Disproportionate Costs of Uncertainty: Small Bank Hedging and Dodd-Frank

Working Paper

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Abstract

Uncertainty in banking regulation may impose widespread economic costs by increasing financial constraints on credit availability. Four years of Dodd Frank uncertainty over undecided risk weightings increased regulatory uncertainty for smaller banks, restricting "vanilla" interest rate hedging activities. This paper uses newly reported mortgage banking data as an identification strategy and finds that when costs of uncertainty are removed, small banks hedge 97-120% more interest rate risk while mortgage securitization income increases by 65.2% compared to large banks. These findings support the need for tailored regulations that considers the higher costs of regulatory uncertainty for smaller banks.

JEL classification:

Keywords: Derivatives, Regulatory uncertainty, Dodd Frank, interest rate swaps, mortgages held for sale, interest rate locks, banking regulation, hedging, risk management, interest rate risk

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1 Introduction

Hedging reduces uncertainty, but only for those who can afford it. Four years after Dodd Frank was signed into federal law on July 21, 2010, law makers were still shaping capital risk requirement policies, increasing uncertainty and information costs for bank compliance, especially for smaller community banks (Dahl, Meyer, and Neely, 2016a). After the Recession of 2008, lawmakers were under little political pressure to differentiate between low risk "plain vanilla" interest rate swaps and riskier derivatives such as collateralized debt obligations (CDO's) and credit default swaps (CDS), which were often blamed for the financial crisis. However, interest rate derivatives are commonly used by small community banks and large transactional banks to hedge interest rate risks such as 60 day mortgage rate locks. This paper measures the costs of uncertainty by analyzing newly available mortgage securitization data from the Federal Financial Institutions Examination Council and whether this cost was disproportionately higher for community banks. I find that uncertainty surrounding Dodd Frank is associated with a 35% loss in mortgage securitization income and a 49-55% reduction in hedging for community banks compared to transactional banks. The differences is evident in Fig 1(a) and Fig 1(b) [1] as community banks mostly use interest rate derivatives for non-trading while holding higher balances of residential mortgages.

This paper measures the costs of regulatory uncertainty by examining "vanilla" hedging activity around the deliberations of Dodd Frank. Initially, I expect to find less hedging during regulatory uncertainty when information costs are higher for banks. I also expect to find a disproportionate cost of regulatory uncertainty with community banks facing a higher information cost as a percentage of expenses. However, this is not entirely clear as larger banks may have higher costs due to financial lawsuits and targeted regulations. Since the financial crisis, banks such as Bank of America and JPMorgan Chase have been assessed fines of \$76 billion and \$44 billion respectively while smaller community banks have never been assessed such large fines. On the other hand, smaller community banks may have higher costs of regulatory uncertainty because of their lack of

[1] Figure 1(a) demonstrates that community banks use interest rate derivatives for non trading purposes while holding a higher percentage of residential mortgages while larger transactional banks use interest rate derivatives for trading while holding a lower percentage of residential mortgages. All figures exclude TBTF banks and show even when excluding the largest banks, there still remains considerable heterogeneity in the use of derivatives between community and non-community banking models.

financial resources and higher regulatory expenses (Dahl et al., 2016a) expose more sensitivity to information costs. Higher information costs may reduce or delay interest rate hedging which may constrain credit availability.

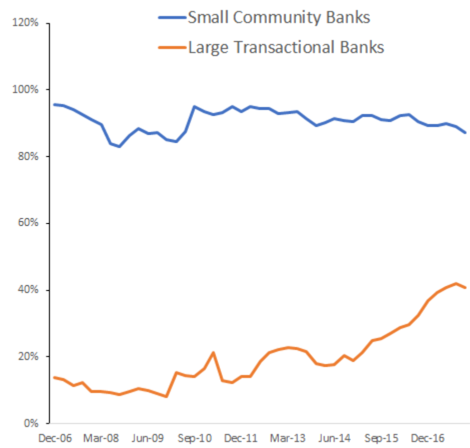
The use of interest rate derivatives for hedging purposes is shown in Figure 1(c) where community bank's hedging activity closely tracks mortgage securitizations. Hedging mortgage rate risk from application until delivery to third parties is a crucial step in bank risk management. [2]. This is supported by the aggregated data suggesting a strong positive relationship between non-trading IRD and securitized mortgages. In figure 1(d), large transactional banks (not TBTF) exhibit a similar relationship, but a higher ratio of non-hedging IRD suggests that bank level differences may not be similar to community banks.

The Schedule RC-P 1-4 Family Residential Mortgage Banking Activities is a new mortgage banking reporting requirement that started in 2006 Q3[3]. One newly reported line item is RIADF184, which is non-interest income from mortgage securitization. This line item is especially informative as a dependent variable in measuring the effect of hedging mortgage securities. For hedging activities, I look at interest rate derivatives that banks use to hedge *held for sale* mortgages also reported in the Schedule RC-P. This new reporting requirement provides an instrument linking mortgage banking activities and hedging activities, which provides an ideal setting to examine the effects of derivative regulation on hedging and mortgage income. Hedging interest rate risk is integral for financial intermediation (Diamond, 1984) and central in banks provision of credit access. As far as I am aware, this paper is the first to explore the role of hedging using new reporting requirements of the RC-P of the Call Reports.

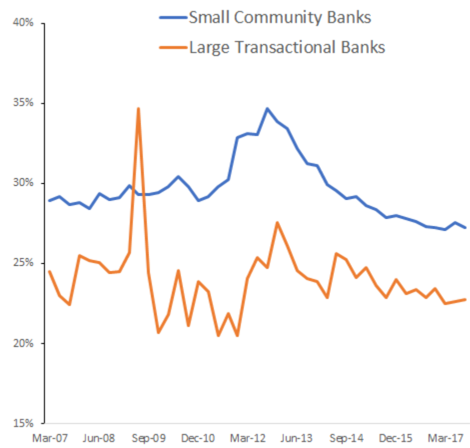
The rest of this paper is organized as follows: Section 2 covers the literature review on regarding banking uncertainty and the use of interest rate derivatives in banks, Section 3 covers the theoretical underpinnings of how banks consider risk weightings and risk adjusted returns in capital allocation,

[2] Federal Housing Finance Agency has released guidance on how To Be Announced (TBA) mortgages are sold in the Agency MBS market and hedged with interest rate swaps.
https://www.fhfa.gov/SupervisionRegulation/Documents/Securitizations_Module_Final_Version_1.0_508.pdf

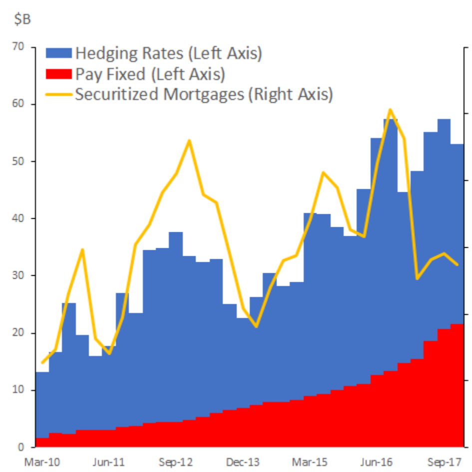
[3] The Federal Deposit Insurance Corporation (FDIC) and Financial Accounting Standards Board (FASB) under FAS 149 has outlined that interest rate swaps are recorded when banks hedge *held for sale* mortgages, not *held to maturity* mortgages. Both are listed in the RC-P Family Residential Mortgage Banking Activities.
https://www.fdic.gov/regulations/safety/manual/section3-8.pdf



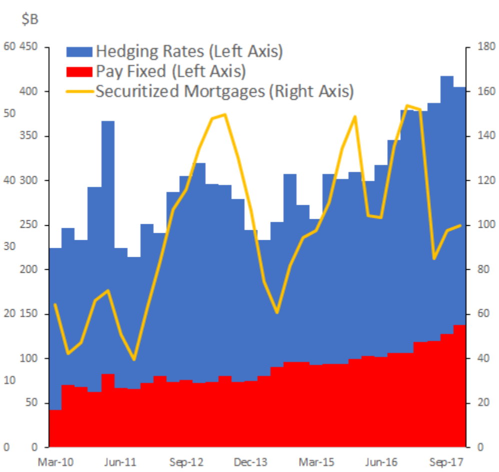
(a) Non Trading IRD/Total IRD %



(b) Residential Loans/Total Loans %



(c) Small Community Banks



(d) Large Regional Banks

Figure 1: Subfigure (a) represents aggregated non trading interest rate derivatives (IRD) as a percentage of total interest rate derivatives as reported on the RC-L Derivatives and Off Balance Sheet Items section of the Call Reports. Subfigure (b) represents residential loans as a percentage of total loans as reported on the RC-C section of the Call Reports. Community banks and non-community banks are identified by the FDIC figures exclude TBTF banks as identified by the Federal Reserve. Subfigure (c) and (d) are represented by:

$$\textit{Non Trading IRD} = \textit{Hedging IRD} + \textit{Pay Fixed IRD}$$

Hedging IRD are non-trading interest rate derivatives where banks enter into an agreement to pay floating while Pay Fixed IRD are non-trading interest rate derivatives where banks agree to pay fixed interest rates to a counterparty. Securitized mortgages are the sum of residential mortgages sold and held for sale as reported in the RC-P of the Call Reports.

Section 4 and 5 goes over the data and empirical results, and lastly, Section 6 outlines the conclusions of this paper.

2 Literature Review and Discussion

Two strands of literature serve as the foundation for this paper. The first strand of literature highlights the fundamental mechanisms behind bank hedging, specifically the use of interest rate derivatives in hedging interest rate risk. This paper contributes to this literature by being the first show a direct hedging mechanism using new Federal Reserve reporting requirements containing data on mortgages sold to third parties and interest rate lock swaps. The mechanism used in this paper also contributes the literature on costs of uncertainty as it relates to regulations and economics. More specifically, a growing subsection of literature on the costs of regulatory uncertainty as it pertains to banks during Dodd-Frank.

Interest Rate Hedging in Banking

Banks are essentially repositories for interest rate risk (Gorton and Rosen, 1995), and risk management of this exposure is central to its function. Banks find it optimal to hedge all interest rate risk, leading to an improvement in it's financial intermediation capabilties (Diamond, 1984) Financial intermediaries use of interest rate hedging provides a great setting to measure regulatory uncertainty, as interest rate derivatives are the most widely used derivative among banks, both small and large. The literature empirically demonstrates the positive relationship between derivative use and loan growth (Brewer III, Minton, and Moser, 2000; Landier, Sraer, and Thesmar, 2013)[4] which allow banks to hedge exposure to macroeconomic, credit, and cash flow risks[5]. Cash flow risk can stem from many difference sources such as mismatched maturities (Purnanandam, 2007), repricing risk, bankruptcy risk (Smith and Stulz, 1985), financing risks (Froot et al., 1993), interest rate risk, monetary policy risks, and market risks. Hedging allows for lending policies become less sensitive to macroeconomic shocks with the use of interest rate derivatives (Purnanandam, 2007) and subsequently lend more than non-users of derivatives. This paper specifically focuses on banks hedging of interest rate risk of mortgage originations sold to third parties, which were new regu-

[4] Brewer III et al. (2000) found that banks that use interest rate derivatives experience greater growth in their loan portfolios than banks that did not use them.

[5] Hedging their interest rate risk allows firms to increase firm value by lowering expected transaction costs of bankruptcy (Smith and Stulz, 1985) as well as avoiding the costs of external financing during low internal cash flow states (Froot, Scharfstein, and Stein, 1993).

latory reporting requirements in the Call Reports starting in 2006 Q3, and has not been covered previously in the banking literature. Heterogeneity in hedging practices of mortgages held for sale is also explored for the first time in this paper, following the extensive literature on heterogeneity in banking practices.

Heterogeneity of banking models is reflected in differences between relationship lending in community banks transactional lending in larger non-community banks. This fundamental heterogeneity is also reflected in how community banks use "vanilla" interest rate swaps for mostly "interest rate locks" on mortgages while larger banks use interest rate derivatives for more complex tasks such as dealer intermediation (Begenau, Piazzesi, and Schneider, 2015)[6] , and speculation (Gorton and Rosen, 1995)[7]. This heterogeneity is also extended to differences in compliance costs for banks. It might be surprising to some that although larger banks have more complex financial intermediation to regulate, the relative burden of compliance costs is much higher for smaller community banks. This higher regulatory burden on smaller community banks has been well researched by academics, regulators, and practitioners. These sentiments were also confirmed by the Conference of State Bank Supervisors (CSBS) as eighty-five percent of bankers surveyed also cited that regulatory costs were important in considering acquisition offers (Dahl, 2018) [8] This unique dataset by Dahl et al. (2016a) documents surveyed compliance costs collected by the Conference of State Board Supervisors, documenting a clear trend of higher compliance costs in smaller banks after the passage of Dodd Frank, supporting similar findings by Cyree (2016). Dahl et al. (2016a) found heterogeneity of compliance costs as smaller banks faced compliance costs of 8.7% as a percentage of non interest expenses compared to 2.9% larger banks. These higher costs stem from fixed costs of compliance such as the Bank Secrecy Act, RESPA, TILA, Regulation Z, qualified mortgages, data reporting, accounting audit, and consulting and appraisal advisory services (GAO, 2015). Survey responses showed that community bankers frequently hire outside consultants on an incremental, need to know basis, representing an information cost mechanism for regulatory uncertainty [9] Given

[6]Begenau et al. (2015) find that banks use pay-fixed positions in swaps to insure against surprise interest rate increases, but did not find evidence of interest rate derivatives being used to hedge loans. Hentschel and Kothari (2001) and Chernenko and Faulkender (2011) also show this empirically, while Jermann and Yue (2013) use a theoretical framework to study why non-financial firms need pay-fixed swaps

[7] Gorton and Rosen (1995) find that agents claim that speculative risk taking was unintentional.

[8]Unfortunately, non-interest expenses in Call Reports do not break down compliance costs, making the task of quantifying the level of compliance burden difficult.

[9] The cost of compliance is not dependent on credit quality of a bank, as Dahl et al. (2016a); Dahl (2018) finds

that the cost of compliance is higher for community banks, I use the community banking classification to proxy for higher costs of uncertainty in the empirical model. This proxy is also confirmed in a logistic empirical test.

Costs of Regulatory Uncertainty

How does anticipation of regulatory uncertainty play into this heterogeneity across banks? As the uncertainty literature has shown, risk factors in the financial regulation peaked after the passage of Dodd Frank in 2010 Q3 (Baker, Bloom, and Davis, 2016), which can impose economic costs for banks as well. Restrictive regulation can lead to volatile events such as asset sales (Boyson, Helwege, and Jindra, 2014) used to satisfy capital requirements. Regulatory requirements can have the effect of shrinking balance sheets and given the complimentary nature of loans and interest rate derivatives, regulatory uncertainty surrounding IRD may disincentivize this symbiotic pairing and as a result, reduce hedging activities. This is precisely what I find in this paper. A reduction in hedging due to regulatory uncertainty would also be broadly consistent with literature on banking regulation and how uncertainty has negative effects on bank lending (Gissler, Oldfather, and Ruffino, 2016; Bordo, Duca, and Koch, 2016), contributing to a growing importance on a banking perspective on effects of economic policy uncertainty (Baker et al., 2016; Brogaard and Detzel, 2015; Bonaime, Gulen, and Ion, 2016; Koijen, Philipson, and Uhlig, 2016; Giavazzi and McMahon, 2012) on the economy.

Regulatory rule making processes in banking allows for banks to comment on proposed rules, naturally favoring banks with the financial and legal resources to engage in a dialogue with regulators. Given the information cost asymmetry as a percentage of non-interest expenses (Dahl et al., 2016a), banks with high information costs can face significant periods of uncertainty while comments are considered and debated prior to the issuance of the final rule (Hendricks, Neilson, Shakespeare, and Williams, 2016). While Hendricks et al. (2016) found that the SEC took an average of 313 days between a rule proposal and a final ruling, the period of uncertainty in this study took four years from the passage of Dodd Frank in 2010 until February 20, 2015 when the FDIC released the final

that bank regulatory burden varies by size among banks with similar CAMEL ratings, which is a measurement rating for bank asset quality and management.

rule to be used on March 31, 2015 (FDIC, 2015). This long period of regulatory uncertainty could have a particularly negative cost for banks with limited resources for compliance as the bank's benefits of waiting for a final ruling increases with a longer period of uncertainty. Until a final ruling is reached, banks may also engage in lobbying efforts to change proposals (Bozanic, Dirsmith, and Huddart, 2012), as some consequences of meeting capital requirements are asset sales (Boyson et al., 2014). Information costs of regulatory uncertainty in banking is also compounded by three different regulators, the Federal Reserve, Office of the Comptroller of the Currency (OCC), and the Federal Deposit Insurance Corporation (FDIC) coordinating their efforts to pass a Basel III Final Rule in July 2013, which also considers changes required by the Dodd-Frank Act of 2010 (Guynn, 2015).

Discussion

Uncertainty in banking regulations has already shown to have detrimental effects on lending. For instance, Gissler et al. (2016) looks at the period of uncertainty in mortgage regulations from 2011-2014 and documents its negative effects on bank lending at the firm level. Banks reaction towards uncertainty is in line with Hendricks et al. (2016) who found that banks anticipate and adjust to regulatory uncertainty in real time. In a highly regulated industry like banking, academic literature also measures the costs of funding uncertainty and crisis regulations on different types of banks as Ritz and Walther (2015) points to bank level differences in lending due to costs of funding uncertainty while Banerjee and Mio (2017) and Cyree (2016) research the actual effects of Dodd-Frank and finds an increased regulatory burden for smaller banks. Baker et al. (2016) also finds that at the firm and industry level, there can be heterogeneous effects of uncertainty. This paper extends this literature on the heterogeneous costs of uncertainty into the banking sector. As far as I know, this is the first paper to look at the effects of regulatory uncertainty on hedging activity and its varying impact at the bank level. Using new regulatory data on mortgage originations in the Call Reports, I examine a period of regulatory uncertainty regarding the undecided risk weightings of bank balance sheet assets, which impacted smaller banks that were well capitalized during the global financial crisis.

The period of uncertainty used in this study relates to Dodd Frank's Subpart D, Section 34 which outlines future changes for risk weighting of interest rate derivatives, such as eliminating the 50% risk weight cap on interest rate derivatives. On October 25, 2012, the American Banker's Association wrote in a letter to the Office of the Comptroller of the Currency and the Board of Governors of the Federal Reserve System "The impact of changing risk weight calculations [on assets] is surprising to many that have been and remain well capitalized through the most recent economic difficulties." This period of uncertainty starts from the passage of The Dodd-Frank Wall Street Reform and Consumer Protection Act in 2010 until February 2015 when risk weightings for regulatory capital were finally released by the Federal Insurance Deposit Corporation (FDIC) and the Federal Reserve (FDIC, 2015) [10]. Dodd Frank's risk-based capital regulations were mostly centered around regulating complicated large too-big-to-fail (TBTF) banks, which drew out the process of final rulings on various regulatory measures such as risk weightings for interest rate derivatives (Scott, 2018). This unusually long period of regulatory uncertainty from 2010 to 2014 in a highly regulated industry provides a unique environment to study the costs of uncertainty on a banking services.

3 Framework

I present a simple model of a bank's objective function in optimizing between lending and market based trading similar to Boot and Ratnovski (2016) using a maxmization of risk adjusted returns similar to Kim (2018). Instead of market based trading in Boot and Ratnovski (2016), I use hedging derivatives for non-trading purposes and instead of using just risk adjusted returns based on volatility and credit risk as in **?**, I also consider the relative risk weighting ω of risk adjusted returns for each investment, defined as capital risk requirements defined by a regulatory body. Returns of derivative investments $r_{i,s}$ are defined by many of the fundamental assumptions in Gerali, Neri, Sessa, and Signoretti (2010), Alessandri and Nelson (2015), and **?**.

In simple form, banks will maximize their capital allocation decision by considering the risk adjusted

[10] ["Proposed changes starting March 31, 2015] will include an increased number of risk-weight categories to which on-balance sheet assets, derivatives, off-balance sheet items, and other items subject to risk weighting would be allocated." in a news release by the FDIC on February 20, 2015 FDIC (2015)

return of a loan and an interest rate derivative contract. $\tilde{R}$ is defined as risk adjusted returns and $\tilde{R}_\omega$ is the risk weighted risk adjusted returns defined in this simple model as:

$$\text{Risk Weighted-Risk Adjusted Return}_i = \frac{1}{\kappa}\sum_{i=1}^{\kappa} \max\left[\frac{\tilde{R}_i^{Loan}}{\omega_i^{Loan}}, \frac{\tilde{R}_i^{Derivative}}{\omega_i^{Derivative}}\right]$$

Consider an economy comprised of n firms (or individuals) with a measure of unity based normalization and bank i with with a level of bank equity $\kappa \in \{C, \rho\}$ representing a community bank and a regional bank, respectively. In this economy, each firm has unitary loan considerations with the bank, representing heterogeneous loans with a uniform based distribution of risk adjusted returns $\tilde{R}_j \in [0, 1]$. L is a transformation function that maps $\tilde{R}_j$ onto a uniform distribution of lending returns, $L \in [0, 1]$, from the perspective of the bank's treasury department, who additionally considers the balance sheet risk of the loan. The final consideration of risk weighting, $\omega_{\kappa,t}$ captures the standardized measure of risk weighting by an outside regulatory body. This risk weighting considers the bank's portfolio of loans and derivatives at time t, which is 50% for both types of assets and at time $t+1$ which is 100% for just derivatives.

Proposition 1. *"Derivative skill" and compliance costs are a function of a bank's economy of scale α and banking type. As α increases, the marginal cost of derivatives and regulatory compliance decreases. Derivatives skill initially has a high fixed cost of acquisition. Fixed costs of compliance and the first derivatives trader employee is proportionately high and variable cost is low because of the scalability of derivatives transactions.*

Interest rate derivative contracts are measured in a unity based normalization where the risk adjusted returns are represented by $\tilde{R}_r \in [0, 1]$. From the perspective of a bank's treasury department, risk adjusted returns are measured also in risk management gains from interest rate risk management, hedging maturity mismatch risk and portfolio repricing risk, as well as dealer broker activities. Purnanandam (2007) empirically equates derivative use as a way for a bank to manage the cost of financial distress.

Proposition 2. *Community banks with a level of bank equity C have a low derivatives skill and are mostly end users, implementing derivative strategies for simple hedging defined as mortgage forward* *contracts that lock in an interest rate for delivery in the future. This forward allows banks to offer interest rate locks to mortgage clients during the origination and underwriting process. Regional banks with a level of bank equity ρ have a higher rate of derivatives skill, and engage in dealer intermediation, derivatives trading, and a higher rate of derivatives usage relative to bank assets and loan holdings.*

$\tilde{R}$ will take into consideration costs related to economies of scale and balance sheet exposures. The following framework allows for the additional interest rate and repricing risk that a loan acquisition adds to a bank's balance sheet, the risk weightings for each type of investment, and the costs related to acquiring "derivative skill" to hedge balance sheet risks. A bank i will deploy a unit of capital j at time t to either loans or interest rate derivatives, choosing to invest a unit of capital to the asset with a higher risk weighted return.

$$\tilde{R}^{\omega}_{i,j,t} = \max_{\theta,L}\left[\frac{\tilde{R}^{L}_{i,j,t}(r^m, I(L,\theta))}{\omega_t(L_{i,j})}, \frac{\tilde{R}^{\theta}_{i,j,t}(r^s, I(L,\theta))}{\tau^{\theta}_{i,t}(\alpha_{i,t}) \times \omega_t(\theta_{i,j})}\right]$$

$\tilde{R}^{\omega} = \textit{Risk Weighted Adj Return}$ $r^m = \textit{Mortgage rate}_t$

$\theta = \textit{Interest Rate Lock Swap}$ $r^s = \textit{Swap rate}$

$L = \textit{Securitized Loan}$ $\tau^{\theta} = \textit{Information cost of derivative risk weightings}$

$I = \textit{Balance Sheet Risk}$ $\alpha_i = \textit{Scale of bank}$

Before Dodd Frank, given the similar risk weightings of 50% for balance sheet first lien residential mortgages and a 50% maximum risk weighting given for off balance sheet interest rate derivatives, an equilibrium would be reached where the marginal benefit of interest rate derivatives would be equal to the marginal effect of derivative risk weighting in the context of overall risk weighted returns.

$$\frac{\partial I(L,\theta)}{\partial L} \geq 0 \quad (1) \qquad \frac{\partial I(L,\theta)}{\partial \theta} \leq 0 \quad (2)$$

$$\frac{\partial \tilde{R}^{L}}{\partial I} \leq 0 \quad (3) \qquad \frac{\partial \tilde{R}^{\theta}}{\partial I} \geq 0 \quad (4)$$

In equation (1), the partial derivatives show that balance sheet risk of a bank goes up as the bank takes on more loans, and equation (2) shows that balance sheet risk goes down with more interest rate lock derivatives. This assumes that balance sheet risk is comprised of mostly interest rate risk. Equation (3) shows that when interest rate risk of a bank balance sheet goes up, the risk adjusted return of an additional loan goes down. Likewise, equation (4) shows that when interest rate risk of a bank's balance sheet goes up, the risk adjusted return of an additional interest rate derivative goes up. Taking equations (2) and (3) the multiplicative result is that:

$$\frac{\partial \tilde{R}^L}{\partial \theta} \geq 0$$

As a bank increases its interest rate derivatives, it lowers the interest rate risk of a bank and increases (or keeps constant) the risk adjusted return of originating a mortgage, given all else equal. Taking equations (1) and (4) also similarly lead to $\frac{\partial \tilde{R}^\theta}{\partial L} \geq 0$ where an additional mortgage holding increases the interest rate risk of bank, thereby increasing the risk adjusted benefit of an interest rate derivative used for hedging.

The key insight of this paper is highlighted in the relationship between interest rate derivatives and mortgage originations. Banks that offer interest rate locks on mortgages to borrowers take on interest rate risk before a loan is closed. While a borrower "locks in" a mortgage rate, the time from approval to closing may take anywhere from 30-90 days, during which time the bank is exposed to interest rate volatility. In order to hedge this interest rate risk, banks can originate a loan intended for sale and enter into forward contracts with a third party buyer before delivery of the underlying loan to the buyer. This is important because banks will record a derivative contract before it records a loan. This means that a key relationship of the variable is:

$$\frac{\partial \tilde{R}^L_t}{\partial \theta_{t-1}} \geq 0 \implies \frac{\partial L_t}{\partial \theta_{t-1}} \geq 0$$

The partial derivatives show an increase in interest rate derivatives will lead to an increase in risk adjusted returns of a loan in the next period. This will increase lending. The use of interest rate derivatives can hedge interest rate exposures, so that a bank can take additional risk in the future, showing a positive link between derivatives and lending.

I then introduce the condition of a regulatory shock with a similar structure to Dodd Frank in Subpart D, Section 34 which outlines new rules for risk weighting of interest rate derivatives.

Condition 1. *As regulatory risk weight increases are implemented from $\omega_t \rightarrow \omega_{t+1}$, the risk weightings of interest rate derivatives will increase from 50% to 100%, while remaining the same for loans.*

After Condition 1, a bank will recalibrate the its optimal risk weighted return based on the optimal scenario framework.

Theorem 3.1. *After a regulatory shock reduces the risk weighted risk adjusted returns of an interest rate derivative, banks will use less interest rate derivatives leading to less lending in the new equilibrium.*

As a regulatory risk weight increase is implemented, represented by $\omega_t \rightarrow \omega_{t+1}$, the risk weight of an interest rate derivative will rise from 50% to 100% and apply to both scenarios in this paper's framework. In the first scenario for a regional bank, $\tilde{R}^{\omega,\theta}_{regional}$, the marginal benefit of derivatives will fall as a result of this higher risk weighting, increasing the balance sheet risk and lowering $\tilde{R}^{\omega,L}_{regional}$, the risk weighted risk adjusted benefit of loans. Community banks with lower derivatives skills are more conservative and hold greater marginal benefits from derivative hedging than regional banks. Community banks will see a similar but stronger effect from an increase in risk weights of interest rate derivatives. Community banks will also have a greater effect because of the higher information cost during regulatory uncertainty. As a smaller bank gains more derivative skills, the balance sheet becomes more optimal and will eventually reach the same equilibrium as a regional bank where $\frac{\partial \tilde{R}^{\omega}}{\partial \theta} = \frac{\partial \tilde{R}^{\omega}}{\partial L}$.

Two key predictions that will be tested are that regulatory uncertainty regarding risk weights of interest rate derivatives will lead to lower usage of derivatives used for hedging, especially amongst community banks with higher information costs and lower derivative skills. The other prediction is that lower hedging derivative usage will lead to less lending in the future. The empirical section in section 5 will set up and test these predictions.

4 Data

I obtained the data for empirical testing from three main sources: 1) Federal Reserve's Call Reports which contain quarterly financial data of all US insured commercial banks, 2) Compliance cost data from the Conference of State Board Supervisors and 3) Chicago Board of Exchange for interest rate swap data, covering the period from 2006 Q3 to 2017 Q4. 2006 Q3 is the first quarter where the FDIC required banks to report detailed mortgage activities, including the amount of mortgages originated, sold, and held for sale or investment throughout the quarter. This detailed mortgage data is reported in the Schedule RC-P 1-4 Family Residential Mortgage Banking Activities and is central to this paper's analysis. The RC-P form (Figure 2) is also shown in on a graph in Figure 1(a), 1(b), 1(c), 1(d) allows for a clean lending instrument for interest rate hedging because it is standard practice in the mortgage banking industry to offer borrowers an interest rate lock during the underwriting process of a mortgage application. In order to offer an interest rate lock without taking on additional interest rate risk, the bank enters into a forward interest rate contract to deliver the underlying mortgage in the future to a third party who will purchase the loan. When Dodd-Frank Act passed in 2010Q4, deliberations regarding final risk weightings for interest rate derivatives which include forward contracts to deliver mortgages for sale were not finalized and implemented until February 20, 2015, mandating 2015 Q1 as the first reporting quarter where regulatory certainty was established. Smaller banks such as community tend to use interest rate derivatives mostly for non-trading purposes as seen in Figure 1(a) and have higher information costs during times of regulatory uncertainty.

The data in this paper starts with all bank listed in the Call Reports from 2006Q3 to 2017Q4. This period was chosen because 2006Q3 was when the RC-P data was first collected. Banks were matched with FDIC Identifiers for Community Banks using the FDIC Certificate Number. TBTF banks were dropped from the data throughout the paper in order to study the effects of regulatory uncertainty on firms that were not subject to additional TBTF regulatory requirements such as stress tests. Banks that were not matched with Community/Non Community Banking identifiers were also dropped. Banks with missing IDRSSD were also dropped. Variables used in this paper were scaled by total assets and banks with total assets listed as zero or missing were also dropped. Banks that have zero or missing non-trading interest rate derivatives was also dropped from the sample. Non-trading derivatives are defined in this paper as total gross notional amount of derivative contracts held for purposes other than trading (RCON8725) as listed in the Schedule RC-L Derivative and Off Balance Sheet Items. Pay Fixed is defined as interest rate swaps where the bank has agreed to pay a fixed rate (RCONA589) and Hedging Derivatives are defined as non trading interest rate derivatives that are not pay fixed. Non trading interest rate derivatives include futures, forwards, written options, purchased options, over the counter options and swaps.

Consolidated and domestic bank data were merged and duplicates were eliminated. Due to various changes to reporting requirements such as the implementation of Dodd Frank, some call report variables are not consistent over time. Consistent time series were formed by looking at the Call Report forms and matching variables as they change from quarter to quarter. Summary statistics in Table 1, 2, 3, and 4 show that the median large regional bank has total assets that are over 3x larger than the median small community bank during uncertainty, and this difference grows after uncertainty ends. Small community banks do not use interest rate derivatives for trading, while the same is true for a majority of large regional banks. Smaller community banks are more conservative than larger regional banks as seen by lower overall non performing assets and smaller maturity gap rations across the board. Also, mortgage lending makes up a larger portion of community bank's business than it does for larger regional banks. Overall usage of interest rate derivatives for hedging is similar between the two types of banks. Compliance cost is also higher for smaller community banks.

In Table 5, compliance cost ratios were obtained from Dahl et al. (2016a) and Call Reports. In Dahl et al. (2016a), compliance cost data was collected from a survey conducted by state banking commissioners and the Conference of State Bank Supervisors (CSBS). The CSBS survey collected survey responses from 974 responders, and the final sample consisted of 469 banks. The survey asked bankers to identify five categories of expenses in 2014, in each of the following categories: 1) data processing; 2) accounting and auditing; 3) consulting and advising; 4) legal; and 5) personnel. Respondents were asked to specify the dollar amounts spent on compliance in these categories and these responses were used in Table **??**. Off balance sheet data on bank's use of interest rate derivatives were obtained from the Schedule RC-L of the quarterly Call Reports. Interest rate derivatives are defined as total gross notional amounts of interest rate derivative contracts held by either trading or non trading purposes. In examining the off balance sheet data, about 80-90% of derivative use consists of interest rate derivatives. Trading and non trading interest rate derivatives were combined for the variable "Interest Rate Derivatives". Total residential mortgages, residential mortgages sold, and residential mortgages held for sale are from the RC-P Family Residential Mortgage Banking Activities. C&I Loans are from the RC-C Loans and Lease Financing Receivables and Maturity Gap is calculated from the RC-A Cash and Balances Due from Depository Institutions, RC-C, RC-B Securities, and RC-E Deposit Liabilities. Non Performing Assets are from the RC-N Past Due and Nonaccrual Loans, Leases, and Other Assets. All variables are scaled by total assets except for compliance costs and the community banking identifier. The panel data used is on a quarterly basis and is from 2010Q4-2017Q4. Consolidated and domestic bank data were merged and duplicates were eliminated. Due to various changes to reporting requirements such as the implementation of Dodd Frank, some call report variables are not consistent over time. Consistent time series were formed by looking at the Call Report forms and matching variables as they change from quarter to quarter. All bank quarter observations reflect banks with active mortgage lending and derivatives divisions. The total number of bank quarter observations are 16,930 from 2010 Q4 to 2017 Q4. Summary statistics show that banks increased in asset size and all ratios after regulatory certainty was established. Concerns that increase in assets, lending and hedging are endogenous to an economic recovery are addressed by the use of two way and three way interaction variables between compliance burden, regulatory certainty, and covariates in Table **??**. management in regards to macro and interest rate risk in its long term balance sheet. Residential mortgages did not have it's risk weighting and capital treatment of 50% affected in Dodd Frank regulation. The first differences of this variable measures the change in willingness of banks to hold loans on it's long term balance sheet. This variable can be shown in simple form:

$$\text{Loans Held to Maturity}^{residential} = \text{Loans}^{total} - \text{Loans}^{heldforsale}$$

Loans Held to Maturity (LHM) represent a loan that is of higher credit quality and lower risk than a loan that is originated for sale. Low risk loans will also have little need for hedging, which is why the LHM shoud not and does not show any significant relationship with usage of interest rate derivatives used for hedgng. Mortgages originated for sale during the quarter will either be sold and listed in Mortgages sold or continued to be held in mortgages held for sale.

$$\text{Mortgages Originated for Sale}^{residential} = \text{Mortgages Sold}^{residential} + \text{Mortgages Held for Sale}^{residential}$$

However, since mortgages that are held for sale can be held for more than one quarterly reporting period, there can be discrepancies in the total figures quarter to quarter. This is one reason why throughout the paper the left hand side and right hand side of mortgages above are not used in the same analysis. Also, interest rate derivatives used to hedge an ongoing loan application can be reported first because forward contracts are engaged before the closing and delivery of a loan to a third party. However, these issues seem to be minor and are not expected to cause any issues for this paper's main conclusions. In order to isolate the risk management function of derivatives to balance sheet risk, control factors were used. Banks mainly use interest rate derivatives for three reasons[11]: hedging Brewer III et al. (2000), dealer intermediation Begenau et al. (2015) Hentschel and Kothari (2001) Chernenko and Faulkender (2012)Jermann and Yue (2013), and speculation Gorton and Rosen (1995). In order to control for dealer activity and speculation, Chicago Board of Options Exchange (CBOT) data consisting of the 10-Year Interest Rate Swaps and non-trading IRD are used.

5 Empirical Model and Results

5.1 Assumption Testing of Information Costs and Interest Rate Betas

First, I investigate the link between bank types and information costs. Banks with higher information costs will have more regulatory uncertainty. More regulatory uncertainty would mean less access and less informed decision making. In Table 5 a logit model was estimated where the dependent variable is the community banking classification and the predictor variable of interest is

[11] Interest rate swaps are a core derivative product that banks use for dealer activities as well as hedging their balance sheet interest rate risk. Gorton and Rosen (1995) show that interest rate risk is non diversifiable and banks are repositories of interest rate risk. This interest rate risk is hedged using swaps (Gorton and Rosen (1995)) and in larger banks, swaps used for hedging are difficult to separate from speculation. Recent interest rate swap models are outlined in Begenau et al. (2015) and Vuillemey (2015).

compliance cost as measured by Dahl et al. (2016a); Dahl (2018). Compliance costs are estimated as a percentage of non-interest expenses.

The results of the regressions are as expected when looking across all specifications. Compliance costs, when looking at the z statistic values of 58.48 in the univariate (1) without clustered standard errors and 6.58 in the multivariate specification (5) with clustered standard errors, are the most significant in predicting a community banking identifier of a bank. These results allow for the use of community banking identifier as a proxy for high compliance costs and high information costs. The results of this logistic regression also reinforce what the literature already tells us about the conservative and lending focused nature of community banks. In regression (5) you can see that the coefficients for maturity gap (-2.69) and non performing assets (-37.67) are still significantly negative after including bank cluster standard errors. A significant negative coefficient on total interest rate derivatives are not surprising because total interest rate derivatives include trading usage, and non-community banks have much higher usage of trading derivatives than community banks as seen in Figure 1(a). One unexpected result is the positive significant result for Residential Mortgages Sold but no significance for Residential Mortgages Held for Sale in regression (5). This suggests that community banks seem to dispose of mortgage assets more quickly compared to non community banks. This would also fall into line with the overall more conservative nature of community banks with respect to risk.

Next in Table 6 I tested the assumptions used in this paper that market interest rates affect the risk adjusted returns for both loans and interest rate derivatives. This is an important empirical test in order to see how interest rates affect the composition of a bank's balance sheet over time. Because it may take anywhere from 30-90 days for a mortgage to close, if mortgage rates fall one quarter, it should affect mortgage closings in the future. In this multivariate panel data regression, you can see that it does hold true that falling mortgage rates are significant in increasing the volume of mortgages sold and held for sale in the current and future quarters. The combined beta of $\sum_{\tau=0}^{3} \beta^{MortSold} \Delta MortgageRates_{t-\tau}$ is (-.081) and $\sum_{\tau=0}^{3} \beta^{MortHeldSale} \Delta MortgageRates_{t-\tau}$ is (-.017) for community banks. This means that for every 100 basis point drop in mortgage rates in a quarter, it is expected to increase a community bank's mortgages sold as a percentage of assets by 8.1% and mortgages held for sale by 1.7% over the next few quarters. For larger banks the combined betas are (-.023) and (-.007) respectively. For every 100 basis point drop in mortgage rates in a quarter, larger banks are expected to increase mortgages sold as a percentage of assets by 2.3% and mortgages held for sale by .7% as a percentage of assets. Small banks have betas that are nearly 5x and 2x larger than larger banks respectively for mortgages sold and mortgages held for sale.

I also test the effect of 10Y swap rates on non-trading interest rate derivatives. Hedging IRD are also used when borrowers want a fixed interest rate instead of a floating interest rate on their loan. In order to convert their floating rate loan into a fixed rate loan, banks will offer to pay the borrower a "floating rate" and receive fixed from the borrower. This will effectively turn their floating rate loan into a fixed rate loan. The capability to offer fixed rate loans is especially important for banks, because when interest rates fall companies seek to lock in lower fixed interest rate payments and take a fixed rate loan with a bank. This is why we expect a banks interest rate derivative assets to increase when swap rates fall. Companies want to lock in lower interest rates and also hedge the volatility of their interest rate exposures. Later in Table To focus on hedging solely due to interest rate risk, maturity gap and non performing loans are used as covariates in order to control for potential use of derivatives due to mismatching of assets and liabilities due to balance sheet issues and also due to credit issues respectively. The combined beta of $\sum_{\tau=0}^{3} \beta^{HedgingIRD} \Delta SwapRates_{t-\tau}$ is (-.021) for small banks and (-.012) for larger banks. The R^2 for the estimated betas are low across Table 6, suggesting that interest rate betas are not the only explanation for the dependent variables that were tested. However, these tests do establish that market interest rates do play a part in understanding risk adjusted returns of mortgages and their respective hedging instruments.

5.2 Panel VAR

Next in Table 7 I test one of the main predictions in Section 3:

$$\frac{\partial L_t}{\partial \theta_{t-1}} \geq 0$$

An increase in hedging interest rate derivatives will increase lending in the future. This is because when a bank approves of a mortgage for a borrower, the bank offers an interest rate lock for a period of time. During this time, a bank will enter into a forward agreement with a third party to sell the mortgage to them in the future. This forward rate agreement increases the risk adjusted return of that mortgage asset because it hedges the bank from interest rate risk. This leads to more lending and more liquidity of mortgages sold in the future.

Key assumptions about the mortgage market hold in the Panel VAR. For instance, in (3) residential mortgages held for sale have a z-statistic of 4.36, confirming that the impact of RHS has a significant shock on time path of residential mortgages sold.. This makes sense because mortgages held for sale are sold in the future. In (4) mortgages held for sale is insignificant as expected, since mortgages that were sold are no longer able to be held for sale in the future. Regression (6) is where the main predictions is tested and confirmed with very strong results. $HedgingIRD_{t-1}$ has a z-statistic of 4.55, confirming that the impact of hedging derivatives in one quarter has a significant shock on the time path of residential mortgages originated for sale. In the Panel VAR (9) and (12), this same impact is confirmed in both small banks and larger banks. The impulse response is larger in larger banks, suggesting that the transactional nature of larger banks may be more timely and structured than smaller banks. Overall, the Panel VAR generally confirms the mechanics of the banking mortgage and hedging markets as outlined in this paper and do not produce any unexpected results.

5.3 Panel Data Regression with Three Way Interactions

This section will deal with the main empirical model in Table 8 and Table **??** which tests for the costs of regulatory uncertainty for banks with higher information costs. The specifications of the empirical model uses bank fixed effects, quarter fixed effects, bank and time clustered standard errors, and all bank specific continuous variables are scaled by total assets:

$$\frac{\textit{Hedging IRD}_{it}}{\textit{Assets}_{it}} = \alpha_i + \lambda_t + \textit{Community Bank}_i \times \textit{Regulatory Certainty}_t \times \frac{\textit{[Residential Mortgages Sold, Held for Sale]}_{it}}{\textit{Assets}_{it}} + X'\beta + \varepsilon_{it}$$

Control variables are maturity gap ratios for each bank and 10 year swap rates. There are two main hypothesis being tested. The first is that the costs of uncertainty is higher for banks with fewer resources and higher compliance costs. This will be tested by looking for evidence of "pent up demand" by looking at the three way interaction of two binomial dummies (one which is time invariant) with a continuous variable. In Table 8, the three way interaction term of Certainty $\times$ CB$\times$ Residential Mortgages Held for Sale has a coefficient of 1.196** and represents the additional amount of hedging that a community bank does when holding a mortgage intended for sale after uncertainty ends. This specification uses only bank fixed effects and bank clustering of standard errors. As I tighten the specifications in (2), (3), and (4) by adding time clusters, time fixed effects, and controls respectively, the significance of the three way interaction remains economically and statistically significant. The community bank identifier and the two way interaction of Community Bank $\times$ RMHS are not significant, suggesting that the difference in hedging between community banks and transactional banks occurs after Dodd-Frank rules are finalized and implemented. The three way interaction coefficient of 1.168** in (4) has the tightest specifications and shows that community banks increase hedging by 120.2% ($\frac{1.168+0.971}{0.971} - 1$) after final rules on risk weightings of interest rate derivatives are implemented. This suggests that hedging activity was muted by 54.6% during times of uncertainty for community banks ($1 - \frac{0.971}{0.971+1.168}$) This also suggests that smaller banks were exposed to 120.2% more interest rate risk due to residential mortgages held for sale during the four years of uncertainty when Dodd Frank rules were being debated and information costs were high.

In Table 9, residential mortgages sold is the dependent variable and the specifications are the same as Table 8. Here, the three way interaction term of Certainty $\times$ CB$\times$ RMS in (1) is 0.276* and this remains economically and statistically significant across all four specifications as the specifications are tightened in (2), (3), and (4) by adding time clusters, time fixed effects, and controls respectively. The community bank identifier and the two way interaction of Community Bank $\times$ RMS are not significant, suggesting that the difference in hedging between community banks and transactional banks occurs after Dodd-Frank rules are finalized and implemented. The three way interaction coefficient of 0.272* in (4) has the tightest specifications and shows that community banks increase hedging by 97.1% ($\frac{0.272+0.28}{0.28} - 1$) after final rules on risk weightings of interest rate derivatives are implemented. This suggests that hedging activity was muted by 49.3% during times of uncertainty for community banks ($1 - \frac{0.28}{0.28+0.272}$) This also suggests that smaller banks were exposed to 97.1% more interest rate risk due to residential mortgages sold during the four years of uncertainty when Dodd Frank rules were being debated and information costs were high.

In Table 10 a placebo test was conducted using trading interest rate derivatives in (3) and (4). The hedging IRD dependent variable in (1) and (2) uses similar specifications in Table 8 and Table 9 in a combined panel regression using both RMHS and RMS. In the placebo test in (3) and (4), the trading dependent variable should not show significant relationships with the covariates and interactions that were found to be significant in (1) and (2). Trading IRD are used for non-hedging activities, and would not be expected to be associated with residential mortgages. The insignificant regressors in (3) and (4) confirms that the specifications used in the panel data in Table 8 and Table 9 apply to hedging derivatives and not to trading derivatives. Banks exposed to interest rate risk by offering a borrower an interest rate lock would need a forward delivery contract to hedge the mortgage, not a derivative used for trading purposes. The panel data specifications are confirmed with the placebo test in Table 10.

In Table 11, I test the assumption that income from mortgage securitizations are derived from mortgages that are originated for sale, held for sale, and sold. The left hand side variable across all four specifications is income from mortgage securitizations as listed in the RC-P. This is quarterly non interest income from the sale, securitization, and servicing of mortgages originated for sale as shown in Figure 2. Right hand side variables are also from the RC-P, mortgages originated for sale, mortgages held for sale, and mortgage loans sold. All specifications use bank and quarter fixed effects as well as clustering of standard errors at the bank and quarter level. Panel regressions in (1) indicate that every \$100 of mortgages originated for sale, small banks have about 3.1% profit margin. In specification (2) and (3), mortgages held for sale and mortgage loans sold indicate a 4.4% and 1.4% profit margin respectively. When all three mortgage items are included in specification (4), mortgages originated for sale subsume the significance of the other two variables as mortgage originations are made up of mortgages held for sale and mortgage loans sold. Mortgages originated for sale on a yearly basis make up about 20-40% of a bank's total assets, suggesting that income from mortgage securitizations is a significant source of income for a bank.

In Table 12, similar to Table 11 the left hand side variable is income from mortgage securitizations as listed in the RC-P. The three right hand side variables are hedging, mortgages held for sale, and mortgage loans sold. Hedging is included in a three way interaction with a community banking dummy and a certainty dummy. All specifications use bank and quarter fixed effects as well as clustering of standard errors at the bank and quarter level. This table is estimating the cost of uncertainty for community banks on mortgage securitization income. Specification (1) estimates that every dollar in hedging contracts will eventually lead to a 1.2% increase in income from mortgage securitizations. This finding supports this paper in regards to TBA mortgages as banks issue a forward derivative contract for mortgage delivery to a third party upon closing of a mortgage. Uncertainty in utilizing forward contracts will increase the interest rate risk of a bank during the mortgage underwriting period which may last from 30 days to several months. The positive significance of the triple interaction term (0.006**) also supports the main findings of this paper, as community banks increase their securitization income by 53.4% ($\frac{0.012+0.006}{0.012} - 1$) for every unit of hedging after Dodd-Frank rules are implemented, while this effect was insignificant for larger banks. A similar effect is seen in (3) which uses lagged hedging as an independent variable. Since the mortgage approval process may take several months, lagged hedging variables will affect mortgage income variables in the next quarter when mortgages are sold and income is recorded.

6 Conclusion

Using a new identification strategy, this paper empirically tests bank's mortgage rate hedging practices during times of regulatory uncertainty. Among banks that use interest rate derivatives, their yearly mortgage securitization business makes up about 20-40% of total assets, representing a significant source of interest rate risk when banks offer approved applicants an interest rate lock period that can last months. This mortgage rate risk can accumulate on a bank's balance sheet as shown in the interest rate betas in Table 6 Hedging this risk using interest rate derivatives is standard industry practice and shown to be the case even after controlling for asset liability mismatches and credit risk (Table 8 and 9. I find that smaller banks hedge 97-120% more mortgage rate risk compared to larger banks during times of regulatory certainty compared to periods of regulatory uncertainty. In Table 12 this increased hedging led to a 65.2% increase in mortgage securitization income for smaller banks, while this effect was insignificant for larger banks. Four years of discussion and commenting passed before final risk weightings for interest rate derivatives were implemented, representing a high information cost for many smaller banks.

This paper's findings of a decline in hedging as a result of regulatory uncertainty supports similar conclusions in Gissler et al. (2016) and Bordo et al. (2016) where they find that regulatory and policy uncertainty in banking led to less lending. This paper's contribution lies in the identification method of the hedging instrument and the hedged asset. Previous papers looked at the effect of interest rate derivatives on balance sheet metrics and not at identifying a direct channel for hedging. This direct channel allows for further testing in terms of the costs of uncertainty for Dodd Frank. This period of uncertainty regarding the implementation of risk weightings reduced interest rate hedging for small banks, contributing to a period of constrained credit availability. This higher cost is likely from the higher regulatory burden that community banks face stemming from limited resources. From a policy standpoint, these findings support the need to tailor cost effective regulatory policies for smaller banks not only to relieve constraints on lending and credit availability, but also interest rate hedging activities.

Appendix

Figure 2:

Schedule RC-P—1–4 Family Residential Mortgage Banking Activities

Schedule RC-P is to be completed by (1) all banks with $1 billion or more in total assets[1] and (2) banks with less than $1 billion in total assets at which either 1–4 family residential mortgage loan originations and purchases for resale[2] from all sources, loan sales, or quarter-end loans held for sale or trading exceed $10 million for two consecutive quarters.

Dollar Amounts in Thousands	RCON	Amount	
1. Retail originations during the quarter of 1–4 family residential mortgage loans for sale:[2]			
a. Closed-end first liens	F066		1.a.
b. Closed-end junior liens	F067		1.b.
c. Open-end loans extended under lines of credit:			
(1) Total commitment under the lines of credit	F670		1.c.(1)
(2) Principal amount funded under the lines of credit	F671		1.c.(2)
2. Wholesale originations and purchases during the quarter of 1–4 family residential mortgage loans for sale:[2]			
a. Closed-end first liens	F068		2.a.
b. Closed-end junior liens	F069		2.b.
c. Open-end loans extended under lines of credit:			
(1) Total commitment under the lines of credit	F672		2.c.(1)
(2) Principal amount funded under the lines of credit	F673		2.c.(2)
3. 1–4 family residential mortgage loans sold during the quarter:			
a. Closed-end first liens	F070		3.a.
b. Closed-end junior liens	F071		3.b.
c. Open-end loans extended under lines of credit:			
(1) Total commitment under the lines of credit	F674		3.c.(1)
(2) Principal amount funded under the lines of credit	F675		3.c.(2)
4. 1–4 family residential mortgage loans held for sale or trading at quarter-end (included in Schedule RC, items 4.a and 5):			
a. Closed-end first liens	F072		4.a.
b. Closed-end junior liens	F073		4.b.
c. Open-end loans extended under lines of credit:			
(1) Total commitment under the lines of credit	F676		4.c.(1)
(2) Principal amount funded under the lines of credit	F677		4.c.(2)
5. Noninterest income *for the quarter* from the sale, securitization, and servicing of 1–4 family residential mortgage loans (included in Schedule RI, items 5.c, 5.f, 5.g, and 5.i):	RIAD		
a. Closed-end 1–4 family residential mortgage loans	F184		5.a.
b. Open-end 1–4 family residential mortgage loans extended under lines of credit	F560		5.b.
6. Repurchases and indemnifications of 1–4 family residential mortgage loans *during the quarter*:	RCON		
a. Closed-end first liens	F678		6.a.
b. Closed-end junior liens	F679		6.b.
c. Open-end loans extended under line of credit:			
(1) Total commitment under the lines of credit	F680		6.c.(1)
(2) Principal amount funded under the lines of credit	F681		6.c.(2)
7. Representation and warranty reserves for 1–4 family residential mortgage loans sold:			
a. For representations and warranties made to U.S. government agencies and government-sponsored agencies	L191		7.a.
b. For representations and warranties made to other parties	L192		7.b.
c. Total representation and warranty reserves (sum of items 7.a and 7.b)	M288		7.c.

1. The $1 billion asset-size test is based on the total assets reported on the *June 30, 2016*, Report of Condition.
2. Exclude originations and purchases of 1–4 family residential mortgage loans that are held for investment.

Table 1: **Summary Statistics for Small Community Banks During Uncertainty**
Data is from Call Reports (2010 Q4 - 2014 Q4). Ratios are scaled by total assets and are represented as percentages. Regulatory uncertainty centers around the risk weighting of assets for bank assets and liabilities which were unknown before Dodd Frank was fully implemented in 2015 Q1. Community banking identifiers are from the FDIC.

Variable	Obs	Mean	Std	Min	P25	P50	P75	Max
Total Assets ($M)	12,348	730	1,300	9	200	390	780	27,000
Interest Rate Derivatives (%)	12,348	5.37	14.36	0.00	0.42	1.23	4.08	241.43
Hedging Rates (%)	12,348	4.68	14.21	0.00	0.27	0.88	2.87	241.43
Fixed Swaps (%)	12,348	0.54	1.99	0.00	0.00	0.00	0.00	21.48
Trading Rates (%)	12,348	0.15	1.38	0.00	0.00	0.00	0.00	33.67
Mortgages Held for Sale (MHS) (%)	5,750	2.76	6.76	0.00	0.11	0.45	1.79	83.87
Mortgages Sold (MS) (%)	5,751	11.92	27.64	0.00	1.05	2.98	9.05	345.06
Mort Originated for Sale (%)	5,749	8.27	18.32	0.00	0.81	2.51	6.86	269.11
Other Loans Held for Sale (OLS) (%)	5,750	0.31	3.46	-12.95	0.00	0.00	0.00	72.40
Maturity Gap Ratio (%)	12,348	5.56	11.47	-54.12	-1.92	5.08	12.45	61.16
Compliance Cost (%)	12,348	0.11	0.10	0.00	0.05	0.09	0.14	2.54
Non Performing Assets (%)	12,348	0.09	0.36	0.00	0.00	0.00	0.05	9.26

Table 2: **Summary Statistics for Large Regional Banks During Uncertainty**
Data is from Call Reports (2010 Q4 - 2014 Q4). Ratios are scaled by total assets and are represented as percentages. Regulatory uncertainty centers around the risk weighting of assets for bank assets and liabilities which were unknown before Dodd Frank was fully implemented in 2015 Q1. Community banking identifiers are from the FDIC.

Variable	Obs	Mean	Std	Min	P25	P50	P75	Max
Total Assets ($M)	6,791	7,400	24,000	21	410	1,200	4,800	320,000
Interest Rate Derivatives (%)	6,791	10.80	39.11	0.00	0.85	2.81	9.12	1,182.44
Hedging Rates (%)	6,791	5.53	18.56	0.00	0.44	1.46	4.50	607.52
Fixed Swaps (%)	6,791	2.12	15.41	0.00	0.00	0.00	0.64	574.92
Trading Rates (%)	6,791	3.14	21.16	0.00	0.00	0.00	0.00	597.93
Mortgages Held for Sale (MHS) (%)	4,810	1.49	4.47	0.00	0.05	0.26	0.78	61.57
Mortgages Sold (MS) (%)	4,810	5.34	16.19	0.00	0.33	1.31	3.47	284.82
Mort Originated for Sale (%)	4,809	4.36	14.66	0.00	0.23	1.08	3.01	268.99
Other Loans Held for Sale (OLS) (%)	4,810	0.25	2.14	-13.66	0.00	0.00	0.00	56.44
Maturity Gap Ratio (%)	6,791	11.73	15.87	-52.81	1.41	9.43	20.12	91.49
Compliance Cost (%)	6,791	0.09	0.11	-0.05	0.04	0.07	0.10	3.34
Non Performing Assets (%)	6,791	0.26	1.23	0.00	0.00	0.00	0.08	21.27

Table 3: **Summary Statistics for Small Community Banks During Certainty**
Data is from Call Reports (2015 Q1 - 2017 Q4). Ratios are scaled by total assets and are represented as percentages. Regulatory uncertainty centers around the risk weighting of assets for bank assets and liabilities which were unknown before Dodd Frank was fully implemented in 2015 Q1. Community banking identifiers are from the FDIC.

Variable	Obs	Mean	Std	Min	P25	P50	P75	Max
Total Assets ($M)	11,653	940	1,800	16	230	460	950	43,000
Interest Rate Derivatives (%)	11,653	5.59	14.41	0.00	0.46	1.31	4.42	272.21
Hedging Rates (%)	9,775	4.70	14.81	0.00	0.23	0.84	2.61	272.21
Fixed Swaps (%)	9,775	0.93	2.92	0.00	0.00	0.00	0.00	59.65
Trading Rates (%)	11,653	0.19	1.65	0.00	0.00	0.00	0.00	46.75
Mortgages Held for Sale (MHS) (%)	4,821	2.63	7.16	0.00	0.08	0.31	1.51	82.20
Mortgages Sold (MS) (%)	4,821	10.27	27.42	0.00	0.70	1.92	7.01	448.47
Mort Originated for Sale (%)	4,820	8.10	22.74	0.00	0.50	1.73	5.44	367.06
Other Loans Held for Sale (OLS) (%)	4,821	0.39	3.80	-26.88	0.00	0.00	0.00	65.58
Maturity Gap Ratio (%)	11,653	8.10	12.48	-54.69	0.60	7.83	15.42	98.98
Compliance Cost (%)	11,653	0.11	0.20	0.00	0.05	0.08	0.12	9.92
Non Performing Assets (%)	11,653	0.06	0.20	0.00	0.00	0.00	0.03	3.89

Table 4: **Summary Statistics for Large Regional Banks During Certainty**
Data is from Call Reports (2015 Q1 - 2017 Q4). Ratios are scaled by total assets and are represented as percentages. Regulatory uncertainty centers around the risk weighting of assets for bank assets and liabilities which were unknown before Dodd Frank was fully implemented in 2015 Q1. Community banking identifiers are from the FDIC.

Variable	Obs	Mean	Std	Min	P25	P50	P75	Max
Total Assets ($M)	3,475	13,000	32,000	19	1,200	3,600	9,900	320,000
Interest Rate Derivatives (%)	3,475	13.38	34.36	0.00	1.33	5.14	14.16	545.68
Hedging Rates (%)	3,455	5.83	17.25	0.00	0.42	1.50	5.04	268.94
Fixed Swaps (%)	3,455	2.95	14.63	0.00	0.00	0.00	2.52	276.74
Trading Rates (%)	3,475	4.64	16.14	0.00	0.00	0.00	0.98	203.86
Mortgages Held for Sale (MHS) (%)	2,918	1.21	4.68	0.00	0.02	0.16	0.53	80.49
Mortgages Sold (MS) (%)	2,917	3.58	11.68	0.00	0.13	0.75	2.12	222.08
Mort Originated for Sale (%)	2,918	2.42	6.49	0.00	0.06	0.61	1.75	71.06
Other Loans Held for Sale (OLS) (%)	2,918	0.21	1.42	-1.07	0.00	0.00	0.00	25.51
Maturity Gap Ratio (%)	3,475	18.78	16.35	-42.08	7.78	16.52	28.51	93.41
Compliance Cost (%)	3,475	0.06	0.07	0.00	0.03	0.05	0.07	2.26
Non Performing Assets (%)	3,475	0.18	1.04	0.00	0.00	0.01	0.05	14.16

Table 5: **Panel Logistic Model of Community Banks and Compliance Costs**
A logit model was estimated where the dependent variable is a dummy that equals one if the bank is classified as a Community Bank by the Federal Deposit Insurance Corporation. Compliance costs were collected from a survey conducted by the Conference of State Bank Supervisors (CSBS) Dahl et al. (2016a). Total interest rate derivatives include both trading and non-trading interest rate derivatives from the RC-L Derivatives and Off Balance Sheet Items section of the Call Reports. Total residential mortgages, residential mortgages sold, and residential mortgages held for sale are from the RC-P Family Residential Mortgage Banking Activities. C&I Loans are from the RC-C Loans and Lease Financing Receivables and Maturity Gap is calculated from the RC-A Cash and Balances Due from Depository Institutions, RC-C, RC-B Securities, and RC-E Deposit Liabilities. Non Performing Assets are from the RC-N Past Due and Nonaccrual Loans, Leases, and Other Assets. All variables are scaled by total assets except for compliance costs and the community banking identifier. The panel data used is on a quarterly basis and is from 2010Q4-2017Q4.

	Community Bank Identifier				
	(1)	(2)	(3)	(4)	(5)
Compliance Costs	59.812***	58.521***	86.576***	72.694***	72.694***
	(58.48)	(10.84)	(7.95)	(28.37)	(6.58)
Total Interest Rate Derivatives		-1.175***		-3.091***	-3.091***
		(-3.87)		(-15.67)	(-3.55)
Total Residential Mortgages			1.589**	1.283***	1.283*
			(2.28)	(7.81)	(1.76)
Residential Mortgages Sold			3.162***	5.356***	5.356***
			(2.77)	(12.81)	(4.07)
Mortgages Held for Sale			-7.677***	-5.36***	-5.36
			(-2.63)	(-4.92)	(-1.46)
C&I Loans			-2.025*	0.212	0.212
			(-1.95)	(0.8)	(0.18)
Maturity Gap				-2.69***	-2.69***
				(-17.65)	(-4.46)
Non Performing Assets				-37.67***	-37.67**
				(-9.87)	(-2.2)
Observations	34,267	34,267	16,549	16,549	16,549
Bank FE		✓	✓		✓
Bank Clusters		✓	✓		✓
Pseudo R^2	0.102	0.110	0.106	0.154	0.154

Table 6: **Panel Interest Rate Betas of Small Banks and Larger Banks**

The panel data used is on a quarterly basis and is from 2006Q3-2017Q4. Mortgage rates 30Y fixed rate per quarter from the Primary Mortgage Market Survey from Freddie Mac. 10Y Swap Rates are on a quarterly basis from Bloomberg. Mortgages Sold and Mortgages Held for Sale are from the RC-P of the Call Reports. Hedge IRD and Pay Fixed IRD are non trading interest rate derivatives as reporeted in the RC-L of the Call Reports. Betas are estimated using the following empirical specification:

$$\Delta MortgagesSold_{i,t} = \alpha_i + \sum_{\tau=0}^{3} \beta_{i,\tau}^{MortSold} \Delta MortgageRates_{t-\tau} + \varepsilon_{i,t}$$

	$\Delta MortgagesSold_{I,t}$		$\Delta MortgagesHeldforSale_{I,t}$	
	Small Banks	Larger Banks	Small Banks	Larger Banks
ΔMortgageRates$_t$	-0.013***	-0.003***	-0.004***	-0.002***
	(-4.84)	(-3.36)	(-6.43)	(-4.29)
ΔMortgageRates$_{t-1}$	-0.048***	-0.019***	-0.01***	-0.005***
	(-9.92)	(-7.71)	(-9.74)	(-6.58)
ΔMortgageRates$_{t-2}$	-0.018***	-0.01***	0.002***	0
	(-7.33)	(-6.83)	(3.31)	(1)
ΔMortgageRates$_{t-3}$	0.002	0	-0.001	0
	(1.11)	(-0.08)	(-1.43)	(-0.58)
Observations	11,134	9,937	11,134	9,937
Bank FE	✓	✓	✓	✓
Bank Clusters	✓	✓	✓	✓
R^2	0.037	0.031	0.032	0.020

	$\Delta HedgeIRDRatio_{I,t}$		$\Delta PayFixedIRDRatio_{I,t}$	
	Small Banks	Larger Banks	Small Banks	Larger Banks
ΔSwapRates$_t$	-0.015***	-0.006***	0	0.001
	(-9.55)	(-3.6)	(0.93)	(1.38)
ΔSwapRates$_{t-1}$	-0.005***	-0.005***	0	0
	(-6.85)	(-4.77)	(0.86)	(0.36)
ΔSwapRates$_{t-2}$	0	0.001	0	0.001
	(-0.91)	(1.09)	(1.54)	(1.48)
ΔSwapRates$_{t-3}$	0.001**	0	0	0.001
	(2.36)	(0.3)	(0.16)	(1.51)
Observations	26,153	15,148	26,153	15,148
Bank FE	✓	✓	✓	✓
Bank Clusters	✓	✓	✓	✓
R^2	0.023	0.006	0.000	0.001

Table 7: **Panel VAR of Hedging and Mortgage Activities**

Panel Vector Autoregression is estimated using quarterly Call Report data from 2006Q3-2017Q4. Residential Mortgages are family residential loans that are closed end and revolving which are both held for sale and for investment. Non Trading IRD are interest rate derivatives that are not used for trading consisting of pay fixed swaps and hedging swaps (Hedging IRD). Residential sold are closed end and open end family residential loans that were sold during the quarter. Residential Held for Sale are closed end and open end family residential loans that are held for sale or trading at quarter end. Residential Originated for Sale are closed end and open end family residential mortgages originated for sale which excludes mortgages originated for investment. All banks with zero or missing Non Trading IRD and TBTF banks are excluded. Small Banks and Large Banks are defined as community banks and non community banks as identified by the FDIC.

	AllBanks(DependentVariable)					
	Resid Mort (1)	NonTrad IRD (2)	Resid Sold (3)	ResHeldSale (4)	HedgingIRD (5)	ResidOrigSale (6)
NonTrad IRD_{t-1}	-0.011	0.906***				
	(-1.69)	(17.11)				
Resid $Mort_{t-1}$	0.941***	0.409*				
	(17.26)	(2.31)				
Hedging IRD_{t-1}			0.183***	0.028**	0.829***	0.117***
			(4.29)	(2.93)	(16.97)	(4.55)
Resid Held $Sale_{t-1}$			1.264***	0.869***	0.389*	
			(4.36)	(13.95)	(1.98)	
Resid $Sold_{t-1}$			0.647***	0.006	0.03	
			(7.67)	(0.55)	(0.78)	
Resid Orig $Sale_{t-1}$						0.693***
						(3.76)
Observations	22,974	22,974	22,974	22,974	22,974	22,974

	SmallBanks(DependentVariable)			Larger Banks (Dependent Variable)		
	Resid Sold (7)	Hedging IRD (8)	ResOrigSale (9)	Resid Sold (10)	Hedging IRD (11)	Resid Orig Sale (12)
Hedging IRD_{t-1}	0.34***	0.86***	0.154***	0.117***	0.837***	0.672*
	(4.44)	(12.57)	(3.57)	(4.07)	(10.96)	(2.18)
Resid $Sold_{t-1}$	0.817***	0.1*		0.757***	-0.085	
	(8.38)	(2.44)		(3.59)	(-0.65)	
Resid $OrigSale_{t-1}$			0.717**			0.0698***
			(3.06)			(3.39)
Observations	11,950	11,950	11950	11,024	11,024	11,024

Note: *p < 0.05; **p < 0.01; ***p < 0.001

Table 8: **Panel Data: Residential Mortgages Held for Sale or Trading**
Using Panel Data from Call Reports (2010 Q4-2017 Q4) and community banking identifiers from the FDIC. I use the following empirical model:

$$\frac{Hedging\ IRD_{it}}{Assets_{it}} = \alpha_i + \lambda_t + Community\ Bank_i \times Regulatory\ Certainty_t \times \frac{Residential\ Mortgages\ Held\ for\ Sale\ or\ Trading_{it}}{Assets_{it}} + X'\beta + \varepsilon_{it}$$

Residential Mortgages Held for Sale or Trading (RCONF072+RCONF073+RCONF676+RCONF677) are 1-4 family residential mortgage loans held for sale or trading at quarter end as reported on the Schedule RC-P 1-4 Family Residential Mortgage Banking Activity from the Call Reports. Hedging Interest Rate Derivatives are reported on the Schedule RC-L Derivatives and Off-Balance Sheet Items (RCON8725-RCONA589). Each regression includes the main effects and first order interaction terms but these variables are not tabulated for clarity. Control variables are maturity gap ratios for each bank and 10 year swap rates. Maturity gap is a measure of mismatching between assets and liabilities. Certainty is a dummy variable with a value of 1 from 2015 Q1-2017 Q4 after Dodd Frank's risk weightings for derivatives were finalized, and a value of 0 from 2010 Q4-2014 Q4 during the four years of congressional deliberations and uncertainty. Community bank is a dummy variable with a value of 1 if the bank identified as a community bank by the FDIC, and a value of 0 if it is identified as a non-community bank. The three way interaction of Community Bank × Certainty × Residental Mortgages Held for Sale or Trading represents the amount of additional interest rate hedging per mortgage that a community bank implements after uncertainty ends. Time fixed effects are at the quarter level and standard errors are clustered at the bank and quarter level. T-statistics are in parenthesis.

	Hedging Interest Rate Derivatives/Assets			
	(1)	(2)	(3)	(4)
Community Bank × Certainty × Residential Mortgages Held for Sale	1.196**	1.196**	1.167**	1.168**
	(2.08)	(2.08)	(2.05)	(2.05)
Residential Mortgages Held for Sale	1.035***	1.035***	0.971***	0.971***
	(3.72)	(3.51)	(3.38)	(3.38)
Observations	18,254	18,254	18,254	18,254
Controls				✓
Bank FE	✓	✓	✓	✓
Time FE			✓	✓
Bank Clusters	✓	✓	✓	✓
Time Clusters		✓	✓	✓
Adjusted R^2	0.79	0.79	0.79	0.79

Table 9: **Panel Data: Residential Mortgages Sold**
Using Panel Data from Call Reports (2010 Q4-2017 Q4) and community banking identifiers from the FDIC. I use the following empirical model:

$$\frac{\textit{Hedging IRD}_{it}}{\textit{Assets}_{it}} = \alpha_i + \lambda_t + \textit{Community Bank}_i \times \textit{Regulatory Certainty}_t \times \frac{\textit{Residential Mortgages Sold}_{it}}{\textit{Assets}_{it}} + X'\beta + \varepsilon_{it}$$

Residential Mortgages Sold (RCONF070+RCONF071+RCONF674+RCONF675) are 1-4 family residential mortgage loans sold during the quarter as reported on the Schedule RC-P 1-4 Family Residential Mortgage Banking Activity from the Call Reports. Hedging Interest Rate Derivatives are reported on the Schedule RC-L Derivatives and Off-Balance Sheet Items (RCON8725-RCONA589). Each regression includes the main effects and first order interaction terms but these variables are not tabulated for clarity. Control variables are maturity gap ratios for each bank and 10 year swap rates. Maturity gap is a measure of mismatching between assets and liabilities. Certainty is a dummy variable with a value of 1 from 2015 Q1-2017 Q4 after Dodd Frank's risk weightings for derivatives were finalized, and a value of 0 from 2010 Q4-2014 Q4 during the four years of congressional deliberations and uncertainty. Community bank is a dummy variable with a value of 1 if the bank identified as a community bank by the FDIC, and a value of 0 if it is identified as a non-community bank. The three way interaction of Community Bank × Certainty × Residental Mortgages Sold represents the amount of additional interest rate hedging per mortgage that a community bank implements after uncertainty ends. Time fixed effects are at the quarter level and standard errors are clustered at the bank and quarter level. T-statistics are in parenthesis.

	Hedging Interest Rate Derivatives/Assets			
	(1)	(2)	(3)	(4)
Community Bank × Certainty × Residential Mortgages Sold	0.276*	0.276*	0.275*	0.272*
	(1.83)	(1.86)	(1.87)	(1.85)
Residential Mortgages Sold	0.294***	0.294***	0.281***	0.28***
	(3.99)	(3.66)	(3.66)	(3.65)
Observations	18,252	18,252	18,252	18,252
Controls				✓
Bank FE	✓	✓	✓	✓
Time FE			✓	✓
Bank Clusters	✓	✓	✓	✓
Time Clusters		✓	✓	✓
Adjusted R^2	0.79	0.79	0.79	0.79

Table 10: **Placebo Test of Hedging Covariates**
Using Panel Data from Call Reports (2010 Q4-2017 Q4) and community banking identifiers from the FDIC. I use the following empirical model:

$$\frac{\textit{[Hedging, Trading]}_{it}}{Assets_{it}} = \alpha_{it} + Community\ Bank_i \times Certainty_t \times \Big[\frac{Mortgages\ Held\ for\ Sale_{it}}{Assets_{it}} + \frac{Mortgages\ Sold_{it}}{Assets_{it}}\Big] + X'\beta + \varepsilon_{it}$$

Residential Mortgages Held for Sale or Trading (RCONF072+RCONF073+RCONF676+RCONF677) are 1-4 family residential mortgage loans held for sale or trading at quarter end and Residential Mortgages Sold (RCONF070+RCONF071+RCONF674+RCONF675) are 1-4 family residential mortgage loans sold during the quarter as reported on the Schedule RC-P 1-4 Family Residential Mortgage Banking Activity from the Call Reports. Each regression includes the main effects and first order interaction terms but these variables are not tabulated for clarity. Control variables are maturity gap ratios for each bank and 10 year swap rates. Maturity gap is a measure of mismatching between assets and liabilities. Certainty is a dummy variable with a value of 1 from 2015 Q1-2017 Q4 after Dodd Frank's risk weightings for derivatives were finalized, and a value of 0 from 2010 Q4-2014 Q4 during the four years of congressional deliberations and uncertainty.Time fixed effects are at the quarter level and standard errors are clustered at the bank and quarter level. T-statistics are in parenthesis.

	Hedging(IRD)		*Trading(Placebo)*	
	(1)	(2)	(3)	(4)
Community Bank × Certainty × Residential Mortgages Held for Sale	1.271**	1.207**	0.052	0.065
	(2.13)	(2.17)	(0.23)	(0.26)
Community Bank × Certainty × Residential Mortgages Sold	-0.045	-0.03	-0.087	-0.095
	(-0.26)	(-0.2)	(-1.12)	(-1.09)
Residential Mortgages Held for Sale	0.838***	0.777***	-0.035	-0.032
	(2.83)	(2.63)	(-0.48)	(-0.47)
Residential Mortgages Sold	0.117*	0.119*	0.021	0.02
	(1.9)	(1.88)	(0.35)	(0.31)
Observations	18,251	18,251	18,251	18,251
Controls		✓		✓
Bank FE	✓	✓	✓	✓
Time FE		✓		✓
Bank Clusters	✓	✓	✓	✓
Time Clusters		✓		✓
Adjusted R^2	0.80	0.80	0.77	0.77

Table 11: **Panel Analysis of Income from Mortgage for Sale Activities**
Income from Mortgage for Sale Activities (RIADF184+RIADF560) is noninterest income from the sale, securitization, and servicing of mortgages originated for sale as shown in Figure 11 from the Schedule RC-P 1-4 Family Residential Mortgage Banking Activities. Residential Mortgages Held for Sale or Trading (RCONF072+RCONF073+RCONF676+RCONF677) are 1-4 family residential mortgage loans held for sale or trading at quarter end and Residential Mortgages Sold (RCONF070+RCONF071+RCONF674+RCONF675) are 1-4 family residential mortgage loans sold during the quarter. Quarterly data is from the Call Reports and are from 2006Q3-2017Q4.Time fixed effects are at the quarter level and standard errors are clustered at the bank and quarter level. T-statistics are in parenthesis.

	Income from Mortgage Securitization/Assets			
	(1)	(2)	(3)	(4)
Mortgages Originated for Sale	0.031***			0.027***
	(7.64)			(6.61)
Mortgages Held for Sale		0.044***		0.003
		(4.22)		(0.42)
Mortgage Loans Sold			0.014***	0.003
			(4.05)	(1.44)
Observations	25,238	25,239	25,238	25,237
Bank FE	✓	✓	✓	✓
Time FE	✓	✓	✓	✓
Bank Clusters	✓	✓	✓	✓
Time Clusters	✓	✓	✓	✓
Adjusted R^2	0.83	0.77	0.79	0.84

Table 12: **Panel Analysis of Income from Hedging Activities**
Income from Mortgage for Sale Activities (RIADF184+RIADF560) is noninterest income from the sale, securitization, and servicing of mortgages originated for sale as shown in Figure 11 from the Schedule RC-P 1-4 Family Residential Mortgage Banking Activities. Residential Mortgages Held for Sale or Trading (RCONF072+RCONF073+RCONF676+RCONF677) are 1-4 family residential mortgage loans held for sale or trading at quarter end and Residential Mortgages Sold (RCONF070+RCONF071+RCONF674+RCONF675) are 1-4 family residential mortgage loans sold during the quarter. The independent variable of interest is Hedging which are Non-Trading Interest Rate Derivatives which are used hedge mortgage originations for sale during the interest rate lock period, which is later sold to a third party. Certainty is a dummy variable with a value of 1 from 2006Q3-2010Q3 and 2015 Q1-2017 Q4 and a value of 0 from 2010 Q4-2014 Q4 during the four years of congressional deliberations and uncertainty. Community bank is a dummy variable with a value of 1 if the bank identified as a community bank by the FDIC, and a value of 0 if it is identified as a non-community bank.(1) and (2) represent the use of the contemporaneous hedging variable of interest while (3) and (4) represents using the lagged hedging variable. All variables are scaled by total assets. Quarterly data is from the Call Reports and are from 2006Q3-2017Q4.Time fixed effects are at the quarter level and standard errors are clustered at the bank and quarter level. T-statistics are in parenthesis.

	Income from Mortgage Securitization/Assets			
	$Hedging_t$	$Hedging_t$	$Hedging_{t-1}$	$Hedging_{t-1}$
	(1)	(2)	(3)	(4)
Community Bank × Certainty × Hedging	0.006**	0.006**	0.007**	0.006**
	(2.16)	(2.16)	(2.14)	(2.2)
Community Bank × Hedging	0.00	-0.003	-0.001	-0.003
	(0.01)	(-0.63)	(-0.13)	(-0.5)
Hedging	0.012**	0.008**	0.014**	0.01*
	(2.27)	(1.97)	(2.06)	(1.84)
Mortgages Sold		0.011**		0.009*
		(2.28)		(1.69)
Mortgages Held for Sale		0.002		0.005
		(0.16)		(0.45)
Observations	18,249	18,248	17,196	17,195
Bank FE	✓	✓	✓	✓
Time FE	✓	✓	✓	✓
Bank Clusters	✓	✓	✓	✓
Time Clusters	✓	✓	✓	✓
Adjusted R^2	0.80	0.82	0.84	0.86

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