structural model in this paper explicitly estimate market prices of the guarantees that incorporate forward-looking risk premia and expected losses from the perspective of market participants. Consistent with this paper's findings, Freddie Mac (2017) reaches a similar conclusion that in the post-crisis period, g-fees exceed the market price of credit risk implied by STACR security prices. However, Golding and Lucas (2022) shows that conclusions about subsidies from STACR are sensitive to assumptions about the riskiness of the retained senior tranche and its associated tail risks. This paper provides new methods for determining the overall subsidy by explicitly estimating the price of this tail risk using the model framework of Nagel and Purnanandam (2020) and by directly estimating the market value of the underlying guarantee cash flows.

These findings also have implications for the policy discussion of GSE privatization. Although the government may be able to provide subsidies that promote homeownership, such subsidies would not be sustainable for private shareholders who require market-rate returns. Although GSEs provided a subsidy in the precrisis period, my findings show that

the current GSE guarantee book is economically profitable. This profitability implies that the guarantee component of the GSE business model would remain valuable to shareholders if privatized, even if the guarantee pricing were not changed.

A limitation of this paper is that it focuses solely on measuring the subsidy banks receive from GSEs' pricing of guarantees on fixed-rate single-family mortgages. The findings in this paper do not speak to the valuation of other instruments on their balance sheet or whether their shareholders benefit from implicit government bailout guarantees. For instance, GSEs purchased significant amounts of *subprime* MBS during the housing crisis (Richardson, Van Nieuwerburgh, and White, 2017). Studies by Passmore (2005), Lucas and McDonald (2006), and Lucas and McDonald (2010) analyze the total implicit subsidy to GSE shareholders using option prices and market comparison of their debt to similarly risky institutions. By focusing on cash flows of guarantees, this paper directly examines how much subsidy is passed to the *banks* that sell their mortgages with Fannie Mae guarantees. Delineating between the subsidies to GSE shareholders and subsidies passed to market participants matters for understanding how this government-sponsored intermediation contributes to the functioning of this market.

This paper contributes to several bodies of literature analyzing mortgage lending, securitization, and the role of the GSEs. This paper complements Bhutta (2012), Hurst, Keys, Seru, and Vavra (2016), Tsai (2023), and Gete, Tsouderou, and Wachter (2024) which analyze the *cross-sectional* mispricing in GSE loan guarantees across different demographics, geographies, and borrower characteristics. To the best of my knowledge, this paper is the first to measure the overall *level* of subsidy provided by GSEs on their loan guarantees by estimating their value from the perspective of public market investors. This paper also provides empirical evidence that can inform models that change or remove GSE guarantee subsidies, such as in Elenev et al. (2016) and Gete and Zecchetto (2018). This paper focuses on the credit risk differential between GSE and markets, which complements Fuster and Vickery (2015), which studies lenders' reluctance to absorb interest rate and prepayment risk frocm 30-year mortgages. The findings in Fuster and Vickery (2015) also offer another potential explanation as to why lenders continue to sell to GSEs despite charging an above market price to insure credit risk. The structural default risk valuation in this paper is also related to Golding and

Lucas (2022) and O'Neill (2022), which study the risk of GSE credit risk transfer (CRT) programs using reduced-form approaches and Gete et al. (2024) and Gete, Pavlov, Tsouderou, and Wachter (2025), which study the impact of climate risk and forbearance on market assessments of risk using CRT prices. This paper's results on the jumbo-conforming spread differential across banks and nonbanks also speak to recent developments in the GSE market in the post-GFC period and the rising role of non-bank intermediation in this market (e.g., Buchak, Matvos, Piskorski, and Seru (2018a), Buchak, Matvos, Piskorski, and Seru (2018b), and Fuster, Plosser, Schnabl, and Vickery (2019)). I also contribute to the literature studying conforming-jumbo loan spreads (Passmore et al., 2005; Kaufman, 2014; DeFusco and Paciorek, 2017; Fisher, Fratantoni, Oliner, and Peter, 2021) by establishing a link between this spread and the valuation of GSE guarantees and applying an instrumental variable approach to estimate the spread in the post-crisis period.

This paper also relates to the large literature that focuses on the securitization and incentives of mortgage originators, securitization, and the role of nonbank lenders, including work of Keys, Mukherjee, Seru, and Vig (2010), Purnanandam (2011), Buchak et al. (2018a), Buchak et al. (2018b), and Fuster et al. (2019), among many others. Despite the extensive literature on mortgage financing, there is limited empirical evidence on quantifying subsidies from GSEs by risk-adjusting the returns from their loan guarantees, which is crucial to understanding the moral hazard that financial intermediaries face in offloading mortgages through securitization.

1 GSE Policy and Institutional Background

Fannie Mae was created in 1938 as a part of Franklin D. Roosevelt's New Deal and, at the time, was owned entirely by the government. To address homeownership during the Great Depression, Fannie Mae introduced the 30-year mortgage and had a policy objective of promoting "liquidity, stability, and affordability" by purchasing and holding mortgages in its portfolio [3] Later, in 1968, Fannie Mae was restructured as a private but government-sponsored

[3]For a complete history of Fannie Mae, see https://www.fanniemae.com/about-us/who-we-are/history

enterprise. Despite being private, this association with the government meant it benefited from lower funding costs due to implicit government backing. In 1970, Freddie Mac was created and began to securitize the conventional mortgages it purchased into MBS, creating a liquid secondary market for mortgages. In 1980, Fannie Mae also began securitizing its mortgages into MBS rather than only holding the mortgages in their portfolio.

The typical contract GSEs still offer today was introduced when Fannie Mae began securitizing mortgages. GSEs maintain a set of eligibility criteria for mortgages they will purchase using characteristics such as LTV, debt-to-income, and credit scores. GSEs then bundle the mortgages into MBS, insure the credit risk of the MBS, and sell the resulting securities to market investors. Lenders can either sell their mortgages at the 'cash window' and receive money upfront using prevailing To-Be-Announced (TBA) prices of MBS or through the 'swap channel' in which lenders receive MBS guaranteed of any credit risk in exchange for selling the mortgages (An, Li, Liu, and Song, 2022). In order to sell their mortgages to GSEs through either channel, lenders must purchase credit risk insurance from the GSEs by paying a 'guarantee fee' or 'g-fee.' Additionally, lenders retain the servicing rights to the loans and are paid a residual cash flow to forward the principal and interest to the MBS bondholders. The guarantee fee is a type of insurance premium GSEs use to cover losses on interest and principal on the MBS bondholders when the underlying mortgages become delinquent or default. As a result, the MBS holders bear interest rate and prepayment risk, and the GSEs bear the corresponding credit risk of the mortgages.

The primary function of the GSEs has been to purchase, insure, and securitize conventional 30-year mortgages. However, during the subprime crisis, the GSEs expanded their role and began purchasing Alt-A and subprime MBS, holding them on their balance sheet, and financing them with debt that had perceived government backing (Richardson et al., 2017). Due to their thin equity position and large losses from these riskier mortgage purchases during the GFC, they were placed into government conservatorship in September 2008 (Richardson et al., 2017). Presently, the GSEs are still in conservatorship; however, there are recent policy discussions around privatizing the GSEs again[4]. As a step in the direction of privatization,

[4](e.g., see https://www.wsj.com/finance/regulation/trump-aiming-to-ipo-fannie-mae-and-freddie-mac-later-this-year-13b138cf?mod=WSJ_WNPOD)

in 2013, GSEs began reinsuring some of the mortgage guarantee default risk to private capital markets through credit risk transfer (CRT) programs, such as Freddie Mac's STACR transactions, with the goal of reducing taxpayer exposure to this risk.

2 Data & Methodology

2.1 Freddie Mac Loan Guarantee Cash Flows

To value the GSE loan guarantees, I estimate the present value (PV) of the net cash flows Freddie Mac receives from the guarantee contract with loan originators/sellers. To compute the cash flows GSEs receive on their guarantees, I follow the decomposition in Fuster, Goodman, Lucca, Madar, Molloy, and Willen (2013).[5] I also use this decomposition to show how GSE guarantees relate to the cash flows that borrowers pay and lenders receive. Upon receiving a mortgage, borrowers pay principal P_t and interest payments $r_{note,t}$. When lenders then sell their mortgages to GSEs, they agree to pay a negotiated g-fee rate $r_{gfee,t}$ on the outstanding balance of loans, receive residual servicing rights cash flow $\sigma_{servicing,t}$, and receive a MBS insured from any credit risk that pays $r_{coupon,t}$ and is valued at $TBA(r_{coupon,t})$ in the TBA market.[6] The resulting relationship between mortgage rates borrowers and the MBS coupon rate is:[7]

$$r_{note,t} = r_{coupon,t} + r_{gfee,t} + \sigma_{servicing,t}.$$

After extending a given $LoanAmt$ to a borrower, the corresponding value a lender receives for selling that mortgage to the GSEs is:

$$PV(\sigma_{servicing,t}) + TBA(r_{coupon,t}) - PV(r_{gfee,t}) - LoanAmt.$$

As shown in Fuster et al. (2013), the value of the above term has been rising recently, suggesting that lenders need higher returns to cover the higher intermediation costs of making

[5] Without any loss of generality, the below example ignores upfront fees paid by borrowers.

[6] Or identically, they receive the value of $TBA(r_{coupon})$ if using the cash window. Because the resulting MBS bond is free of credit risk, the bond pricing in the TBA market only reflects the interest rate of the coupons and the prepayment risk of the underlying mortgages.

[7] Lenders exercise some discretion in substituting a lower coupon rate on the MBS they receive for a higher servicing rights cash flow (Fuster et al., 2013).

mortgages.

If a loan goes into default or becomes delinquent, Freddie Mac must continue to send interest to bondholders even if the borrower does not pay their mortgage note. Because GSEs bear this risk, the present value of any defaults on mortgages' unpaid principal balance (UPB) plus any other delinquent accrued interest, $PV(P_t^D + r_t^D)$, (net of any recoveries) is a cost borne by the GSEs in exchange for receiving the associated g-fees. The GSEs' present value of this insurance contract is the main economic object of interest in this paper:

$$PV(GSE_Guarantee_t) = PV(r_{gfee,t}) - PV(P_t^D + r_t^D). \tag{1}$$

If the NPV of the net guarantee cash flows is zero, this means that the insurance premiums from guarantee fees exactly cover the expected financial costs of paying any claims and that there is no subsidy.[8]

To estimate the value of GSE mortgage guarantees, I need both the g-fee cash flows that GSEs receive from lenders and the cash flows that GSEs forward to MBS bondholders when mortgage borrowers default or are delinquent. Additionally, if a borrower defaults, GSEs limit their losses by recovering some of the UPB by selling off the house as collateral and requiring borrowers with high LTVs to purchase private mortgage insurance. Combining the g-fees, the mortgage losses, and the asset recovery into a single cash flow term, I write the net cash flows from GSEs guarantees at any point in time as:

$$GSE_cf_t = r_{gfee,t} - \mathbb{1}_{Default}[P_t^D - Recoveries_t + r_t^D]. \tag{2}$$

I apply the methodologies described in the risk-adjustment section to value these net cash flows to estimate $PV(GSE_Guarantee) = PV(GSE_cf_t)$. I describe the data sources for computing the net cash flows in the section below.

Default, Recovery, and Delinquent Interest: I use the Freddie Mac Single Family Performance Dataset to compute the default, recovery, and delinquent interest portion of the

[8]The complete relationship between the value of the underlying mortgages, the value of the credit-risk-free MBS, the value of servicing rights, and the value of the defaults/ delinquent interest is $PV(P_t + r_{coupon,t}) = PV(\sigma_{servicing,t}) + TBA(r_{coupon,t}) + PV(P_t^D + r_t^D)$. This relationship follows from the splitting of the cash flows in the securitization process.

guarantee cash flows in the above Equation (2). The key advantage of the Freddie Mac data set, unlike Fannie Mae's Single Family Performance Data, is that it is selection-bias-free and includes all mortgages in its guarantee book since 1999.[9] In contrast, the Fannie Mae data set only reports the performance of loans that resemble those that meet its current underwriting standard.[10] This dataset offers detailed information on loan performance, starting with loans originated in 1999, and reports the exact amount of loan losses and forbearance losses covered by Freddie Mac's guarantees and owed to MBS bondholders.[11] I end the sample with loans originated in 2018 in order to have a sufficiently long time series to completely observe the guarantee cash-flow realizations. Most of the outstanding loan principal on loans originated prior to 2018 was paid down by 2024Q4, the final period for which I have collected realized cash-flow data. I limit the sample from this dataset to only cover fixed-rate single-family mortgages.

Guarantee-Fees: To get the guarantee fee part of the cash flows, I follow Fuster et al. (2013) use Freddie Mac's 10-Ks and annual reports to determine the average effective guarantee fees for new single-family acquisitions, which is plotted in Figure 3.[12] After April 2012, there was a 10 bps statutory increase in g-fees as a result of the Temporary Payroll Tax Cut Continuation Act of 2011. These 10 bps are sent to the Treasury. I include these 10 bps as part of the cash flow because they are still cash flows that lenders must pay in order to receive the guarantees, and matter for whether the pricing lenders pay is fair relative to a market based benchmark.[13] In the post-crisis period, GSEs introduced differential guarantee pricing on loans based on a matrix of loan characteristics. Because the main empirical exercise is to

[9] In the Appendix, I report the results from using the Fannie Mae Single Family Performance data set.

[10] In particular, Freddie Mac reports data on both "standard" mortgage performance and "non-standard" mortgage performance, which no longer conform with their current underwriting standards and performed significantly worse during the GFC. Fannie Mae only reports the performance of "standard" mortgages in their single-family performance data set. For more information, see: https://capitalmarkets.freddiemac.com/crt/docs/docs/sflld_nsd_summary.pdf.

[11] In particular, the data set reports the "Actual Loss", which is the UPB plus delinquent interest minus any recoveries and credit enhancements (e.g., proceeds from requiring borrowers to use PMI), and "Cumulative Modification Cost", which is the amount of interest cost borne by the guarantees from having to forward interest to MBS bondholders when a loan is placed into forbearance. The complete data dictionary is available at https://www.freddiemac.com/fmac-resources/research/pdf/user_guide.pdf

[12] The reported guarantee fees are 'effective' because lenders can partially 'buy down' the recurring premiums in exchange for a one-time fixed payment. The total effective g-fees are reported on an annualized basis in Freddie Mac's annual reports.

[13] One way to interpret this 10 bps surcharge is that it divides up how the guarantee fees are distributed amongst different parts of the government

value the overall guarantees offered by GSEs, I simply use the average guarantee fees on the guarantee book to perform the cash flow valuation.

Guarantee Cash Flow Vintages: I sum the guarantee cash flows into portfolios based on the quarter in which those loans originated. Because cash flows have both a vintage t dimension and each vintage has multiple horizons h of cash flows after origination, I update GSE net cash flows notation as $GSE_cf_{t,t+h}$. I divide these raw cash flows by the total loan amounts covered by the guarantees, meaning that the PV of the cash flows measures the profit per dollar of loan insured. To measure the aggregate subsidy provided by Freddie Mac on its loan guarantees, I report the value-weighted results in the baseline table, adjusting for the fact that the volume of loans originated varies over time.

Cash Flow Summary Statistics

Table 1 presents summary statistics on the net guarantee cash flows for mortgages originated from 1999 to 2018, spanning 80 quarters of data. Realized cash flows extend through 2024Q2, capturing both the Global Financial Crisis (GFC) and the COVID-19 pandemic. On average, Freddie Mac insured $63 billion in mortgages each quarter, with the outstanding balances having an average weighted life of 4.2 years, reflecting the substantial prepayment of 30-year fixed-rate loans. In nominal terms, Freddie Mac collects $130 million more in premiums than it pays out for losses, on average. At the end of the distribution, the worst quarter of originations saw $4.9 billion more in losses than premiums, whereas the best quarter of originations had $2.62 billion more in premiums than losses. Over the sample, the guarantee fee averages 32 basis points, ranging from 19 to 57 basis points.

Discounting these net cash flows by the risk-free term structure yields a "risk-free" present value of $0.004 per dollar of loan guaranteed, or about $263 million in each quarter on a present-value basis. The central question is whether this value remains positive once risk premia are taken into account.

Figure 2 plots the average cash flow distribution over time. Net cash flows are generally positive in the first few years after origination but become negative beginning around year six when defaults emerge from problem loans once most of the principal has already been paid down. Any cash flows occurring after year 16 are discounted back to year 16 using the term structure of risk-free rates following Gupta and Van Nieuwerburgh (2021).

2.2 Structured Agency Credit Risk (STACR) Data

For the valuation exercise using the prices of Freddie Mac reinsurance tranches, I collect data on STACR tranches. Using STACR prospectuses, I collect the interest rate spreads, credit enhancement attachment points, detachment points, and CUSIPs for 55 STACR transactions originated over 2015 - 2023 from the Freddie Mac website.[14] I obtain the market prices for these notes in the month after their issuance from TRACE.

2.3 HMDA and Other Loan Origination Data

I use HMDA data to investigate reduced-form evidence on the pricing of loans across conforming and nonconforming loans and banks' decisions to sell loans to the GSEs.

Pre-2017 HMDA: I use this original HMDA dataset to investigate how banks change their likelihood of selling mortgages to GSEs around the increase in guarantee fees. Because of the size of the dataset when including multiple vintages, I use a 10% random sample.

Post-2017 HMDA: The updated HMDA dataset that begins covering loan originations in 2017 provides more detail than the original HMDA dataset. In particular, this updated dataset contains information on loan interest rates. I use this dataset to estimate the conforming-nonconforming loan spread.

MIRS: To measure the nonconforming-conforming loan spread in years prior to 2017, I use the Monthly Interest Rate Survey (MIRS) data provided by the FHFA.

2.4 Risk-Adjustment Methodology

The risk of default/delinquency in the GSE guarantees means that the net cash flows in these contracts are risky and that any valuation must appropriately account for this risk. To discount these cash flows appropriately for their risk, I employ cash flow discounting methods developed in the private equity context. Specifically, I use the Korteweg and Nagel (2016) GPME methodology and the Flanagan (2024) and Gupta and Van Nieuwerburgh (2021) RAP methodology to value these cash flows. I describe both methodologies below in detail.

[14]The data on the tranche is available at https://capitalmarkets.freddiemac.com/crt/securities. I only collect data on DNA and HQA "actual loss" transactions, for which the writedown of subordinate tranches depends both on the default rate and the loan recovery amount.

GPME

Specifically, I use the Korteweg and Nagel (2016) GPME methodology to estimate a stochastic discount factor (SDF) that correctly prices public market benchmarks with similar risk and cash flow distribution timing, and use this SDF to price the guarantees.

The first method I use to measure the risk-adjusted value of the GSE insurance contracts is the generalized public market equivalent (GPME) approach of Korteweg and Nagel (2016). The GPME methodology involves estimating a stochastic discount factor (SDF) of the form:

$$m_t = exp(a - b * r_t).$$

This SDF is estimated to correctly price capital market benchmarks with similar risks and cash flow distribution timing as the GSE guarantees. The resulting SDF can then be used to price the cash flows of interest, the GSE guarantees. Because the SDF is constructed to price these benchmark assets correctly, it will, therefore, correctly price the risk embedded in the guarantee cash flows that are spanned by these benchmarks. Additionally, an advantage of GPME for pricing insurance-like contracts is that the SDF is constructed to be strictly positive, meaning that it restricts arbitrage opportunities when pricing contracts with nonlinear payoffs(Korteweg and Nagel, 2016; Cochrane and Saa-Requejo, 2000). To apply GPME to valuing GSE guarantees, I calibrate the SDF to price test assets, described below, that span the relevant risk factors in GSE guarantees and instrument it with the outstanding principle balance of GSE mortgage guarantees following the Gredil, Sorensen, and Waller (2019) implementation of GPME. I then use the estimated SDF to discount the net guarantee cash-flow distributions normalized to a $1 of loan guaranteed:

$$GPME = \frac{1}{T}\sum_{t=1}^{T}(\prod_{t}^{h} m_s) * GSE_cf_{t,t+h}. \tag{3}$$

Risk-Adjusted Profit

Next, I apply the Flanagan (2024) implementation of the Risk-Adjusted Profit (RAP) framework (Gupta and Van Nieuwerburgh, 2021) to the GSE contracts. The core insight from Gupta and Van Nieuwerburgh (2021) is that privately held assets—whose market values are not directly observable—can be priced by constructing replicating portfolios from publicly

traded benchmarks. The market value of these replicating portfolios can then be used to price these non-traded cash flows. Building on this idea, Flanagan (2024) develops benchmarks specific to debt-like cash flows, relying on the law of one price to construct benchmarks without the need for an explicit asset pricing model.

Because the GSE guarantees' cash flows include insurance premiums (analogous to loan interest) and policy claims (effectively loan defaults), the Flanagan (2024) methodology applies directly. The only distinction between loan cash flows and mortgage insurance guarantees cash flows is the absence of principal repayments. Similar to Flanagan (2024), the declining balance on each guaranteed loan over time allows me to construct instrumented "gain benchmarks" from Flanagan (2024) by weighting investments in public securities according to the fraction of outstanding principal. This time-varying exposure helps capture the non-linearity of the payoffs. Following this methodology, I estimate

$$GSE_cf_{t,t+h} = a_{t+h} + \sum_{k=1}^{K} [c_h^k \tilde{G}_{t+h}^{i,k}] + e_{t+h}^i. \tag{4}$$

I compute the corresponding present value of the GSE cash flows by taking the present value of both sides. By the law of one price, if the benchmarks on the right-hand side span the relevant risk on the left-hand side, then the benchmarks' market prices are equal to the market prices of the cash flows, and the residuals are correctly valued at mean zero.

Factor Selection

For both the GPME and RAP approaches, I select benchmarks to capture the key price risk factors embedded in the loan guarantee cash flows. Below, I summarize these chosen benchmarks.

Interest Rate Risk: The horizon intercept coefficients a_{t+h} in Equation (4) correspond to investing in risk-free zero-coupon bonds of varying maturities that are discounted back using the term structure of Treasury bond yields of corresponding maturities.

Market Risk: To account for aggregate risk and broad equity-related risk, I include the CRSP value-weighted market return.

Credit Risk: An ideal benchmark for mortgage default risk would be returns from securities directly investing in mortgages. The closest such security during the sample period is the

tranches of private label/nonagency securitizations, which, unlike agency MBS, are not insured from default risk. However, market price and return data for these securities are largely unavailable before TRACE reporting began covering them in 2013. As an alternative benchmark, I use returns from nonagency mortgage REITs (mREITs), which take leveraged positions in these nonagency securitizations. Using the list of nonagency and hybrid mREITs identified in Pellerin, Sabol, and Walter (2013), I compute their value-weighted returns from CRSP data. Additionally, I incorporate the Nareit REIT index returns following Gupta and Van Nieuwerburgh (2021) to capture broader real estate risk exposure

3 Results

3.1 GSE Guarantee Cash Flow Valuation

I start by estimating the risk-adjusted valuation of the GSE loan guarantees covering mortgages originated and insured over the full sample period, 1999-2018. I present the estimates of $PV(GSE_Guarantee)$ using both the GPME methodology and the RAP methodology to appropriately discount the cash flows according to their riskiness. I report both equal-weighted and value-weighted estimates of the guarantee cash flows. However, I focus on the value-weighted results in the exposition because these determine the overall value of the guarantees.

Generalized Public Market Equivalent (GPME)

Table 2 contains the valuation estimates using the GPME approach. Panel A contains the equal-weighted estimates, and Panel B contains the value-weighted estimates. Across the Columns (1)-(3), I estimate GPME using each of the risk factors separately and in Column (4) I estimate a specification that includes all three risk factors.

Column (1) estimates a version of GPME that prices the risk-free and the stock market portfolio correctly, analogous to the CAPM. The estimation finds similar SDF parameters for the same specification as in Korteweg and Nagel (2016). On an equal-weighted basis, the corresponding estimate of $PV(GSE_Guarantees)$ is statistically indistinguishable from zero with a PV \$0.001 per \$1 of mortgage guaranteed. On a value-weighted basis, the same figure

is effectively zero. The estimate means that, on average, GSEs charge a fair price to insure mortgage default risk rather than provide a subsidy that would imply a negative valuation.

Next, I expand the set of risk factors to include priced benchmarks with relevant mortgage credit risk, including REIT and nonagency MREIT factors. Columns (2) and (3) show similar estimates with these risk factors. Including all three factors into the estimation in Column (4), I find similar point estimates as in the first specification – I find a valuation indistinguishable from zero on an equal-weighted basis. These findings contradict the premise that GSEs, on average, provide a credit risk subsidy on their conventional mortgage guarantees.

Risk-Adjusted Profit

Table 3 presents the risk loadings and risk-adjusted valuations following the RAP methodology. Panel A reports the risk loadings from estimating Equation (4) with cash flow horizons out as far as 16 years after the loans were originated. The guarantee cash flows load positively on both the CRSP VW stock market index and on the nonagency MREIT benchmark returns. These loadings confirm the intuition that cash flows of the GSE credit risk insurance are exposed to both aggregate risk and mortgage-specific risk factors.

Panel B of the table presents the estimates of the valuation of the GSE guarantees by using market prices of the replicating portfolio implied by the factor loadings in Panel A. The RAP methodology finds that Freddie Mac earns \$0.002 per \$ 1 of loan guaranteed on an equal-weighted basis and \$0.002 per \$ 1 guaranteed on a value-weighted basis. Again, neither estimate is statistically different zerom zero. These findings reinforce the earlier evidence that, on average, GSEs break even on their conventional mortgage guarantees.

Pre- and Post-Crisis Valuations

Next, I estimate the PV of GSE guarantees for subsamples of loans originated before and after the Global Financial Crisis using 2010 as a cutoff year. This analysis is motivated by the sharp change in the GSE pricing of guarantees following the GFC, as shown in Figure 3. For this exercise, I report the value-weighted guarantee valuations. The results are described in Table 4.

Table 4 shows that in the pre-GFC period, the value of the GSE guarantees is negative and statistically significant for both methodologies. The point estimate is -\$0.009 per \$1 of loan guaranteed, meaning that on an annualized basis, Freddie Mac provided a guarantee

fee subsidy of approximately 20 bps in the pre-crisis period. The evidence shows that in the pre-crisis period, GSEs used their government-backed funding to provide credit risk subsidies to mortgage originators. This finding is consistent with banks' strong preference for selling mortgages to GSEs rather than holding them on their balance sheet.

In the post-GFC period, however, both estimates are positive and highly statistically significant, with point estimates of \$0.012 and \$0.020 for GPME and RAP, respectively. These estimates show that Freddie Mac began to no longer provide a subsidy after the GFC and even began to earn a risk-adjusted profit. After the crisis, Freddie Mac's stricter underwriting guidelines reduced underlying mortgage credit risk while higher guarantee fees boosted revenues. As a result, Freddie Mac incurred minimal losses even during the COVID-19 pandemic, leading to substantial risk-adjusted profits rather than a subsidized cost of credit. GSE's operating expenses are approximately 7 bps (Golding et al., 2023). Although the financial cost of the guarantees seems to be fairly priced, even after paying expenses, these estimates still suggest that GSEs charge an above-market price for their guarantees in the post-crisis period.

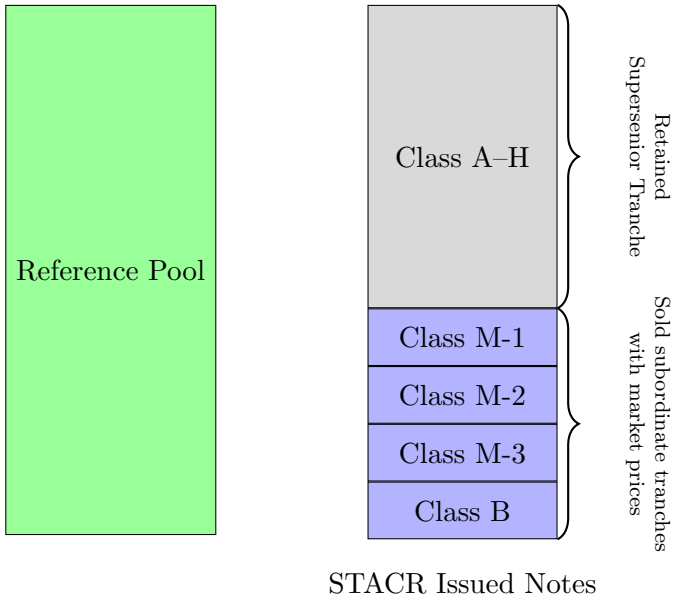
3.2 Valuation Using Market Prices of GSE Reinsurance

There are two potential concerns with the cash flow valuation analysis so far. The first concern is that the market benchmarks used do not fully capture the risk factors needed to form a replicating portfolio of identical risk as the underlying mortgage guarantees. Relatedly, although the realized guarantee cash flows have in-sample default shocks from the GFC and the Covid-19 pandemic, there is a concern that there is still some omitted tail risk because the sample does not have a sufficiently long time series. To address these issues and develop a market price of security with identical risk as the guarantees, I exploit the fact that Freddie Mac sells synthetic securitization tranches that effectively reinsure the underlying mortgage default risk from their guarantee loan book through the Structured Agency Credit Risk (STACR) program. The STACR program began in post-crisis period and allows for an alternative benchmark for the market price of insurance in this period. Figure 1 below illustrates the typical structure of a Freddie Mac STACR deal.

For each STACR transaction, Freddie Mac selects a subset of their guarantee mortgages and

assigns them as assets on the STACR balance sheet. As in a typical mortgage securitization transaction, the securitization vehicle then issues notes with varying seniorities that are "backed" by these mortgages. The most junior tranches – Class M-1, Class M-2, Class-M3, and the first loss Class-B notes – typically absorb the first 5-6% of losses from the reference loan pool in exchange for receiving a coupon to compensate for the potential losses. If the underlying mortgages perform well and do not realize significant losses, then these subordinate notes will pay back their principal and coupon; however, if the mortgage pool realizes enough losses, the notes will begin to be written down in reverse order of seniority.[15] These subordinate tranches are sold to market participants and therefore have traded market prices. Freddie Mac then retains the "supersenior" A-H tranche. The entire transaction is "synthetic" because although Freddie Mac pays the note holders based on the underlying mortgage performance, the mortgages do not actually back the notes, because these mortgages are used as "real" collateral elsewhere in agency MBS.

Figure 1: Freddie Mac STACR capital structure. Left: underlying mortgage pool (green). Right: sold subordinate tranches (light-blue) and retained supersenior (gray).



The economic object of interest from this transaction is the market value of expected losses on the underlying mortgage pool. When annualized, this measure corresponds to the

[15] In contrast, the most senior tranches receive principal payment first, and the subordinate note holders are the last to have principal repaid, meaning that the subordinate tranches are less affected by prepayment and have a longer effective maturity than the underlying mortgages.

fair market price to insure the pool from default risk.[16] The market price of insurance can then be directly compared to what Freddie Mac actually charges to insure these mortgages through their guarantee fees.

Although the subordinate notes that are sold to market participants only represent around 5% of the principal balance of the total underlying mortgage pool, they bear most of the expected losses because they are the junior claimholders. The sum of the market prices of these tranches, therefore, provides a nearly complete picture of the market value of expected losses for the underlying mortgage pools. However, what is still needed is a market price of the retained supersenior tranche, which is not sold to market participants.

I handle the market price of the supersenior tranche in two ways. First, I compute the market value of expected losses using the simplistic assumption that the expected losses on the supersenior tranche are negligible and completely absorbed by the subordinate tranches.[17] Second, I estimate a structural model of default risk such that the model exactly prices the subordinate tranches correctly, providing a market price of the supersenior tranche and therefore the total market value of expected losses. Because the underlying assets of the securitization are loans, I follow the model in the Nagel and Purnanandam (2020), which modifies Merton (1974) to account for the case when firm assets are loans. Intuitively, even if there is enough tail risk that the supersenior tranche is not risk free, the subordinate tranches are first exposed to losses, meaning that they help put a bound on the market price of the tranches and the structural model provides discipline by constraining the distribution of losses across tranches based on their seniority in the capital structure.

3.2.1 Default Free Supersenior Tranche Implementation

First, I describe how I compute the market value of expected losses in the case when I assume that the supersenior tranche is default-free. The STACRs notes each promise a coupon at a spread over the 1M LIBOR rate. Therefore, to back out the market price of the

[16] To see this, a fairly price insurance contract requires that the PV of insurance premiums plus the market value of expected losses equals zero.

[17] Golding and Lucas (2022) takes a similar approach to analyzing CRT transactions by taking a weighted average of the tranche spreads and making different assumptions about the A-H tranche spread.

expected losses, I subtract the PV of the expected coupon spread.[18] With the market prices of expected loss for each tranche, I simply add them and annualize them using an expected weighted average maturity of 5 years to arrive at the fair market price of insurance.[19] For some STACRs deals, Freddie Mac retains a small slice (around 0.5% of the loan pool) of superjunior Class-B notes, for which I do not have a market price. When this is the case, I make the very conservative assumption that this superjunior tranche is always completely wiped out and therefore has an expected loss of 100%.

3.2.2 Structural Default Risk Implementation

Turning to the structural default risk estimation, I build on the "single cohort" model framework of Nagel and Purnanandam (2020).[20] In their model, the payoff of an individual loan, L_T^i, with maturity T is written as a short put option on some underlying collateral, A_T^i, with a strike price of the promised face value of the loan F_T^1 due at maturity:

$$L_T^i = min[A_T^i, F_T^1]. \tag{6}$$

The collateral value underlying each loan, A_T^i, follows a geometric Brownian motion with a Vasicek (1991) systematic shock to all borrowers as well as an idiosyncratic shock:

$$\frac{dA_t^i}{A_t^i} = r\,dt + \sigma\left(\sqrt{\rho}\,dW_t + \sqrt{1-\rho}\,dZ_t^i\right). \tag{7}$$

The total loan pool value L_T payoff across individual loans at maturity can then be computed by integrating over all borrowers i and across different realizations of Brownian motion shocks.

[18] I estimate the PV of the expected coupon spread using the hazard rate continuous time approximation:

$$c\int_0^T e^{-(r+\lambda)\,t}\,dt = c\,\frac{1-e^{-(r+\lambda)T}}{r+\lambda}\,. \tag{5}$$

I take $\lambda = spread/0.6$ given the average LGD of mortgage defaults of 40% and assume a maturity of 10 years. A risk-free floating bond that pays the risk-free rate coupon rate should trade at par value, meaning that the price after stripping out the value of the expected coupon spread will equal par value minus the price of the expected losses.

[19] This is similar to the realized weighted average maturity of 4.2 years from the cash flow data

[20] In general, they model banks' assets as consisting of multiple cohorts of loans with varying vintages and maturities. A securitization balance sheet consisting of loans originated at the same point in time with the same maturity corresponds to the special single-cohort case.

Let F_T^2 denote the total promised amount of the loan pool. At maturity, the fraction of realized loan losses as a fraction of the total promised loan pool can be written as:

$$Loss_T = (L_T - F_T^2)/F_T^2 \tag{8}$$

This loss rate is needed to determine the payoffs to the subordinate tranches sold to market participants by Freddie Mac. The key feature of the subordinate tranches is that they have an initial attachment point and a detachment point, which determine when they begin to absorb losses and when they stop covering a given level of losses. For instance, a tranche with a 0% attachment point and 1% detachment point is a first-loss piece, meaning that the first dollar of losses on the loan pool is borne by this tranche. The principal balance of this tranche would be (d-a) = \$0.01 on a \$1 loan pool and is completely written down if loan payoffs fall below 99% of the promised loan amount $L_T < (1 - .01) * F_T^2$. Likewise, a tranche with a 1% attachment point and 3% detachment point does not take any losses until the first loss piece below it is exhausted, but only takes the next 2% of losses up to the point where $L_T < (1 - .03) * F_T^2$. The principal balance of this tranche would be \$0.02 on a \$1 pool. Each subordinate tranche pays a coupon of y on its principal balance; however, the principal balance is written down as the underlying losses on the loans grow.

The total payoff to a tranche that attaches at a and detaches at d at maturity T can be written as follows:[21]

$$Tranche_T^{a,d} = (d - a) * exp(y * T) * (1 + min[Loss_T + a, (d - a)]). \tag{9}$$

This equation states that if the tranche is responsible for no credit enhancement losses, it simply pays the coupon on the tranche principal balance. If the loss ratio exceeds the detachment point d level of credit enhancement offered, then the tranche is completely wiped out. If the level of $Loss_T$ lies between a and d, then the tranche is paid a fraction of its principal and coupons. The present value of the tranche at the time of origination is computed

[21] An alternative approach is to model the loans and tranches as paying only the risk-free rate and to the coupons out of the market price prices of the tranches following the approach in the previous section. I find similar results with this approach.

by taking the risk-neutral expectation and discounting back to the present with $exp(-rT)$:

$$Tranche_0^{a,d} = exp(-r * T) * E^{\mathbb{Q}}[Tranche_T^{a,d}]. \tag{10}$$

To estimate the model, the initial market value of collateral A_0 and σ are key parameters that determine the distribution of the underlying collateral value and pin down the market prices of the tranches. To solve for these two unknowns, I estimate the model so that it correctly prices the most senior subordinate tranche and the most junior tranche for each STACR using the pricing data from TRACE just after the transactions are offered.[22] For the other model parameters, I normalize the total book value of the loans to \$1, assume a ρ of 0.3, use the 10-year Treasury bond as the risk-free rate in the model, and assume that the mortgages pay a 1% spread over the 10-year Treasury bond.[23] Because the model abstracts away from loan prepayment, I assume a maturity of 10 years, which is the typical weighted average life (WAL) of the junior tranches as described in the STACR prospectuses.[24] Although the underlying loan pool will have a shorter WAL than these junior tranches (since subordinate tranches' principal balances are repaid last), this modeling approach has the advantage of pricing default risk while still capturing prepayment effects indirectly. Specifically, when loans prepay faster, the total default risk of the portfolio decreases as loans exit the pool before potential defaults can occur. The structural model implicitly accounts for this relationship because it must generate a default risk distribution that correctly prices the observed market values of all tranches simultaneously. This estimation inherently incorporates market expectations about how prepayments affect the timing and magnitude of potential losses. Finally, after computing the model's market value of expected losses of the loan portfolio, I still annualize it using the shorter average 4.2 WAL of the loan pool that I find in the data, as shown in Table 1.

[22]Unlike in the risk-free supersenior case, I do not have to make assumptions of how to strip out the value of expected coupons, because those payoffs are path dependent within the model. Therefore, I can directly match the raw TRACE prices to the model-implied tranche prices.

[23]On average, mortgage rates are around 1.5% higher than the 10-year Treasury bond. In terms of the promised payoffs of the securitization, however, 35 bps and 60 bps of guarantee fee are subtracted from the mortgage note rates. Taking 1% is therefore a close approximation of the interest due from the loans to note holders.

[24]For example, see: https://capitalmarkets.freddiemac.com/crt/docs/legal-documents/stacr/series-2016-dna1/16_dna1_0720281sto.pdf.

3.2.3 Reinsurance Valuation Results

Table 5 presents the results from this exercise. Panel A contains the results on the approach when assuming that the supersenior tranche is default-free and that any nontraded superjunior tranches experience a 100% loss. The average actual guarantee fee that Freddie Mac charges at the time when these STACR transactions are issued is 56 bps. Using the approach above, I find that the market value of expected losses implied a guarantee fee of only 22 bps, which suggests that Freddie Mac charges more than 35 bps annually compared to what market participants require to hold the same risk.

Panel B presents the estimates from the structural default risk model. I find that the estimated model parameters, the market value of collateral, and the volatility of the collateral are on average \$1.35 and 5% across the STACR transactions, respectively. Unlike the previous case, these estimates explicitly account for the risky and expected losses faced by any nontraded tranches by matching the prices of the traded tranches. The model finds that a market participant requires 29 bps annually to compensate for the market value of expected losses from the loan pool. Even with this more conservative estimate, it implies that the guarantee rates that Freddie Mac charges are roughly double what a market participant would charge to hold a security of identical risk. Figure 4 plots the actual guarantee fees versus the market rate guarantee fees over the sample period of STACR transactions. Comparing these estimates to the previous cash flow valuation exercise in Table 4 implies very similar estimates. Annualizing the post-crisis PV(GSE Guarantee) of \$ 0.012 from the GPME with a WAL of 4.2 indicates that Freddie Mac overcharges by 29 bps.

Taken together, these findings further reinforce the interpretation that the GSEs charge an above-market price for their credit risk insurance in the post-GFC period and illustrate that actual market participants are willing to bear this risk and even pay a lower price for it.

3.3 Reduced Form Evidence From The Conforming Loan Limit

To supplement the cash flow valuation, I also present reduced-form evidence consistent with the GSEs earning a higher risk-adjusted profit on their mortgage guarantees during the post-GFC period. In particular, I examine lender selling behavior and loan pricing

around the conforming loan limit, which is a key institutional feature in GSE-based mortgage securitization. Each year, Fannie Mae and Freddie Mac set a maximum loan limit, which may vary by county, on the size of the mortgages they are allowed to purchase and insure.

After originating a mortgage, banks usually face three primary options for financing the mortgages. The first option is that they could simply retain the mortgage on their balance sheet. The second option is that they could privately securitize the mortgage into a MBS. The third option is that banks could sell the mortgages to one of the GSEs, paying a guarantee fee and, in exchange, receiving an MBS that is free from credit risk (or receiving an equivalent cash amount via the cash window). Because GSE securitization is not an option above the conforming loan limit, the discontinuity around it provides insight into the cost of financing mortgages using balance sheet financing / private securitization versus GSE securitization.

This conforming loan limit generates multiple testable implications related to the valuation and pricing of the GSE mortgage guarantees. First, if GSE securitization offers a subsidy, then all else equal, nonconforming loans will be more expensive and require higher loan rates. Conversely, if GSEs earn an economic profit and charge an above-market price for insuring credit risk, this could raise the financing cost of obtaining a conforming mortgage as compared to a jumbo mortgage. Second, if GSEs offer a subsidy or other advantage over balance-sheet financing, there will be a strong incentive for borrowers and lenders to bunch just below the conforming loan limit. Third, if GSEs increase the pricing of their guarantees and charge higher premiums, lenders will find it relatively more profitable not to sell to GSEs and instead retain mortgages or privately securitize them.

Jumbo - Conforming Mortgage Spread

To test the first prediction, I examine the relative pricing of conforming and nonconforming mortgages in the post-GFC period using the most recent HMDA data covering mortgages in 2018 and 2019.[25] Importantly, unlike the older version of HMDA data, the new version contains information on mortgage interest rates, which are needed to estimate the spread

[25]In this baseline analysis, I exclude the COVID-19 crisis period in 2020-2022. Figure A4 in the Appendix documents the nonconforming spread over 2009 - 2022 by combining estimates from both the MIRS and HMDA datasets. I also include the time series of spread separately for banks and nonbanks when the data is available, beginning in 2018. The spread becomes zero again in 2020/2021, consistent with lender financial constraints due to the stress from the COVID pandemic, making it relatively more difficult to finance loans on the balance sheet, but becomes negative again in 2022.

between jumbo and conforming mortgages. Traditionally, research has found that jumbo loans have higher interest rates than conforming mortgages, suggesting that GSEs offer a subsidy to borrowers (e.g., Passmore et al. (2005)). After the hike in Fannie and Freddie's insurance premiums, as shown in Figure 3, it is not clear that this spread should remain positive in the post-GFC period.

To estimate the spread between nonconforming and conforming mortgages, I begin by implementing a regression discontinuity design around the conforming loan limit, above which GSEs cannot insure/securitize mortgages (DeFusco and Paciorek, 2017; Fisher et al., 2021). I use a bandwidth of loan amounts $50,000 above and below the conforming limit in all specifications.[26]

Figure 5 plots the loan interest rates around each side of the conforming loan limit cutoff. The figure shows a sharp decline in rates for mortgages with loan sizes just on the other side of the conforming loan limit in the post-GFC period. Table 6 tabulates these results, finding that jumbo loans are cheaper by 20 bps points on average, even when controlling for differences in loan-to-value, debt-to-income, closing costs, census tract fixed effects, and time fixed effects. This finding that jumbo loans are cheaper than conforming loans in the post-GFC period corroborates the earlier finding that Fannie Mae earns statistically and economically significant risk-adjusted returns on their loan guarantees and that their guarantee fees are overpriced.

In Figure 7, I use the same procedure to estimate a time series of the nonconforming-conforming spread from 2009 to 2018 using the survey MIRS data from FHFA. I also plot the time series of the NPV of the Fannie Guarantee cash flows using the RAP methodology. The figure shows a strong inverse relationship between the valuation of the guarantee cash flows and the jumbo-conforming spread. Prior to 2014, conforming mortgages were more expensive than nonconforming mortgages. This relationship inverted in 2014, around the same time that GSEs increased their premiums and the valuation of the guarantees increased (see Figure 3). The guarantee values and spread also shrank together in 2016 and 2017, when GSEs slightly reduced their premiums. This evidence further suggests that the pricing and

[26]This cutoff corresponds closely to the optimal bandwidths estimated by using the methods of Calonico, Cattaneo, and Titiunik (2014). I also use a simple linear polynomial on both sides of the cutoff, which is the optimal polynomial estimated by the methods in Calonico et al. (2014).

valuation of GSE mortgage guarantees are related to the relative pricing of conforming and nonconforming loans.

Does this negative spread mean that the GSE insurance pricing is related to the market-funding costs required for financing and holding the loan on a balance sheet? To test this, I exploit a feature of the recently updated HMDA dataset, which separately identifies bank and non-bank originators in the micro-data. Therefore, I can separately estimate the nonconforming-conforming loan spread for banks and non-banks. If banks can access market funding to finance loans at market-risk rates via balance sheet financing, then the nonconforming spread should be more pronounced for banks relative to non-banks originators who face balance sheet constraints limiting their ability to finance loans without relying on GSEs.[27]

Panel A of Table 7 presents the results. There is a negative jumbo-conforming spread of around 18-28 bps for the subsample of banks. This is further consistent with GSE insurance pricing exceeding market price of risk and that banks can access that market price by funding the loans on balance sheet. Further, the gap in the jumbo-conforming spread for non-bank originators is smaller at around 10 bps.[28] This finding is consistent with nonbanks facing relatively stronger balance sheet constraints for retaining loans (Buchak et al., 2018a).

A concern with this analysis so far is that loan size and, therefore, whether a borrower takes out a jumbo or conforming loan is a choice determined by the borrower. A regression discontinuity design using the loan amount as the running variable is potentially problematic because of the lack of a smooth distribution around the cutoff. To address this concern, I follow Kaufman (2014) and use an alternative RDD approach to instrument for whether or not a loan is jumbo. In particular, these papers exploit the fact that borrowers cannot control their home appraisal values, and whether the value comes in at or below an 80% LTV of the desired loan amount determines if a bank is willing to hold the loan on the balance sheet as a jumbo loan. To implement an RDD design with this alternative cutoff, they define the 'appraisal limit' as the conforming loan limit divided by 0.80. In this setting, the running

[27] In the post-GFC period the private jumbo securitization market was fairly illiquid meaning that balance sheet retention rather than private securitization was the more prominent alternative at the time (e.g, see Buchak et al. (2018a), Fuster, Hizmo, Lambie-Hanson, Vickery, and Willen (2021))

[28] Figure A3 in the Appendix plots the rates across the conforming loan limit for both types of lenders.

variable is the home's appraisal value minus the appraisal limit.[29] If a home appraisal value comes in at just below the appraisal limit, the borrower can obtain a conforming loan with less than a 20% down payment, but to qualify for a balance sheet loan, they would have to take a smaller loan. Just above the appraisal limit, a borrower can get a jumbo mortgage with exactly a 20% down payment and even reduce their desired loan amount. However, above the appraisal limit, the borrower must put down more than 20% in order to qualify for a conforming mortgage. For this reason, it is likely that home appraisal values above the appraisal limit are more likely to be jumbo loans.

Figure 6 plots the probability that a loan is jumbo and the interest rate spread around the appraisal limit. In this test, I start by only examining loans originated by banks, because they have balance sheet capacity to retain jumbo loans, unlike nonbanks (e.g., see Buchak et al. (2018a)). Panel A plots the first stage of whether the appraisal limit cutoff is empirically relevant for whether a bank loan is jumbo or conforming in the post-GFC period. The figure shows a sharp and discontinuous increase in the probability that a loan is jumbo above the appraisal limit, in line with the first stage found by Kaufman (2014) in the pre-GFC period. However, unlike the pre-crisis, Panel B shows that the interest rates are discontinuously lower above the appraisal limit. In Table 7, Panel B tabulates this reduced form result as well as the 2SLS estimate, which shows that instrumented jumbo loans have 13 bps lower interest rate spreads. The magnitude of this estimate is similar to the previous conforming loan limit RDD approach and reaffirms the interpretation that the guarantee fee overpricing affects the cost of mortgages.

In contrast with banks, Table 7 shows that nonbanks originators exhibit a positive jumbo-conforming spread when using the 2SLS instrumented value of jumbo. This finding reinforces the view that even if GSEs charge an above-market rate for credit risk insurance, the limited balance sheet capacity of nonbanks prevents them from accessing any cheaper type of financing.

Bank GSE Selling Behavior and Bunching

[29]Table A2 in the Appendix plots the kernel density for the loan amount around the conforming loan limit versus the kernel density of the loan appraisal value around the appraisal limit. The figure shows that although the distribution around the conforming loan limit exhibits bunching, the distribution around the appraisal limit does not.

I next complement the documented loan price effects with evidence on quantities. If Fannie Mae overcharges for mortgage guarantees relative to its market price, do banks reduce their use of GSEs because of these increased costs? An above-market price for GSEs to insure the credit risk implies that banks would be relatively better off retaining the mortgages on their balance sheet or privately securitizing them using market-based funding. I examine how the increased Fannie Mae guarantee pricing affects this choice by studying a bank's decision to sell mortgages to GSEs. When a bank uses one of the GSEs for mortgage guarantees, typically, banks swap their credit-risky mortgages for insured MBS after paying a guarantee fee to the GSE. I refer to this transaction as a mortgage sale to GSEs because the GSE acquires the underlying mortgages and bears any associated credit risk.

I, therefore, study the probability that banks sell their mortgages to GSEs relative to balance-sheet retention or private securitization. Because non-banks have relatively limited options to retain loans on their balance sheets and difficulty relying on illiquid jumbo securitization markets (e.g., see Buchak et al. (2018a) Fuster et al. (2021)), I examine the change in the probability that banks, compared to nonbanks, sell their mortgages to GSEs around the guarantee fee increase and nonconforming spread inversion in 2014.

Table 8 presents the results. Following the non-conforming spread inversion, banks are 20-30 pp less likely to sell their loans to GSEs compared to nonbanks. The 30 pp decline in probability represents an approximate 60% decline relative to the unconditional probability of banks selling loans to the GSEs. This reduced selling supports the notion that banks achieve better risk-adjusted profits by holding onto the loans rather than selling them to GSEs using overpriced insurance.

Another directly testable implication is that if GSEs reduce their subsidies/increase their guarantee pricing, mortgages should bunch less around the conforming limit. I test this implication in Figure 9, which plots the distribution of loans around the conforming loan limit before (2009-2013) and after (2015-2017) the conforming-nonconforming loan spread inversion in 2014. The figure shows strong bunching behavior at the conforming loan limit, indicating that there is something valuable that borrowers/lenders find about selling mortgages to the GSEs. After the inversion of the nonconforming spread, bunching at the limit decreases from 15% of the distribution to 12%, consistent with a lower subsidy provided. Surprisingly, the

post-inversion period still exhibits significant bunching despite the higher guarantee pricing and the lower fraction of loan sales to GSES.

I further investigate this post-inversion bunching in Figure A3. In particular, I break out this histogram into subsamples of mortgages that are retained by their lender at origination. Panel B of this figure shows that although there is significant bunching in the post-inversion period, loans are far more likely to be retained on the balance sheet in the year of origination than mortgages in the pre-inversion period.

4 Conclusion

This paper investigates whether government-sponsored enterprises (GSEs) subsidize the credit risk of conventional residential mortgages. Using a novel dataset of Freddie Mac's guarantee cash flows from 1999 to 2018 and comparing them against publicly traded benchmarks, I uncover several findings. First, I show that GSEs provide a credit risk subsidy during the pre-GFC period on the order of magnitude of 20 bps annually. Second, GSEs do not provide a subsidy after the GFC and instead earn positively and economically significant profits on their guarantees, consistent with higher guarantee fees and stricter post-crisis underwriting standards. Third, although banks do reduce their reliance on GSEs in response to the above-market pricing of guarantees, they continue to sell a substantial share of their loans to GSEs. These results challenge the view that lenders use GSEs primarily to access subsidized pricing and instead imply that lenders value using GSEs for reasons other than government-subsidized funding costs in the post-crisis period.

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Figure 2: Average Guarantee Net Cash Flow by Horizon

Figure 2 plots the average net cash flow distribution of the GSE guarantees by years since the loan was originated.

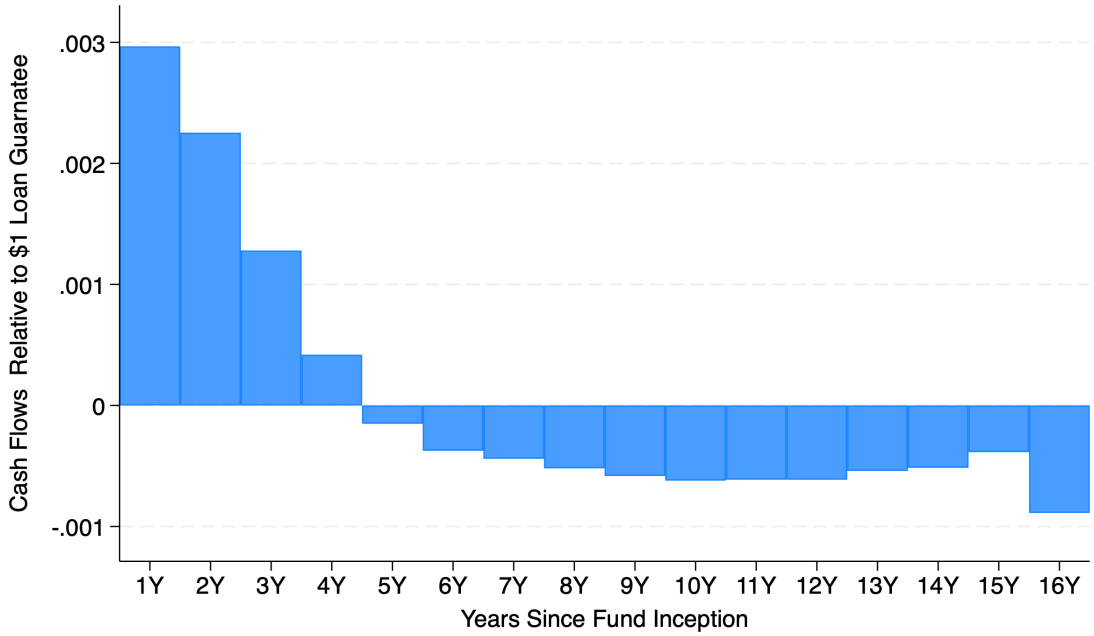


Figure 3: Freddie Mac Guarantee Fees over Time

Figure 3 plots Freddie Mac's average effective guarantee fees on new mortgage originations over time in basis points.

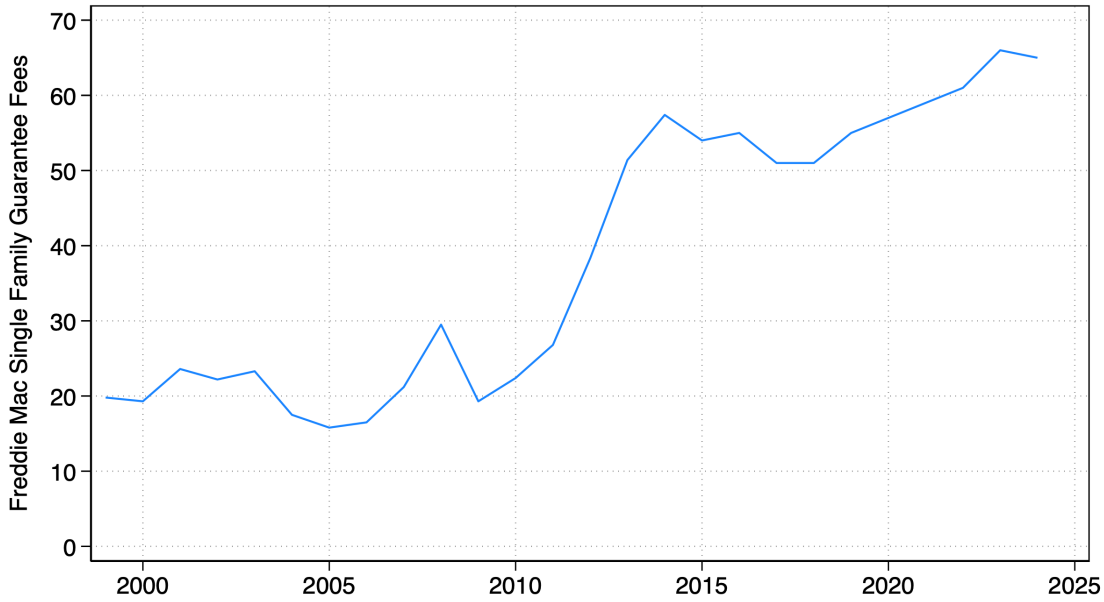


Figure 4: Actual G-fees and Market Implied G-fees

Figure 4 reports the market rate guarantee fees from estimating the Nagel and Purnanandam (2020) model to match the market prices of the junior subordinate and senior subordinate Freddie Mac STACR tranches. The figure reports time series averages of Freddie Mac's actual g-fees in a given year that a STACR deal was originated versus the market rate guarantee fees. All estimates are reported in basis points.

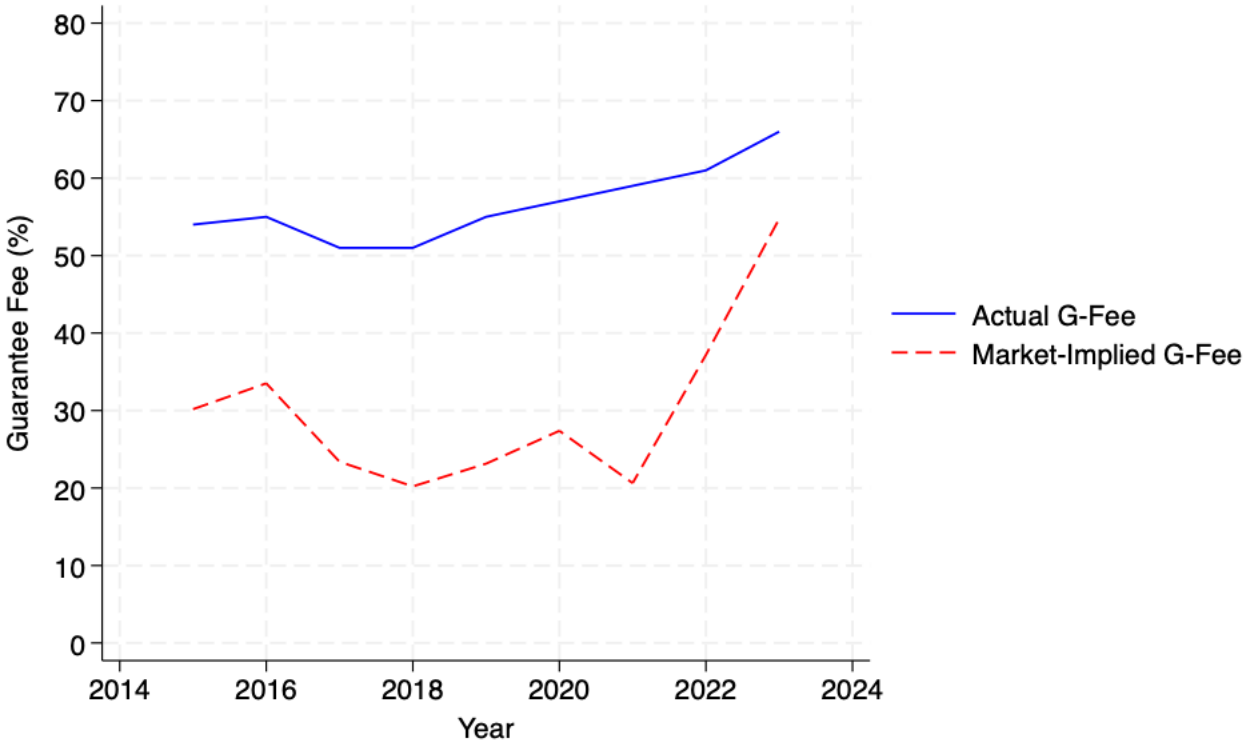


Figure 5: Jumbo-Conforming Loan Spread

Figure 5 plots the discontinuity in the mortgage interest rates around the conforming loan limit using 2018-2019 HMDA data.

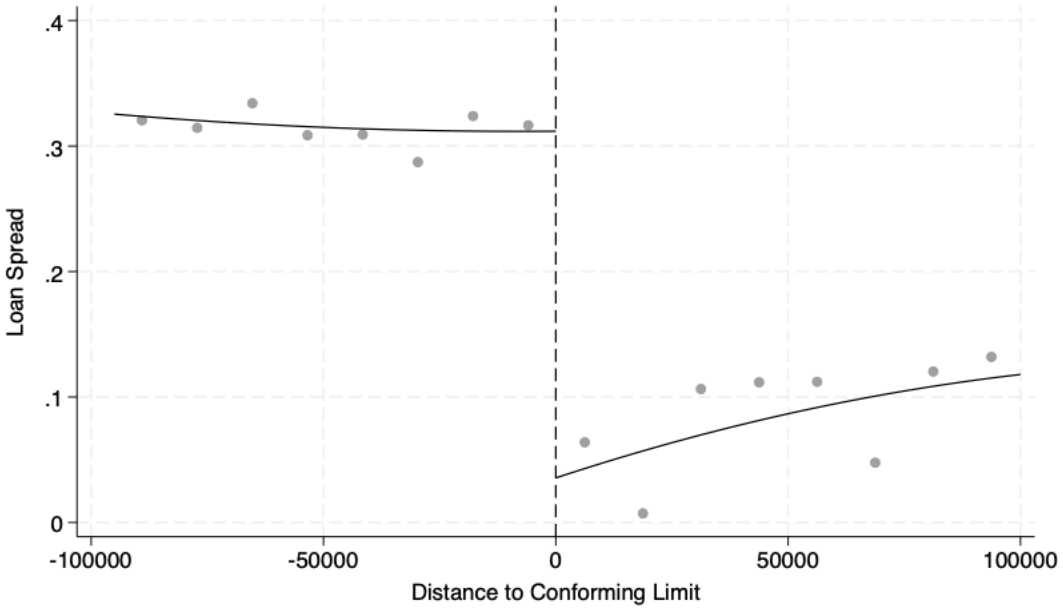
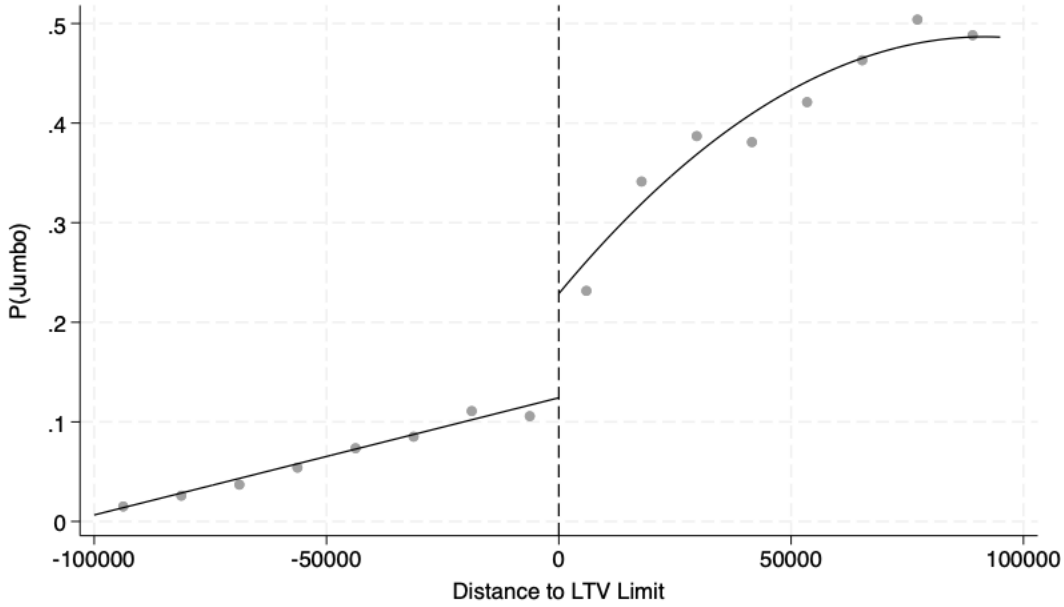


Figure 6: Instrumented RDD: Jumbo-Conforming Loan Spread

Figure 6 plots the conforming-nonconforming spread for bank-originated mortgages using a regression discontinuity design following DeFusco and Paciorek (2017) using the 80% LTV cutoff as an instrument for whether a loan is nonconforming/jumbo. The x-axis running variable is the home appraisal value minus the conforming loan limit divided by 0.80. Panel A plots the probability that a loan is jumbo around the appraisal LTV cutoff, which corresponds to the first stage of the IV regression.. Panel B plots the mortgage interest rate spread around the appraisal LTV cutoff, which corresponds to the reduced form of the IV regression.

(a) Panel A: First Stage



(b) Panel B: Second Stage

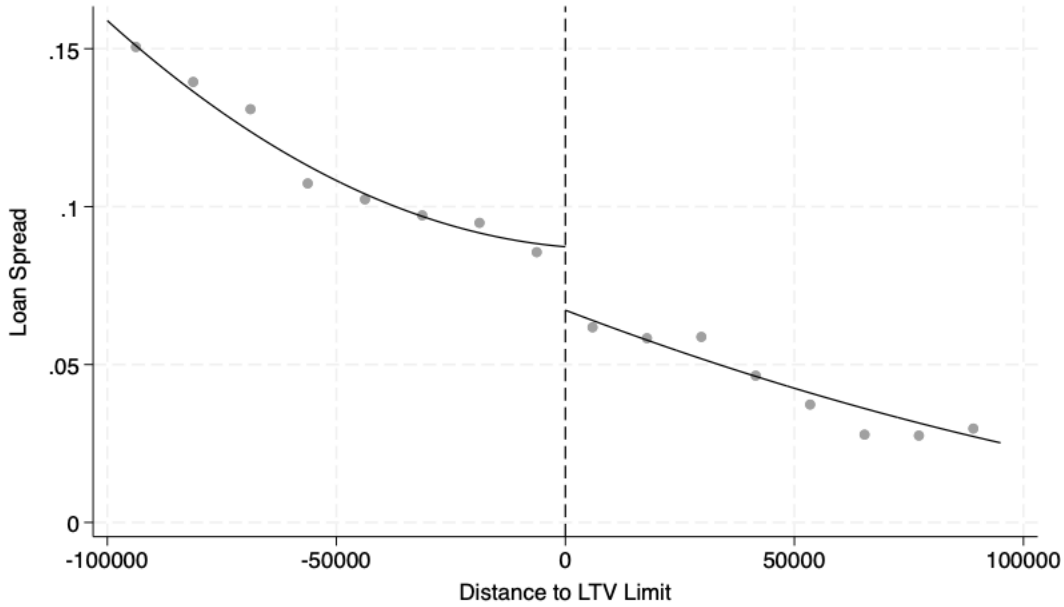


Figure 7: Nonconforming Spread and PV(GSE Guarantees)

This figure plots the time series of the valuation of the guarantee cash flows using RAP for discounting versus the time series of the estimated jumbo-conforming loan spread from 2009 to 2018.

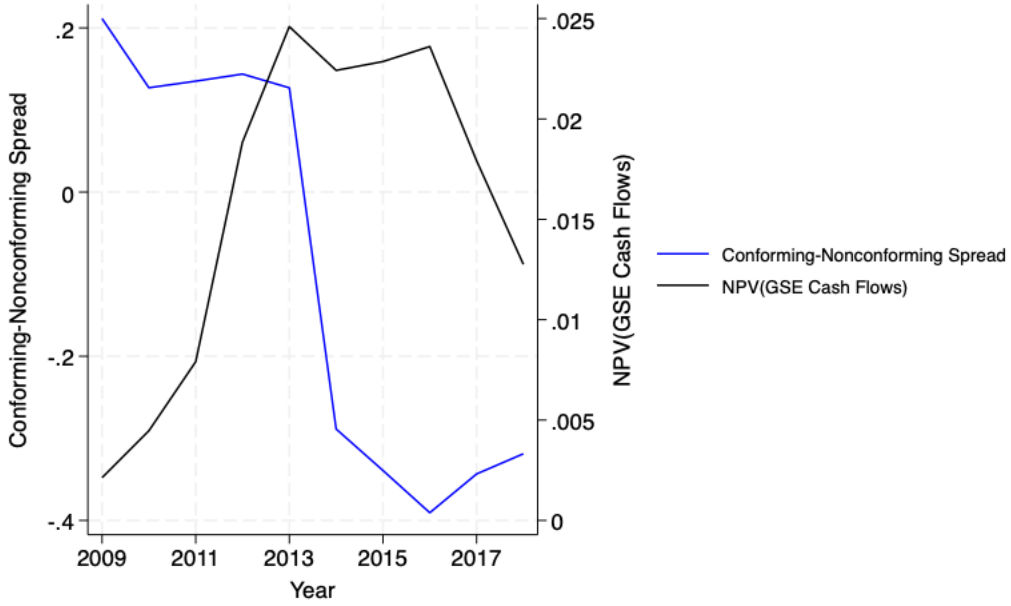


Figure 8: GSE Sold and Non-Sold Bunching

This histogram plots the distribution of loan amounts around the conforming loan limit for loans before (2009 - 2013) and after (2015 - 2017) the inversion of the conforming-nonconforming loan spread using the 2009-2017 HMDA dataset.

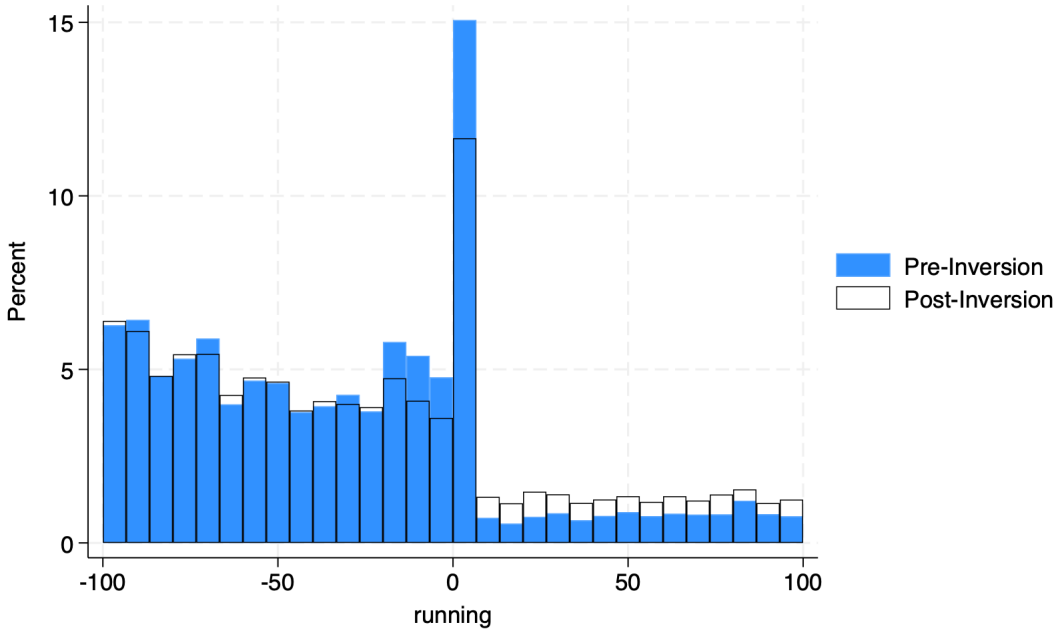
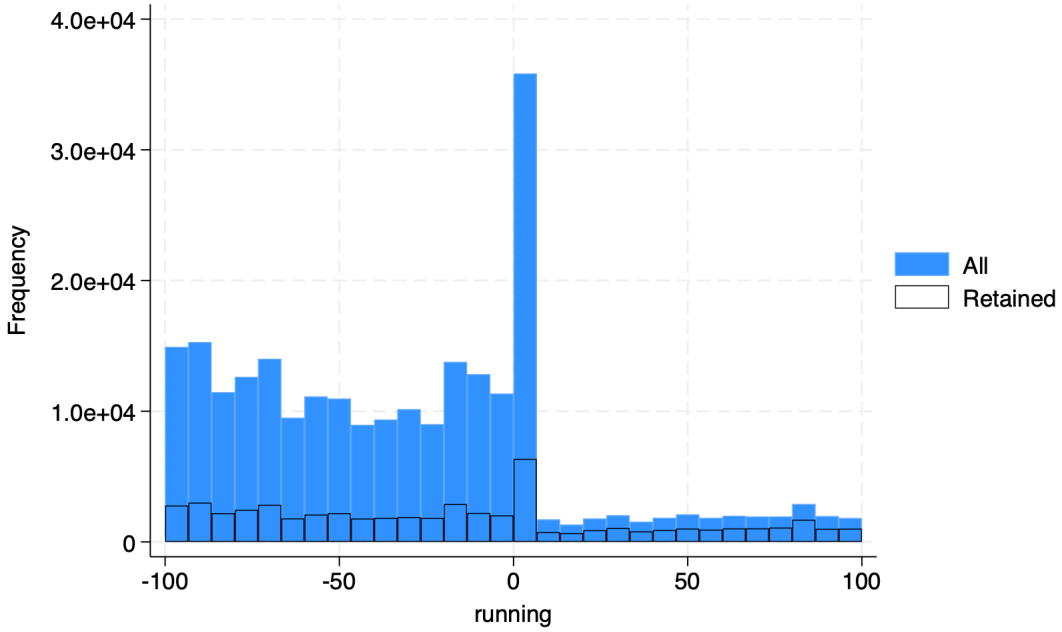


Figure 9: Bunching and Loan Retention

These histograms plot the distribution of loan amounts around the conforming loan limit for all bank loans, as well as the subset distribution of loans that banks retained on the balance sheet.

(a) Panel A: Pre-inversion (2009-2013)



(b) Panel B: Post-inversion (2015-2017)

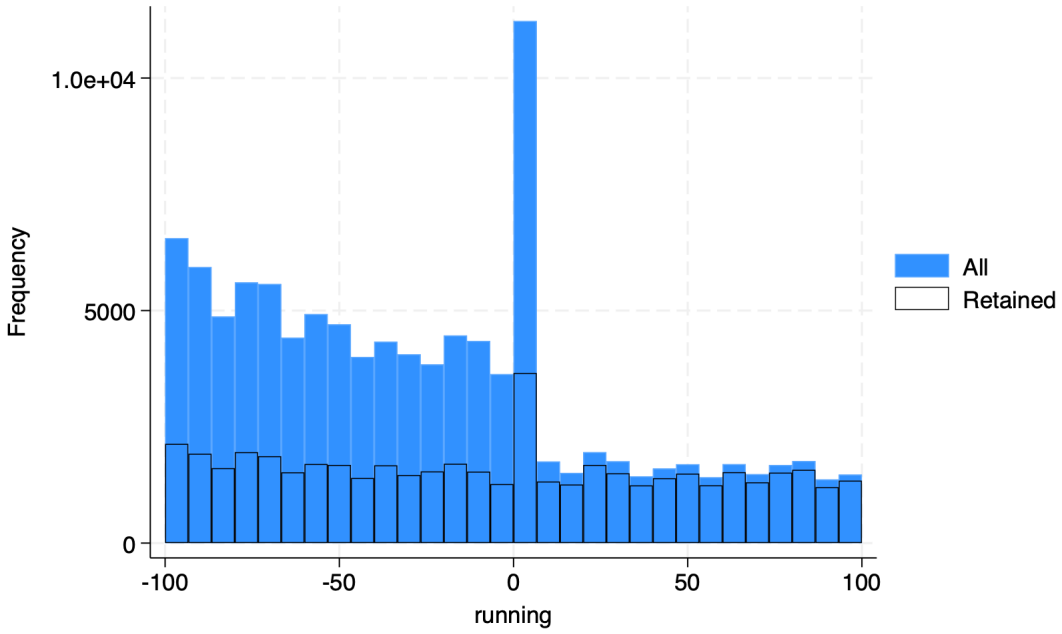


Table 1: Cash Flow Summary Statistics

Table 1 reports summary statistics for the loan guarantee cash flows. 'Weighted Average Life' is the length of years of the average outstanding principal balance of the loans that Fannie insures. 'Total Cash Back' is the raw amount of cash flows that Freddie Mac received from insuring loans that were originated in a given quarter. 'Guarantee Fee' is the average guarantee fee on new mortgage originations in a given quarter. 'Risk-Free Dollar PV' is the present value in dollar terms ($ millions) of the GSE guarantees computed using the term structure of risk-free rates. 'Risk-Free PV' is the present value per $1 of mortgage guaranteed.

	Mean	SD	Min	P25	P50	P75	Max	N
Total Loan Principal Guaranteed ($ Billions)	63.05	28.70	17.94	47.21	58.18	72.50	171.48	80
Weighted Average Life	4.18	1.08	1.84	3.58	4.37	4.89	6.19	80
Total Cash Back ($ Billions)	0.13	1.47	-4.88	0.01	0.40	1.00	2.62	80
Guarantee Fee (bps)	31.77	15.03	15.80	19.55	23.45	51.00	57.40	80
Risk-Free PV	0.004	0.02	-0.050	0.002	0.006	0.018	0.029	80
Risk-Free Dollar PV	263	1154.65	-3377	49	408	963	2505	80

Table 2: Value of GSE Guarantees: GPME

Table 2 estimates the value of the GSE guarantee cash flows using GPME. Panel A presents equal-weighted results, and Panel B presents the value-weighted results using the principal amount of the loan guaranteed as a weight. Columns (1)-(3) estimate the specification using different risk factors, and column (4) estimates an SDF using all three risk factors. The estimated SDF parameters are presented below the table.

Panel A: EW

	PV			
	(1) Stocks	(2) REITs	(3) MREITs	(4) All
PV(GSE Guarantee)	0.001	-0.001	-0.001	-0.000
	(0.002)	(0.003)	(0.003)	(0.003)

Panel B: VW

	PV			
	(1) Stocks	(2) REITs	(3) MREITs	(4) All
PV(GSE Guarantee)	0.000	-0.001	-0.001	-0.000
	(0.002)	(0.003)	(0.003)	(0.002)
$b1$	0.03	0.03	0.00	0.03
$b2$	2.52	1.98	1.14	0.42
$b3$				0.05
$b4$				2.19

Standard errors in parentheses
* $p < .10$, ** $p < .05$, *** $p < .01$

Table 3: Value of GSE Guarantees: RAP

Table 3 reports the risk loadings and corresponding guarantee risk-adjusted valuation from the risk-adjusted profit methodology. Panel A reports the risk loadings for the baseline specification that includes the a_h horizon intercepts for ZCB bonds, Stock (CRSP VW stock returns), MREIT (Nonagency MREIT benchmark returns), and REIT (Nareit REIT benchmark returns). Panel B reports both the total risk-adjusted valuation. Columns (1)-(2) are equal-weighted estimates, and Columns (3)-(4) are value-weighted estimates. The reported risk loadings correspond to the point estimates in Columns (2) and (4) that include all the benchmark returns. Columns (1) and (3) only include the Treasury and stock market benchmarks. Standard errors are in parentheses and computed using a non-parametric block bootstrap procedure.

Panel A: Risk-Loadings

	ZCB	Stock	MREIT	REIT
	(1)	(2)	(3)	(4)
Horizon 1	0.0008***	0.0008***	0.0002	-0.0008***
	(0.0000)	(0.0003)	(0.0003)	(0.0003)
Horizon 2	0.0005***	0.0009***	0.0001	-0.0005**
	(0.0000)	(0.0001)	(0.0002)	(0.0002)
Horizon 3	0.0002**	0.0009***	0.0003	-0.0002
	(0.0001)	(0.0002)	(0.0002)	(0.0002)
Horizon 4	-0.0001	0.0009***	0.0005**	-0.0002
	(0.0001)	(0.0002)	(0.0003)	(0.0003)
Horizon 5	-0.0004***	0.0008***	0.0005*	0.0000
	(0.0001)	(0.0001)	(0.0003)	(0.0005)
Horizon 6	-0.0004***	0.0006***	0.0005*	0.0001
	(0.0001)	(0.0001)	(0.0003)	(0.0004)
Horizon 7	-0.0004***	0.0005***	0.0004**	0.0001
	(0.0001)	(0.0001)	(0.0002)	(0.0003)
Horizon 8	-0.0004***	0.0004***	0.0004**	0.0000
	(0.0001)	(0.0001)	(0.0001)	(0.0002)
Horizon 9	-0.0003***	0.0001**	0.0004***	0.0001
	(0.0001)	(0.0001)	(0.0001)	(0.0002)
Horizon 10	-0.0003***	0.0000	0.0004***	0.0000
	(0.0001)	(0.0001)	(0.0001)	(0.0002)
Horizon 11	-0.0003***	0.0000	0.0004***	-0.0000
	(0.0001)	(0.0000)	(0.0001)	(0.0001)
Horizon 12	-0.0002***	-0.0000	0.0004***	-0.0000
	(0.0000)	(0.0000)	(0.0001)	(0.0001)
Horizon 13	-0.0002***	-0.0000	0.0003***	-0.0000
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Horizon 14	-0.0002***	0.0000	0.0002***	0.0000
	(0.0000)	(0.0000)	(0.0001)	(0.0001)
Horizon 15	-0.0002***	-0.0000	0.0002***	0.0000
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Horizon 16	-0.0004***	-0.0001***	0.0001**	0.0001***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Observations	4217	4217	4217	4217
F-stat p-value	0.000	0.000	0.000	0.000
R^2	0.522	0.522	0.522	0.522

Panel B: Risk-Adjusted Returns Estimates

	EW		VW	
	(1) Stock	(2) Stock + REITs	(3) Stock	(4) Stock + REITs
PV(GSE Guarantee)	0.002	0.002	0.002	0.002
	(0.003)	(0.003)	(0.003)	(0.003)

Standard errors in parentheses
* $p < .10$, ** $p < .05$, *** $p < .01$

Table 4: Value of Guarantees: Pre and Post GFC

Table 4 examines the value-weighted risk-adjusted returns of the GSE mortgage guarantees before and after the GFC using before and after 2010 as a cutoff year. The table presents estimates for both the GPME and Risk-Adjusted Profit methodologies.

	Pre GFC		Post GFC	
GPME				
PV(GSE Guarantee)	-0.009**	(-2.33)	0.012***	(14.78)
Risk-Adjusted Profit				
PV(GSE Guarantee)	-0.009**	(-2.49)	0.020***	(4.57)

t statistics in parentheses
* $p < .10$, ** $p < .05$, *** $p < .01$

Table 5: Market Rate G-Fees from a Structural Credit Estimation

Table 5 estimates the market value of expected losses on GSE mortgages by using the market prices of Freddie Mac STACR reinsurance securitization tranches over 2015-2023. Freddie Mac retains the most senior tranche, so the market price of this tranche must be estimated. Panel A reports estimates when assuming that the most senior tranche is risk-free. Panel B estimates the market value of the most senior tranche (and therefore the expected loan losses) using the Nagel and Purnanandam (2020) model to match to the prices of the junior subordinate and senior subordinate tranches. The model is estimated separately for each STACR deal and the average estimated model parameters, σ and $A0$ are reported. 'Actual Gfee' is the average Freddie Mac GFE on new acquisitions of single-family mortgages in the year in which a CRT deal is issued. Market Rate Gfee is the annualized market value of expected losses using the sum of the market prices of the tranche after removing their coupons. Gfee subsidy is the difference between the actual g-fee and the market-implied g-fee. All estimates are reported in basis points.

Panel A: Risk-Free Most Senior Tranche

	(1) Actual Gfee	(2) Market Rate Gfee	(3) Gfee Gap
Estimate	56.982***	21.809***	35.173***
	(0.443)	(1.020)	(0.996)
Observations	55	55	55

Panel B: Structural Credit Valuation

	(1) Actual Gfee	(2) Market Rate Gfee	(3) Gfee Gap
Estimate	56.982***	28.757***	28.224***
	(0.443)	(1.397)	(1.291)
Observations	55	55	55
$\widehat{\sigma}$		0.05	0.05
$\widehat{A0}$		1.35	1.35

Standard errors in parentheses
* $p < .10$, ** $p < .05$, *** $p < .01$

Table 6: Post-GFC Jumbo-Conforming Spread

Table 6 measures the conforming-nonconforming loan spread using data from the updated HMDA data covering mortgages originated over 2018-2019. The conforming-nonconforming spread is estimated using a regression discontinuity design with a $50,000 bandwidth and linear polynomials on each side of the cutoff. In specified columns, 'Fixed Effects + Controls' include loan-to-value, debt-to-income, loan closing costs, time-fixed effects, and census tract-fixed effects. Data were taken from HMDA.

	(Interest Rate Spread)	
	(1)	(2)
Jumbo	-0.293***	-0.215***
	(-69.37)	(-29.17)
Observations	346388	327054
Fixed Effects + Controls	No	Yes

t statistics in parentheses
* $p < .10$, ** $p < .05$, *** $p < .01$

Table 7: Instrumented Jumbo-Conforming Spread

Table 7 measures the conforming-nonconforming loan spread separately for bank and non-bank originators from the updated HMDA data covering mortgages originated over 2018-2019. Panel A estimates the conforming-nonconforming spread using a regression discontinuity design with the loan amount around the conforming loan limit and a $50,000 bandwidth and linear polynomials on each side of the cutoff. Panel B estimates the conforming-nonconforming spread using a regression discontinuity design following DeFusco and Paciorek (2017) using the home appraisal value around the conforming loan limit divided by 0.80. Appraisal IV is the reduced form regression discontinuity estimate using a $50,000 bandwidth and linear polynomials on each side of the cutoff. $\widehat{Jumbo}$ is the instrumented value of jumbo using the Appraisal IV. In specified columns, 'Fixed Effects + Controls' include loan-to-value, debt-to-income, loan closing costs, time-fixed effects, and tract-fixed effects. Data were taken from HMDA.

Panel A

	Banks		Non-Banks	
	(1)	(2)	(3)	(4)
Jumbo	-0.279***	-0.178***	-0.117***	-0.104***
	(-63.23)	(-35.88)	(-15.45)	(-13.36)
Observations	130302	118638	216086	201139
Fixed Effects + Controls	No	Yes	No	Yes

Panel B

	Banks		Non-Banks	
	(1)	(2)	(3)	(4)
Appraisal IV	-0.015***		0.012***	
	(-3.14)		(2.92)	
$\widehat{Jumbo}$		-0.129***		0.363***
		(-3.14)		(2.91)
Observations	89260	89260	144287	144287
Fixed Effects + Controls	Yes	Yes	Yes	Yes

t statistics in parentheses

* $p < .10$, ** $p < .05$, *** $p < .01$

Table 8: Bank GSE Selling Behavior

Table 8 examines the probability that a mortgage lender sells a loan to the GSEs. 'Non-Conforming Spread Inversion' equals 1 starting in 2014 when the nonconforming loan spread first became negative, as shown in Figure A4. When indicated, columns include time, state, county, and lender fixed effects. Standard errors are clustered at the lender level. Data are taken from a 10% random sample of the HMDA dataset covering loans originated from 2009 to 2017.

	P(Sold to GSE)			
	(1)	(2)	(3)	(4)
Bank Originator	0.163***	0.170***	0.172***	0.000
	(2.71)	(2.96)	(2.96)	(.)
Non-Conforming Spread Inversion	0.196***	0.000	0.000	0.000
	(6.51)	(.)	(.)	(.)
Bank Originator × Non-Conforming Spread Inversion	-0.297***	-0.289***	-0.285***	-0.197***
	(-6.60)	(-6.32)	(-6.30)	(-7.72)
Loan Size		-0.002	-0.017	-0.042**
		(-0.12)	(-1.14)	(-2.48)
Debt Income		-0.008*	-0.008*	-0.005*
		(-1.75)	(-1.72)	(-1.67)
Population			0.000***	0.000***
			(5.93)	(4.95)
Observations	5988927	5585551	5557561	5557105
Time FE	No	Yes	Yes	Yes
State FE	No	No	Yes	No
County FE	No	No	No	Yes
Lender FE	No	No	No	Yes
R^2	0.022	0.025	0.035	0.468

t statistics in parentheses

* $p < .10$, ** $p < .05$, *** $p < .01$

Appendix

A Cash Flow Valuation for Fannie Mae Guarantees

Table A1: Cash Flow Summary Statistics

Table A1 reports summary statistics for Fannie Mae loan guarantee cash flows. 'Weighted Average Life' is the length of years of the average outstanding principal balance of the loans that Fannie insures. 'Total Cash Back' is the raw amount of cash flows that Fannie received from insuring loans that were originated in a given quarter. 'Guarantee Fee' is the average guarantee fee on new mortgage originations in a given quarter. 'Risk-Free Dollar PV' is the present value in dollar terms ($ millions) of the GSE guarantees computed using the term structure of risk-free rates. 'Risk-Free PV' is the present value per $1 of mortgage guaranteed.

	Mean	SD	Min	P25	P50	P75	Max	N
Total Loan Principal Guaranteed ($ Billions)	72.25	37.46	25.34	47.37	63.12	92.77	224.39	76
Weighted Average Life	4.20	1.08	2.05	3.42	4.19	5.02	5.96	76
Total Cash Back ($ Billions)	0.73	1.06	-1.67	0.08	0.71	1.39	3.57	76
Guarantee Fee (bps)	35.09	16.58	19.00	21.50	25.70	57.20	62.90	76
Risk-Free PV	0.008	0.01	-0.027	0.002	0.008	0.020	0.034	76
Risk-Free Dollar PV	733	969.83	-1385	85	682	1336	3436	76

Figure A1: Average Fannie Mae Guarantee Net Cash Flow by Horizon

Figure A1 plots the average net cash flow distribution of the GSE guarantees by years since the loan was originated.

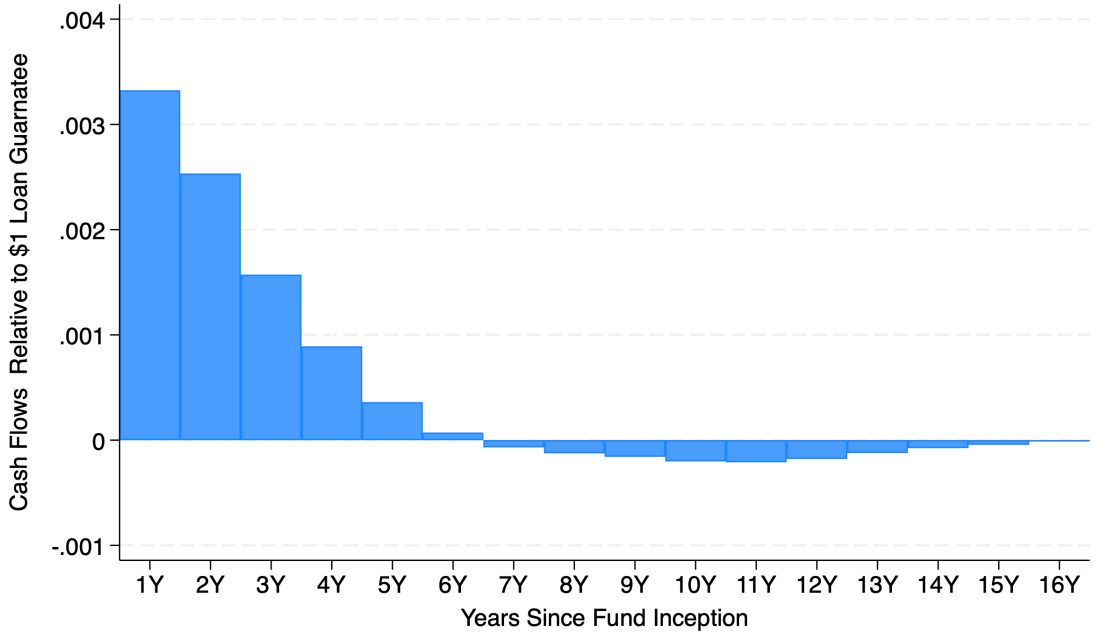


Table A2: Value of Fannie Mae Guarantees: GPME

Table A2 estimates the value of the Fannie Mae guarantee cash flows using GPME. Panel A presents equal weighted results and Panel B presents the value-weighted results using the principal amount of loan guaranteed as a weight. Columns (1)-(3) estimate the specification using different risk factors and column (4) estimate an SDF using all three risk factors. The estimated SDF parameters are presented below the table.

Panel A: EW

	PV			
	(1) Stocks	(2) REITs	(3) MREITs	(4) All
PV(GSE Guarantee)	0.003*	0.004*	0.004*	0.003*
	(0.002)	(0.002)	(0.002)	(0.002)

Panel B: VW

	PV			
	(1) Stocks	(2) REITs	(3) MREITs	(4) All
PV(GSE Guarantee)	0.005***	0.007***	0.007***	0.005***
	(0.001)	(0.002)	(0.002)	(0.001)
$b1$	0.04	0.03	0.00	0.04
$b2$	2.89	1.00	1.19	0.21
$b3$				-0.06
$b4$				2.78

Standard errors in parentheses
* $p < .10$, ** $p < .05$, *** $p < .01$

Table A3: Value of Fannie Mae Guarantees: RAP

Table A3 reports the risk loadings and corresponding Fannie Mae guarantee risk-adjusted valuation from the risk-adjusted profit methodology. Panel A reports the risk loadings for the baseline specification that includes the a_h horizon intercepts for ZCB bonds, Stock (CRSP VW stock returns), MREIT (Nareit MREIT benchmark returns), and REIT (Nareit REIT benchmark returns). Panel B reports both the total risk-adjusted valuation. Columns (1)-(2) are equal-weighted estimates and Columns (3)-(4) are value-weighted estimates. The reported risk loadings coresspond to the point estimates in Columns (2) and (4) that include all the benchmark returns. Columns (1) and (3) only include the Treasury and stock market benchmarks. Standard errors are in parentheses and computed using a non-parametric block bootstrap procedure.

Panel A: Risk-Loadings

	ZCB	Stock	MREIT	REIT
	(1)	(2)	(3)	(4)
Horizon 1	0.0008***	0.0013***	0.0001	-0.0009***
	(0.0000)	(0.0003)	(0.0003)	(0.0003)
Horizon 2	0.0006***	0.0010***	0.0000	-0.0004*
	(0.0001)	(0.0002)	(0.0002)	(0.0002)
Horizon 3	0.0002***	0.0012***	0.0002	-0.0003
	(0.0001)	(0.0002)	(0.0002)	(0.0002)
Horizon 4	-0.0000	0.0012***	0.0004*	-0.0004
	(0.0001)	(0.0002)	(0.0002)	(0.0003)
Horizon 5	-0.0002*	0.0008***	0.0006**	-0.0004
	(0.0001)	(0.0001)	(0.0003)	(0.0003)
Horizon 6	-0.0002**	0.0006***	0.0006***	-0.0003
	(0.0001)	(0.0001)	(0.0002)	(0.0003)
Horizon 7	-0.0002***	0.0004***	0.0004***	-0.0001
	(0.0001)	(0.0001)	(0.0001)	(0.0002)
Horizon 8	-0.0002***	0.0002***	0.0003***	-0.0001
	(0.0000)	(0.0001)	(0.0001)	(0.0001)
Horizon 9	-0.0001***	0.0002**	0.0002***	-0.0001
	(0.0000)	(0.0001)	(0.0001)	(0.0001)
Horizon 10	-0.0001***	0.0001	0.0002***	-0.0001
	(0.0000)	(0.0000)	(0.0001)	(0.0001)
Horizon 11	-0.0001***	0.0000	0.0002***	-0.0000*
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Horizon 12	-0.0001***	0.0000	0.0001***	-0.0000*
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Horizon 13	-0.0000***	0.0000	0.0001***	-0.0000
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Horizon 14	-0.0000***	0.0000	0.0000**	-0.0000
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Horizon 15	-0.0000**	-0.0000	-0.0000	0.0000
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Horizon 16	-0.0000***	0.0000***	-0.0000***	0.0000**
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Observations	3589	3589	3589	3589
F-stat p-value	0.000	0.000	0.000	0.038
R^2	0.579	0.579	0.579	0.579

Panel B: Risk-Adjusted Returns Estimates

	EW		VW	
	(1) Stock	(2) Stock + REITs	(3) Stock	(4) Stock + REITs
PV(GSE Guarantee)	0.008***	0.008***	0.010***	0.010***
	(0.003)	(0.003)	(0.003)	(0.003)

Standard errors in parentheses
* $p < .10$, ** $p < .05$, *** $p < .01$

Table A4: Value of Fannie Mae Guarantees: Pre and Post GFC

Table A4 examines the value-weighted risk-adjusted returns of the GSE mortgage guarantees before and after the GFC using 2010 as a cutoff year. The table presents estimates for both the GPME and Risk-Adjusted Profit methodologies.

	Pre GFC		Post GFC	
GPME				
PV(GSE Guarantee)	-0.001	(-0.67)	0.014***	(15.91)
Risk-Adjusted Profit				
PV(GSE Guarantee)	0.000	(0.07)	0.022***	(5.43)

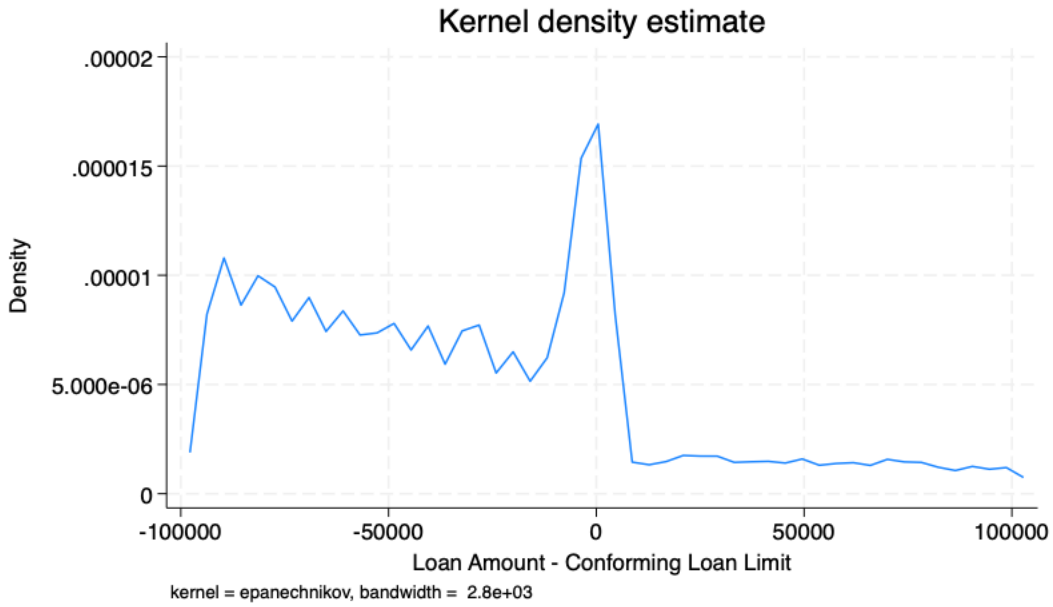
t statistics in parentheses
* $p < .10$, ** $p < .05$, *** $p < .01$

B Additional Jumbo-Conforming Spread Results

Figure A2: RDD Bandwidth Density Distribution

These figures plot the kernel density of the running variables used to estimate the jumbo-conforming loan spread. Panel (A) plots the distribution of the running variable (Loan Amount - Conforming Loan Limit), and Panel (B) plots the distribution of the instrument running variable (Property Value - Conforming Loan Limit/.8).

(a) Panel A: Loan Amount Running Variable



(b) Panel B: Home Appraisal Running Variable

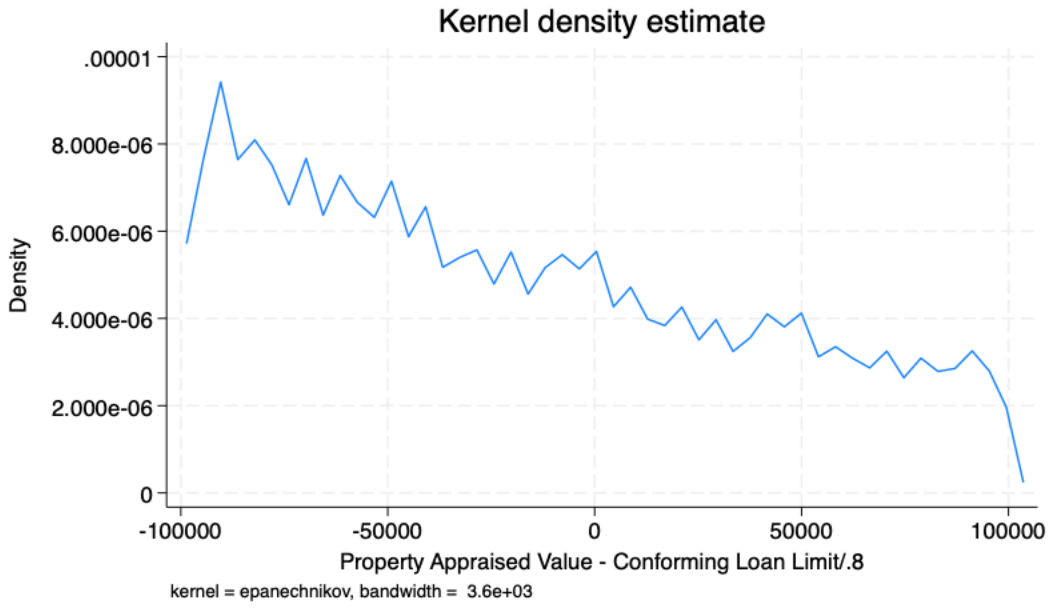
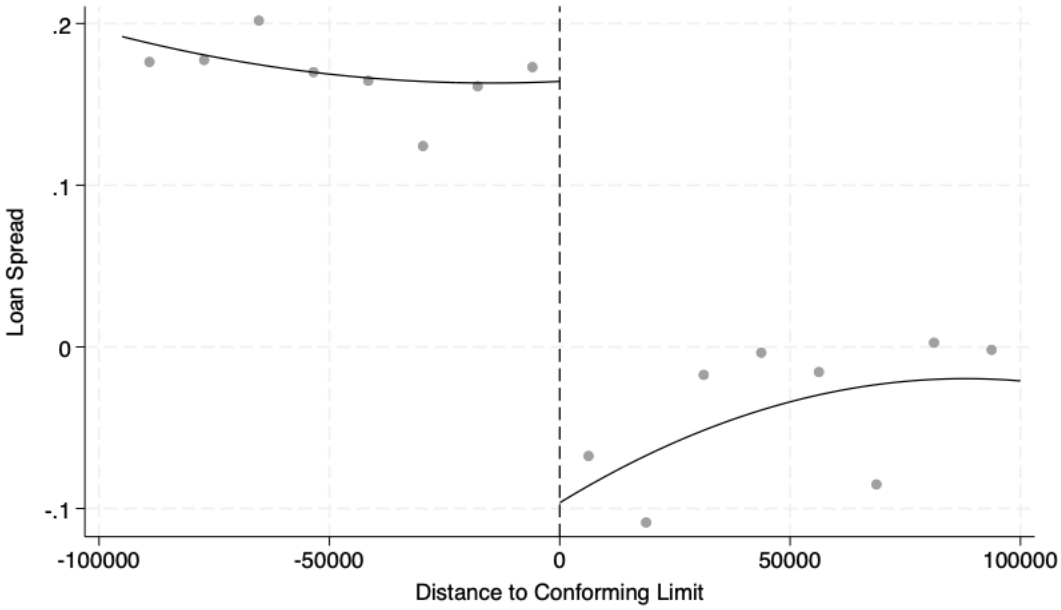


Figure A3: Bank and Non-Bank Nonconforming Spread

This figure plots the discontinuities in the conforming and nonconforming loans separately for banks and non-banks over the sample period 2018-2022.

(a) Panel A: Banks



(b) Panel B: Non-Banks

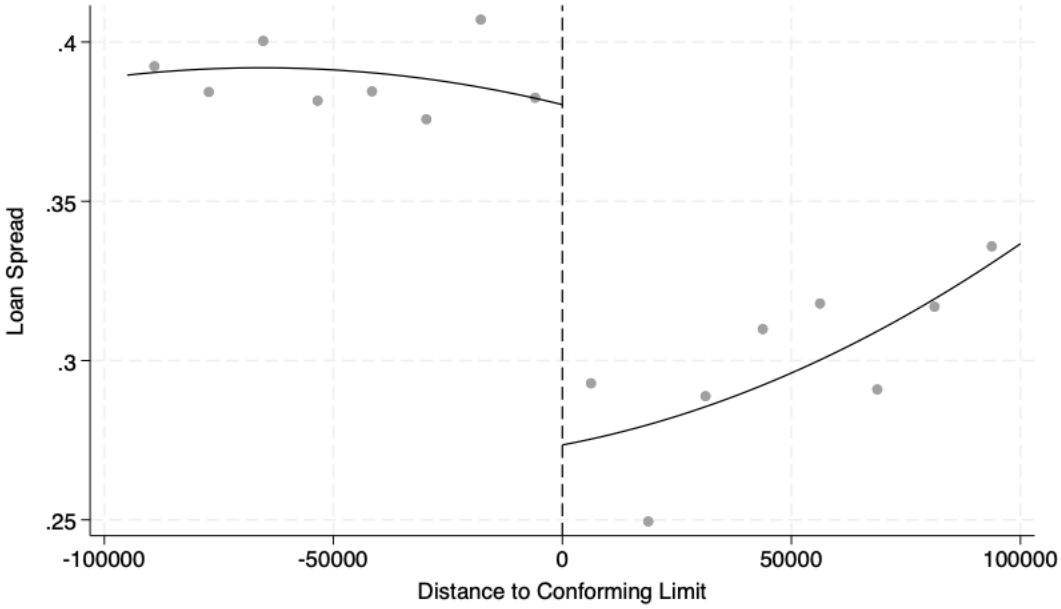


Figure A4: Jumbo-Conforming Spread Over Time

This figure plots the time series of the estimated jumbo-conforming loan spread. The conforming-nonconforming spread is estimated using a $50,000 bandwidth around the conforming loan limit and linear polynomials on each side of the cutoff. I estimate the conforming-nonconforming spread post-2018 using the updated HMDA data, which also allows me to break lender types by bank and non-bank lenders. I estimate the conforming-nonconforming spread pre-2018 using the MIRS dataset.

