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Abstract

During the housing crisis, it came to be recognized that inflated home mortgage appraisals were widespread during the subprime boom. The New York State Attorney General's office investigated this issue with respect to one particular lender and Fannie Mae and Freddie Mac. The investigation resulted in an agreement between the Attorney General's office, the government-sponsored enterprises (GSEs), and the Federal Housing Finance Agency (the GSEs' federal regulator) in 2008, in which the GSEs agreed to adopt the Home Valuation Code of Conduct (HVCC). Using unique data sets that contain both approved and nonapproved mortgage applications, this study provides an empirical examination of the impact of the HVCC on appraisal and mortgage outcomes. The results suggest that the HVCC has reduced the probability of inflated valuations and induced a significant increase in low appraisals. The HVCC also made it more difficult to obtain mortgages in the aftermath of the financial crisis.

Keywords: Property Valuation, Mortgage, Regulation, Appraisal
JEL Classification Codes: G21, G28, R38

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1. Introduction

In the wake of the financial crisis, regulators and policymakers questioned whether inherent conflicts of interests between lenders and appraisers compromised the accuracy of appraisals utilized before the housing crisis. In response, laws and regulations were enacted to address the conflict-of-interest issues in appraisals for residential mortgages.[1] With significantly tightened regulations and the decline in housing prices in many areas, home valuations in some areas became undervalued and new mortgages became harder to obtain in the aftermath of the crisis.[2]

Despite the controversial role of appraisers before and during the most recent housing crisis, there is a dearth of empirical research about the effects of regulatory changes since the crisis on appraisal outcomes and the housing market overall. This study provides the first empirical examination of the impact of a major appraisal rule, the now-superseded Home Valuation Code of Conduct (HVCC), which was adopted in the middle of the housing crisis, on low appraisals and mortgage outcomes. *Appraisal ratio* is defined as appraised value less the contract price as a percent of the contract price in this study, while *low appraisal* is defined as one in which appraised value falls below the contract price.[3]

The HVCC was enacted on May 1, 2009, as the result of a joint agreement[4] between Fannie Mae and Freddie Mac (government-sponsored enterprises, or GSEs), the Federal Housing

[1] Important regulations and rules related to appraisals include the Home Valuation Code of Conduct (HVCC); the Dodd-Frank Wall Street Reform and Consumer Protection Act (Dodd-Frank Act), which repealed the HVCC and directed the Federal Reserve Board (Board) to issue a rulemaking establishing appraisal independence requirements; the Board's October 2010 final rule issued under the Dodd-Frank Act to establish appraisal independence requirements for consumer credit transactions secured by the consumer's principal dwelling; and the revised Interagency Appraisal and Evaluation Guidelines from the federal prudential banking regulators issued in December 2010.

[2] See the Reuters article http://www.reuters.com/article/2011/08/24/us-usa-economy-appraisals-idUSTRE77N2PM20110824 and the *New York Times* articles http://www.nytimes.com/2012/10/13/business/scrutiny-for-home-appraisers-as-the-market-struggles.html and http://www.nytimes.com/2013/09/15/realestate/when-appraisals-come-in-low.html.

[3] Similarly, *significantly low appraisal* is defined as one in which appraisal is at least 5 percent below the contract price. *Share of low appraisals* represents the share of appraisals with appraised values below the contract price. Note: An appraisal is only an opinion of a property's value, so a deviation between appraised value and contract price does not necessarily mean the appraisal is wrong or biased. See similar measures of appraisal bias in Cho and Megbolugbe (1996), Chinloy, Cho, and Megbolugbe (1997), and LaCour-Little and Green (1998).

[4] The agreement is available at http://www.ag.ny.gov/sites/default/files/press-releases/archived/Freddie%20Final%203-3.pdf.

Finance Agency (FHFA),[5] and the New York State Attorney General.[6] The HVCC was set to expire in August 2010. The Dodd-Frank Wall Street Reform and Consumer Protection Act (Dodd-Frank Act), enacted on July 21, 2010, repealed the HVCC, but it also codified several of the HVCC's provisions. The HVCC has several unique features. First, as a private agreement between the GSEs and the New York State Attorney General, the HVCC was an industry standard instead of a federal regulation. In fact, the HVCC was implemented with opposition from major federal bank regulators (Abernethy and Hollans, 2010). Second, while the HVCC initially only covered GSE loans, it had marketwide effects as a result of the oligopoly power of the GSEs and the lack of a robust alternative secondary market for residential mortgages.[7] Third, the HVCC is believed to be a well-intentioned rule; however, some regulatory agencies and industry stakeholders have questioned it for its potential jurisdictional problems and unintended consequences (U.S. Government Accountability Office, or GAO, 2011). The rule introduced tighter scrutiny for appraisers, lenders, GSEs, and other stakeholders to ensure the independence of the appraisal process for GSE loans.[8] However, as the HVCC's efforts to address the conflict-of-interest issues in the middle of the crisis induced radical changes of the entire appraisal industry, concerns arose about the possible decline in appraisal quality and increased difficulty in credit access (GAO, 2011, 2012). For example, one direct effect of the HVCC was the greater use of appraisal management companies (AMCs).[9] AMCs, which act as intermediaries between

[5] The agreement was initially known as the Home Value Protection Program and Cooperation Agreement. The Office of Federal Housing Enterprise Oversight (OFHEO) still existed as the independent regulatory agency of Fannie Mae and Freddie Mac when the HVCC was introduced in March 2008 and FHFA was formed in July 2008.
[6] The HVCC, which was introduced on March 3, 2008, was a direct result of the Washington Mutual legal case. In November 2007, the New York Attorney General filed suit against Washington Mutual. Because GSEs purchased/securitized a large portion of its mortgages from Washington Mutual, the Attorney General's investigation of appraisal practices included the GSEs.
[7] The Federal Housing Administration (FHA) adopted the HVCC on January 1, 2010, eight months later than the GSEs. GSEs accounted for about 69.4 percent of all mortgage originations in 2009; the GSEs and FHA together accounted for about 90 percent (Inside Mortgage Finance, 2013).
[8] The HVCC was designed to enhance the independence and accuracy of the appraisal process primarily by the following: 1) prohibiting lenders and third parties with an interest in the mortgage transaction from influencing the development, reporting, result, or review of an appraisal report, 2) requiring only the lender or any third party specifically authorized by the lender to select, retain, and provide for payment of all compensation to the appraiser, 3) requiring absolute independence between the loan production function and the appraisal function within a lender's organization, 4) limiting communications between loan production staff and appraisers, and 5) requiring lenders to ensure that borrowers receive a copy of the appraisal report within a certain period before closing. See http://www.fhfa.gov/Media/PublicAffairs/Documents/HVCCFinalCODE122308_N508.pdf for more details about the HVCC.
[9] GAO (2012) suggests that some practitioners reported that the HVCC led some lenders to outsource appraisal functions to AMCs because they thought using AMCs would allow them to demonstrate compliance with these

lenders and appraisers and manage appraisals for lenders, only accounted for a small market share before the crisis and received little oversight by regulators during the crisis (GAO, 2012). So on the one hand, with less influence from lenders, brokers, and other stakeholders, appraisers are expected to achieve more objective appraisals and reduce the incidence of the previously widespread inflated appraisals. On the other hand, because of the greater use of AMCs partly induced by the HVCC and the potential overreaction by lenders and appraisers, the quality of appraisals may deteriorate and the share of low appraisals could become artificially high after the HVCC. This, in turn, could cause real estate deals to fall apart.

Based on a unique transaction-level appraisal data set that contains both approved and nonapproved mortgage applications, this study examined the effect of the HVCC using a difference-in-differences approach. Because not all mortgage applications were subject to the HVCC, we were able to use statistical models to isolate the effects of the HVCC by comparing changes in appraisal and mortgage outcomes pre- and post-HVCC for the HVCC-covered loans, relative to those of transactions that were not subject to the HVCC. We found that the HVCC has led to a significant reduction in the probability of inflated valuations and an increased incidence of low appraisals: The odds of low appraisals among HVCC-covered transactions increase by 17.1 percent in the six months after the HVCC, while the odds of significantly high appraisals (5 percent or higher than contract prices) decrease by 15.3 percent.

A higher incidence of low appraisals also induces higher rates of mortgage denials. The overall denial rates declined after the HVCC; however, the decrease in denial rates, especially in the collateral denial rates, was significantly lower for the HVCC-covered applications. The odds of denials for purchase mortgages actually increase by 8.7 percent in the six months after the HVCC, while the odds of denials because of insufficient collateral increase by 16.5 percent, relative to the control group.

The empirical results suggest that the HVCC has done some of what it was supposed to do by reducing inflated valuations that were prevalent during the subprime boom. However, this well-intentioned rule also increases the likelihood of low appraisals and made the origination of purchase mortgages more difficult. Because access to mortgage credit has been tight since the

requirements easily. The FNC, Inc. data suggest that the share of appraisals conducted by appraisers through AMCs increased from about 4.5 percent in the second quarter of 2009 to more than 47.6 percent in the fourth quarter of 2011.

housing crisis, more limited credit availability may have more severe consequences in the long term for certain populations and neighborhoods.

2. Background: Home Mortgage Appraisal and the HVCC

2.1 Appraisal and Appraisal Bias

Lending institutions compare the loan amount with the market value of the home in making loan decisions. Such a comparison is important because lenders need to know the property's market value to provide information for assessing the risk of the mortgage and their potential loss exposure if borrowers default. Appraisals, which provide an estimate of market value based on market research and analysis as of a specific date, have been the most commonly used valuation method for residential mortgage originations (GAO, 2012).[10] The appraised value and the difference between the appraisal and the contract price influence both the likelihood that the mortgage will default and the options that the mortgage lender has if the borrower defaults on the mortgage.[11]

In theory, an appraisal should provide an objective valuation of the true market value of a property; however, appraisals are often biased and can be significantly different from a home's true market value. Recent studies of the accuracy of home mortgage appraisals in the U.S. started with an article by Cho and Megbolugbe (1996), who compared purchase prices with appraised values to determine whether there were systematic differences based on the 1993 Fannie Mae loan acquisition file. They found that appraisals may be biased since too many mortgage appraisals were exactly the same as the transaction price, and the distribution was highly asymmetric: More than 65 percent of appraised values were above the purchase prices, about 30 percent had appraisals that were exactly the same as transaction prices, and only 5 percent had appraisals that were lower than the transaction prices. Appraisers only assign different value

[10] There are various valuation methods other than appraisals for lenders to obtain valuation of the property, such as broker price opinions, automated valuation models, or other mixed methods. When performing appraisals, appraisers can use one or several approaches to determine value, including sales comparison, cost, and income. Of these, the sales comparison approach is most widely used, in which appraisers compare and contrast the property under appraisal with recent offerings and sales of similar properties.

[11] The precise value of the home on the market provides crucial information to the mortgage lender because the equity stake of a mortgage at origination, usually measured by the loan-to-value (LTV) ratio, reflects the credit risk of a mortgage application. In practice, lenders usually use the lesser of sales price and appraisal as the value of the property in calculating LTV ratios (Nakamura, 2010).

estimates when differences between perceived values and transaction prices are substantial. Chinloy, Cho, and Megbolugbe (1997) expanded on the earlier research and continued to argue that appraisal bias was present. They estimated an upward bias of 2 percent and found that appraisals exceeded purchase prices in approximately 60 percent of the cases.

Agarwal, Ben-David, and Yao (forthcoming) documented the appraisal bias for residential refinance transactions. They used the difference in the initial appraisal of the refinance transaction and the subsequent purchase price compared with changes in the prices of pairs of consecutive purchase transactions, as a proxy for valuation bias. They found that the appraisal bias for residential refinance transactions was above 5 percent for a national sample of conforming loans. The bias was found to be larger for highly leveraged transactions (high loan-to-value or LTV), around critical leverage thresholds, and for transactions through a broker.

When appraisals are biased upward, they provide documentation for loans larger than what the collateral's market value justified. This makes mortgages riskier, and the risk of mortgage default increases. Unfortunately, there has been very little academic work examining the impact of biased appraisals despite the importance of the subject. LaCour-Little and Malpezzi (2003) used a small data set from Alaska in the 1980s to illustrate that for a single thrift institution in that state, appraisal bias was positively associated with more frequent defaults. Agarwal, Ben-David, and Yao (forthcoming) also found that refinance mortgages with inflated appraisals default more often; however, lenders account for the appraisal bias through pricing by charging higher rates for mortgages that have higher appraisal bias.

2.2 Determining Factors of Appraisal Bias

The conflict-of-interest issues related to appraisals have been cited as a potential explanation for the upward bias in several empirical studies (e.g., Cho and Megbolugbe, 1996; Chinloy, Cho, and Megbolugbe, 1997). Appraisers face asymmetric costs from overstating versus understating: While an above-contract price appraisal will have no direct impact, deals could be threatened by appraisals that fall below the prices the buyers and sellers had agreed to previously. Buyers, sellers, and real estate agents, as well as lenders who do not bear the risk of originated loans, all have a vested interest in getting an appraisal that is not less than the contract price and completing the sale. The way to ensure the deal is for the appraisers to assess slightly higher than (or equal to) contract prices. Much anecdotal evidence suggests that such bias exists,

such as the well-known legal case involving Washington Mutual in which the lender was found to put pressure on eAppraiseIT (an AMC) to generate systematically high appraisals between July 2006 and April 2007.[12] The HVCC, together with a set of other regulations and policies, was developed to govern the selection, communication, and possible coercion of appraisers to address the conflict-of-interest issues related to appraisal practices.

Cho and Megbolugbe (1996) found that appraisal outcomes are different for loans with different characteristics: Approved loans by Fannie Mae with low LTV ratios and/or high house prices are more likely to have negative appraisal gaps (low appraisals). They suspect that these loans are more likely to be approved despite negative appraisal gaps. LaCour-Little and Green (1998) conducted the only known empirical study that examines the role of appraisals in the residential mortgage lending process, though the study sample is quite small (fewer than 3,000 observations). They found that low appraised value is related to proxies for neighborhood quality instead of census tract racial composition. Properties securing adjustable rate mortgages, condominiums, and properties purchased by African American buyers are also found to have an increased probability of low appraisals.

Based on a theoretical model and empirical evidence, Calem, Lambie-Hanson, and Nakamura (2014) demonstrated that the mortgage practice that requires the use of the lesser of the transaction price and the appraised value in the calculation of LTV ratios results in the upward bias of appraisals, especially the extremely high incidence of appraisals that are exactly the same as or slightly higher than contract prices. They consider the proportion of appraisals that are set at the accepted offer price or very slightly above as "information loss," since substantial information is lost when appraisals are biased upward.

The housing market was experiencing significant changes when the HVCC was first introduced. At the peak of the housing crisis, many of the transactions were sales of distressed properties, which may not provide suitable information for the valuation of a more normal market transaction. As distressed property sales continue to be recorded and could be used as comparables in the appraisals of nondistressed properties, it may cause a downward drag on house value estimates and may have a negative impact on the ability of potential homebuyers to

[12] According to Agarwal, Ben-David, and Yao (forthcoming), Washington Mutual threatened to discontinue its contract with eAppraiseIT and actually did so in a number of cases. With the pressure from Washington Mutual, eAppraiseIT produced a list of "proven accepted" (by Washington Mutual) appraisers. In November 2007, the New York State Attorney General filed a lawsuit against Washington Mutual.

secure mortgage financing.[13] This issue could become more serious when a high number of foreclosed homes flood the market; appraisers are likely to overshoot a downward estimate because they may not be able to find enough sales of nondistressed homes to provide a good estimate of normal home sales.

Second, transaction volume had been low in many markets during the housing crisis for a number of reasons. The lack of market sales, especially mortgage-financed sales, may lead to high degrees of uncertainty in appraisals. Lang and Nakamura (L-N, 1993) suggest that the level of market sales represents an "information externality" for future lending decisions in corresponding neighborhoods. According to the L-N theory, market activities measured by total loan volume reduce the uncertainty associated with the appraised value of a property and thus affect future loan decisions. An insufficient number of originations could lead to greater uncertainty in house price appraisals, and, as a result, mortgage seekers are more likely to be denied because of insufficient appraisals. And if loans are not originated, transactions may not occur, and the true value of the properties will not be determined. A number of empirical studies, based either on national representative data or data for particular metropolitan areas, provided evidence generally in support of the L-N theory (e.g., Calem, 1996; Ling and Wachter, 1998; Blackburn and Vermilyea, 2007; and Ding, 2014).

2.3 Appraisal and Mortgage Lending Decisions

Appraised values and the difference between appraisals and contract prices have a direct effect on mortgage outcomes. An appraised value significantly below the contract price may force a seller to sell the property at a price lower than the agreed-upon price. If a seller is not willing to take a loss, the sale could be canceled. Second, low appraisals may cause lenders to seek larger down payments. Low appraised value may simply push the loan applicant to get a higher LTV loan. When the borrower is capital constrained, however, this may cause the lender to reject the loan application. So while an above-contract price appraisal will have no direct impact, a low appraisal may require buyers to come up with an extra down payment or pay a higher price (a higher interest rate or mortgage insurance that otherwise may not be needed), or it

[13] According to the Appraisal Institute (2008), an appraiser should not ignore foreclosure sales if the consideration of such sales is necessary to develop a credible value opinion. Only sales that might have involved atypical seller motivations (e.g., a highly motivated seller), such as a short sale, could be ignored.

may result in a buyer withdrawing or a lender rejecting the application. LaCour-Little and Green (1998) confirmed that a low appraised value significantly increases the probability of mortgage loan application rejection. A low appraisal raises the likelihood of denial by 1.8 percentage points, while an appraisal that is the same as the offer price also raises the probability of denial by 0.6 percentage point.

This study is related to other studies on lending disparities in the mortgage market, which tested the associations between neighborhood income, racial component, or center city location and mortgage lending (see review in Ladd 1998). Other studies, which are more relevant to this analysis, have investigated the impact of various government regulations on mortgage lending decisions. Such examples include studies on the impact of state antipredatory lending laws on mortgage lending (e.g., Harvey and Nigro, 2004; Bostic et al., 2008) or on the impact of state foreclosure laws on mortgage lending (Pence, 2006). This study contributes to the literature by providing new evidence of the impact of the HVCC, a major appraisal rule enacted in the housing crisis, on appraisal and mortgage outcomes.

3. Data

This analysis used two primary data sets. The first one is the FNC, Inc.'s collateral database (FNC data), which provides a national sample of appraisal records, regardless of whether they ended up with mortgage originations. The FNC data have been built from the data aggregated from major mortgage lenders that agreed to share their nonconfidential appraisal data with FNC. The FNC data have information on property type, contract date, appraisal date, rounded sales price (rounded up to the next $50,000), appraisal-price percent difference, zip code, and county code of the property. The second data set is the expanded Home Mortgage Disclosure Act (HMDA) data with information on mortgage application action dates (approval dates, denial dates, or other action dates) compiled by the staff of the Board of Governors of the Federal Reserve System. Compared with the publicly available HMDA data, this data set allows us to identify the timing of mortgage applications much more precisely.

The FNC data have some unique features compared with the data sets used in prior studies and can provide insights about the appraisal practices during the housing crisis. Prior studies using approved loans only suffer from a selection bias: Appraisals in the approved samples are a conditional distribution-conditional on the loan being made. Since applications

with appraised values lower than contract prices are more likely to be denied, the focus on the approved loans induces an underestimate in the incidence of low appraisals. Second, data sets with approved mortgages usually allow only for a comparison of appraised values with transaction prices, instead of the initial contract prices, which are not always the same as the final transaction prices. If the seller has been forced to renegotiate the asking price when the appraised value of the property is below the contract price, the observed transaction price could actually be lower than the contract price. Of course, this data set has limitations, such as the sparse information on the borrower and mortgage characteristics and the underrepresentation in certain markets.[14]

Figure 1 based on the FNC data shows the change in the share of low appraisals over time. In 2006 and 2007, the share of low appraisals was between 4 percent and 6 percent nationally. After increasing slightly in 2008, the share of low appraisals started to increase sharply after the HVCC was enacted (from 8.3 percent in the fourth quarter of 2008 to 14 percent and 15.2 percent in the second and third quarters of 2009, respectively), with a peak in the third quarter of 2009. Of course, the decline in housing prices, mortgage defaults, and foreclosure rates during this period may also help explain the dynamics of low appraisal rates: Housing prices bottomed out in the first quarter of 2009, while the mortgage serious delinquency rate peaked in the fourth quarter of 2009 (Figure 1).

Figure 2 further compares the distribution of the appraisal ratio pre- and post-HVCC. The share of low appraisals increased from 9.3 percent in the six months before the HVCC to 15.0 percent in the six months after the HVCC. The share of appraisals slightly higher than (or equal to) contract prices (0 percent to 1 percent) also increased slightly, while the share of significantly high appraisals decreased significantly, from 22.3 percent pre-HVCC to 14.6 percent post-HVCC. Overall, at the aggregate level, the distribution curve shifted to the left after the HVCC: More appraisals came in below, equal to, or slightly higher than the contract prices, while there were fewer appraisals that were significantly higher than contract prices.

[14] Because of privacy considerations, geographical information is only available at the zip code level. Information about individual borrowers, mortgage applications, property condition, and property address is generally unavailable. Some sand states including Arizona, California, Florida, and Nevada are overrepresented, while the Midwest areas are slightly underrepresented (see Table 9).

3.1 Descriptive Analysis: A Difference-in-Differences Approach

The changes in the appraisal ratio after the HVCC at the aggregate level do not necessarily reflect the independent effect of the HVCC on appraisal outcomes. As a source of plausibly exogenous variation, we exploit the fact that by regulation, only mortgages below the Conforming Loan Limits (CLLs)[15] are likely to be subject to the HVCC. By regulation, the CLL is a key determinant of whether a loan application is eligible to be purchased/securitized by GSEs and subject to the HVCC: Mortgages with loan amounts below the CLLs are eligible to be purchased by the two GSEs, which either hold the mortgages or package them into securities and sell the securities to investors, while applications for mortgages above the CLLs (jumbo loans) are ineligible to be purchased by GSEs, and thus are not subject to the HVCC.[16] So appraisals for loans under the CLLs can be roughly treated as the treatment group, while appraisals for loans above the CLLs can be considered as the control group.[17] By comparing the changes in the appraisal and loan application outcomes pre- and post-HVCC between the treatment and control groups (difference-in-differences), we can attribute any such differences to the treatment itself, namely, the enactment of the HVCC, by factoring out the time and market trends during the study period.

The HVCC only applies to single-family mortgages sold to GSEs, so the appraisal analysis focuses on appraisals for relatively high-priced single-family properties during the study periods.[18] The mortgage denial analysis primarily used applications for first-lien, single-family,

[15] The national conforming loan limit (CLL) for mortgages that finance single-family one-unit properties was $417,000 for 2006–2008, with higher limits for certain statutorily designated high-cost areas and mortgages secured by multifamily dwellings. The Economic Stimulus Act (ESA) of 2008 temporarily raised the CLLs in designated high-cost areas in the contiguous United States to up to $729,750. These higher temporary CLLs were then extended several times, finally expiring on September 30, 2011. Data for the CLLs at the county level are available at http://www.fhfa.gov/DataTools/Downloads/Pages/Conforming-Loan-Limits.aspx.

[16] Jumbo mortgages are only a subset of the nonconforming market because loan characteristics other than size can also make a loan nonconforming. But these other underwriting criteria are not as clearly defined as the size limit. Usually in high-cost areas, loans between the national floor limit ($417,000) and the CLLs are considered to be jumbo conforming, while loans above the CLLs are considered to be jumbo loans.

[17] When the CLLs changed during the study period in a number of areas, the highest level CLLs during the study period were used to determine the non-HVCC-covered appraisals (or applications), while the lowest level CLLs were used to identify the HVCC-covered appraisals (or applications).

[18] As Liu, Nowak, and Rosenthal (2014) suggested, not all housing submarkets experienced the same level of decline during the housing crisis and small-size starter houses were hit harder. To reduce the potential bias because of unobserved heterogeneity among different housing segments, appraisals for relatively low-priced properties (those with rounded contract prices below $300,000 to $500,000 depending on the area's GSE loan limit) were excluded from the analysis.

home purchase conventional loans[19] with relatively large loan amounts (above 50 percent of the CLL).[20] Nonconventional loan applications that were initially not subject to the HVCC — primarily government-guaranteed loans such as Federal Housing Administration (FHA) and U.S. Department of Veteran Affairs (VA) loans — were excluded from the mortgage denial analysis.

The pre- and post-HVCC periods were classified according to appraisal dates or action dates on mortgage applications. Our preferred specification considers the six months before and after the HVCC (October 1, 2008, to March 31, 2009, versus June 1, 2009, to November 30, 2009) as the pre- and post-HVCC periods (Table 1). The months immediately before and after the enactment of the HVCC (April 1 to May 31, 2009) are considered to be a transitional period and are excluded from the analysis. This doughnut hole sampling technique is designed to remove observations from the data when appraisers and lenders might have been preparing for and adjusting to the new regulation, while still allowing enough observations to provide some precision in the results. Most of our discussions of the empirical results are based on this specification.

Additional assumptions are needed to apply this identification strategy to the appraisal analysis. The FNC data used in this study provide information only on rounded contract prices, instead of the exact contract prices or loan amounts. Because information on the exact loan amount is unavailable, we used 1.25 times of the CLL, which is called the conforming price limit (CPL), as a proxy to identify appraisals for conforming loans based on contract prices. Assuming a typical buyer needs to secure 20 percent for a down payment, transactions with contract prices below the CPLs are eligible for conforming loans and thus subject to the HVCC. If homebuyers only agree to a 20 percent down payment, transactions with contract prices above CPLs are ineligible for conforming loans.[21] As mentioned previously, transactions with relatively low

[19] Only applications that were approved and originated, applications that were denied, and applications that were approved but not accepted by the applicant are included in the analyses. A similar treatment is available in Ding (2014). Eight possible outcomes for a loan application in HMDA include 1) loan originated, 2) application approved but not accepted, 3) application denied by financial institution, 4) application withdrawn by applicant, 5) file closed for incompleteness, 6) loan purchased by financial institution, 7) preapproved request denied by financial institution, and 8) preapproval request approved but not accepted. This study primarily focuses on the first three because it is hard to ascertain whether the application is approved or denied for other outcomes.

[20] Different thresholds, such as 75 percent and 90 percent of the CLL, were tried; the results were quite consistent so this study focuses on this specification only.

[21] As high-priced homebuyers may have the incentive to find ways to raise cash to bridge the gap so they will not have to take out a jumbo loan, different cut-off prices (the CLL divided by 0.8, 0.7, or 0.6, respectively) are used to construct different control groups to test the sensitivity of the results to different cut-off points.

contract prices (less than 50 percent of the CPL) were excluded to construct a more homogeneous group.

Table 2 examines the distribution of the appraisal ratio, including shares of low appraisals, significantly low appraisals, and significantly high appraisals, among the treatment and control groups over the pre- and post-HVCC periods. The differences between periods and groups are provided. Table 3 provides similar data for denial rates and collateral denial rates, respectively, based on the HMDA data.

Appraisal Ratio

The descriptive statistics in Table 2 show that both the treatment group and the control group experienced a quantitatively significant increase in the share of low appraisals between the pre- and post-HVCC periods. The share of low appraisals increased 4.20 percent among the treatment group compared with a 2.73 percent increase in the control group for a difference of 1.47 percentage points. These represent, respectively, a roughly 38 percent relative increase in low appraisals for the treatment group compared with a 24 percent increase for the control group. The treatment group experienced a 1.72 percent increase in the share of significantly low appraisals compared with a 1.13 percent increase in the control group. During the same period, the share of significantly high appraisals decreased 4.32 percent for the treatment group, 0.58 percentage point higher than the 3.74 percent decline in the control group.

Mortgage Denial

We further tracked the changes in both the overall denial rates and the rates of denials because of insufficient collateral for the treatment and the control group. The data in Table 3 show that applications in the control group experienced a significant decline in denial rates, from 23.31 percent in the pre-HVCC period to 16.90 percent post-HVCC, or a decline of 6.41 percentage points. However, the decline was less for the treatment group, which was subject to the HVCC: The denial rate decreased 4.80 percent for the treatment group, or 1.61 percentage points lower than the 6.41 percent decline for the control group. More significant change can be found for the collateral denial rates: The collateral denial rate decreased by 0.50 percent for the treatment group after the HVCC, lower than the 1.37 percent decline for the control group, with a difference of 0.87 percentage point.

Overall, the descriptive analysis suggests, though not conclusively, that there was a general increase in the incidence of low appraisals in the treatment group post-HVCC. While the overall denial rates declined after the HVCC, the decline in the treatment group, which was likely to be subject to the HVCC, was much less. So relative to the control group, the HVCC-covered applications were more likely to be denied, especially in the case of insufficient collateral after the HVCC was enacted. Of course, other market forces that might affect appraisal and mortgage lending outcomes, such as property type, lender type, and neighborhood risk characteristics, need to be taken into consideration in order to arrive at more solid conclusions.

4. Empirical Method

This section lays out several tests that examine the robustness of the results from the descriptive analysis. Specifically, the remainder of this section outlines two separate tests that examine the effect of the implementation of the HVCC on appraisal ratio and mortgage denials.

4.1 Probability of Low (High) Appraisals

We used a standard difference-in-differences model, which compares the change in the probability of low or high appraisals pre- and post-HVCC among appraisals likely to be subject to the HVCC, relative to the control group. We estimate the following logit model for the appraisal outcome:

$$Log(Odds_i) = \beta_0 + \beta_1 * HVCC_i + \beta_2 * CPL_i + \beta_3 * (HVCC_i * CPL_i) + \gamma * CBSA_i + \delta * LENDER_i + \varepsilon * X_i \quad (1)$$

where

- $Odds_i$ represents the odds of low (high) appraisal for appraisal *i* during the study period.
- *HVCC* is the time dummy to identify the pre- and post-HVCC time periods.
- *CPL* is equal to 1 if the contract price is under the *conforming price limit* and equal to 0 if the contract price is above the limit.

- *HVCC* ∗ *CPL* is the interaction that combines the HVCC rule and conforming price limit variables, which is used to assess the impact of the HVCC on the incidence of low appraisals.
- *CBSA* (Core Based Statistical Area) is the metro dummy (major metros only).
- *LENDER* is the lender dummy (major lenders only).
- *X* represents the control variables that include major lender dummies and a few neighborhood characteristics such as prior mortgage originations, recent house price change, prior foreclosure rate, and neighborhood size. The variable definitions are provided in Table 4.

Here appraisals with prices below the CPLs became subject to the HVCC after the rule was enacted (*HVCC***CPL* is equal to 1). So the coefficient of interest, β_3, represents the HVCC effect on the incidence of low appraisal by capturing the changes in the odds of low appraisals of HVCC-covered applications.

4.2 Denial Probabilities

A similar difference-in-differences model was used to compare the change in the incidence of denial before and after the HVCC among conforming loans with that of loans that are likely not to be subject to the HVCC. The model can be summarized as:

$$Log(Denial_i) = \beta_0 + \beta_1 * HVCC_i + \beta_2 * CLL_i + \beta_3 * (HVCC_i * CLL_i) + \gamma * CBSA_i + \delta * LENDER_i + \varepsilon * X_i \quad (2)$$

where

- $Denial_i$ represents the odds of mortgage denial (denial or collateral denial)[22] for loan application *i* during the study period.
- *CLL* is equal to 1 if the loan amount is under the "*conforming loan limit*" and to 0 if the loan amount is above the CLL.

[22] In modeling collateral denial, the dependent variable is constructed based on the reasons for mortgage rejection available in the HMDA data set.

- *HVCC∗CLL* is the two-way interaction of the time and CLL variables, which is used to assess the impact of the HVCC on denial probabilities.
- *X* represents the control variables that may influence mortgage application decisions including borrower demographic information and neighborhood risk characteristics, as well as metropolitan and lender dummies (see Table 4).

4.3 Caveats

To implement the identification strategy effectively, the control group needs to have a stable legal environment during the study period. Unfortunately, this assumption does not hold for the appraisal analysis: An unknown share of appraisals in the control group that was assumed to be unaffected by the HVCC was actually subject to the HVCC during the study period. However, the use of jumbo loans had actually been quite stable during the study period. Based on our estimation, about 24.4 percent of mortgage-financed purchases of higher-priced properties (with purchase prices above 1.25 times of the CLLs) used jumbo loans during the 12 months pre-HVCC, compared with 23.2 percent in the 12 months post-HVCC.[23] We recognize that the lack of information on the exact loan amounts has serious limitations, which makes it impossible for us to determine the treatment/control group precisely. However, our identification strategy to isolate the effect of the HVCC should still be valid since the share of transactions in the control group that may be subject to the HVCC was stable.[24]

Second, the mortgage denial model focuses on both the probability of denials in general as well as the denials because of insufficient collateral, which are based on the denial reasons reported by the applicants. The concern is that not all lenders report the reasons for their denied applications, so the results on collateral denials may be biased because of missing values for some denials.[25] However, the results are still informative because denial reasons are available for a vast majority of denied applications: Based on our estimation using the 2009 HMDA data,

[23] For transactions with purchase prices higher than 1.67 times of the CLLs, the ratios of using jumbo loans were 42.8 percent and 43.5 percent pre- and post-HVCC, respectively. The estimation is based on a 10 percent random sample of originated loans in Black Knight.

[24] As long as the likelihood of obtaining conforming loans for high-priced clients remains unchanged or increasing over the study period, the identification strategy to isolate the effect of the HVCC should still be valid.

[25] Recording reasons for denial was not obligatory for financial institutions supervised by the Federal Reserve System (FRS) and the Federal Deposit Insurance Corporation (FDIC). And reporting institutions may cite up to three reasons for each denied application, although most of those that provide this information cite only one.

about 81.2 percent of the first-lien conventional purchase loan applicants have the first reason reported, and 16.6 percent and 4.4 percent of the applicants reported their second and third reasons, respectively.

5. Multivariate Analysis Results

This section presents multivariate results for each of the models outlined in the previous section. The multivariate results in Table 5 through Table 8 strongly support the descriptive analysis results that the HVCC led to an increased incidence of low appraisals and mortgage denials. The discussion of the empirical results primarily focuses on the effects of the HVCC, while results of some controls are discussed briefly at the end of this section. Again, the discussion is based primarily on our preferred specification, which focuses on the periods six months before and six months after the HVCC.[26]

5.1 Effects of the HVCC on Low (High) Appraisals

Appraisals generally have a higher probability of low appraisals after May 2009 (with an odds ratio of 1.33 for the HVCC variable, Table 5) that is likely because of the general market trend influenced by factors other than the HVCC. Appraisals in the treatment group, which have lower contract prices, are generally less likely to have low appraisals (about 16.6 percent less likely) than those in the control group, which is consistent with the expectation that the likelihood of low appraisals increases with the property price. Appraisers may have greater difficulty in finding comparables for high-priced properties in the control group, and they may be more conservative for the appraisals of these properties as well, given the potentially greater loss for the lenders and investors.

However, the HVCC leads to a significant increase in the likelihood of low appraisals in the treatment group, relative to the control group: The odds of low appraisals for the treatment group increase by 25.6 percent in the three months, 17.1 percent in the six months, and 15.1

[26] As Table 1 summarizes, this study tried several different definitions of the pre- and post-HVCC periods for two considerations: 1) whether there are significant differences between the short-term and the long-term effects of the HVCC, and 2) whether the results are sensitive to different treatments of the period from the time when it was first announced to its enactment date (March 3, 2008, to April 30, 2009).

percent in the 12 months post-HVCC.[27] The magnitude of the HVCC effect diminishes slightly over time likely because lenders and regulators have gradually adjusted to the new system over time. Furthermore, the HVCC effect on low appraisals is greater when compared with the period before the HVCC proposal was first announced in March 2008: The odds of low appraisals increase by 50.5 percent compared with the prerelease period. The results suggest lenders and appraisers may have started to adjust their practices during the transitional period.

The HVCC also leads to more significantly low appraisals and fewer significantly high appraisals (Table 6): For the treatment group, the odds of significantly low appraisals increase by 16.3 percent post-HVCC, while the odds of significantly high appraisals decrease by 15.3 percent.

Because this analysis identified the treatment group based on observed contract prices instead of exact loan amounts, the results could be sensitive to the price cut-off points, especially considering high-priced homebuyers may have the incentive to use cash to bridge the gap to do a conforming loan. As a robustness check, a set of thresholds was used to test the sensitivity of the results to price cut-off points. The results listed in Table 7 suggest that the HVCC effect becomes greater when higher price limits are used: The odds of low appraisals increase by 23.6 percent and 31.7 percent if the CPL is set as 1.43 times of the CLL and 1.67 times of the CLL, respectively, both of which are higher than the 17.1 percent when the CPL is equal to 1.25 times of the CLL.[28] The larger gap between the treatment and control groups is consistent with our contention that the HVCC leads to more low appraisals because appraisals of higher contract prices were increasingly less likely to use conforming loans that were subject to the HVCC.

5.2 Effect of the HVCC on Mortgage Denials

The results discussed in the previous subsection confirm that the HVCC reduces significantly high appraisals and increases the incidence of low appraisals. So what would be the effect of the HVCC on mortgage lending decisions? Regression results suggest that the overall probability of denial decreases (by about 29 percent) after the HVCC (Table 8). However, there are significant variations between the declines for the treatment group and the control group; the

[27] The effects of the HVCC on low appraisals could be underestimated here since the low-end housing segment, which was hit harder by the housing crisis and more vulnerable to tightened regulations such as the HVCC, was not included in the analysis.

[28] The price limit to identify the control group has been kept the same here (1.25 times the CLL).

decline in the control group is much sharper. For the treatment group, the odds of mortgage denials because of insufficient collateral increase by 16.5 percent after the HVCC, while the odds of denials increase by 8.7 percent for purchase loans. The HVCC is explicitly designed to address the appraisal issues, so it is expected to have a greater impact on collateral denials. Of course, note that the measure of collateral denial is imperfect because of missing data on denial reasons for a small share of denied mortgage applications.

During different study periods (three months or 12 months), the results are quite consistent: a 17.3 percent increase for the treatment group in the odds of collateral denials for the three-month evaluation period and a 15.2 percent increase for a longer study period of 12 months.

Overall, the results suggest that the HVCC helps explain the relatively higher mortgage denial rates in the treatment group, likely because of the higher incidence of low appraisals and the resulting higher rates of collateral denials. The HVCC effects are significant in the purchase market, which will inevitably have a negative impact on the access to mortgage credit for potential borrowers.

5.3 Other Determining Factors of Low Appraisals and Mortgage Denial

There is extensive literature on mortgage lending decisions, and our findings are generally consistent with those in early studies: Applications by minority borrowers, those for not-owner-occupied properties, and those in less desirable neighborhoods (low-income neighborhoods or neighborhoods with a higher concentration of foreclosures and/or a lower level of market activities) are more likely to be denied, so we focus the discussion of the empirical results of other controls on factors influencing appraisals here.

Market Inefficiency: Foreclosures and Prior Market Activities

The regression results confirm that the probability of low appraisals is higher in neighborhoods with higher foreclosure rates and those with a lower level of market activities. The results are generally consistent when different outcome measures are used. The results confirm that an insufficient number of mortgage-financed sales leads to an increased probability of low appraisals. The positive association with the foreclosure rate could be explained by the negative impact of foreclosed properties as comparables on appraisals or simply because

foreclosure rates represent neighborhood risk. The impact of prior transactions is also understandable as a sufficient volume of market sales aids in price discovery, allows lenders to distinguish observable risks, and leads to a lower share of low appraisals observed.

Lender Heterogeneity

Because of increased regulations, especially after the HVCC and the Dodd-Frank Act were enacted, AMCs have taken a greater market share. Results from the logit regressions demonstrate that the incidence of low appraisals for those ordered by lenders directly is much lower compared with that of AMC appraisals (about 17.0 percent to 48.7 percent lower in our preferred model). While the incidence of low appraisal does not necessarily represent the quality of appraisals, the results provide some evidence of significant heterogeneity in the appraisal approaches or the enforcement of existing regulations by different lenders.

6. Conclusion and Policy Implications

Appraisers are expected to provide unbiased opinions about the value of assets. However, appraisers have been criticized for frequently providing inflated home values during the housing boom and for providing overly conservative valuations during the housing bust. As market conditions and legal environments have changed radically during the housing crisis, this study demonstrates how one important rule adopted during the crisis, the HVCC, impacted appraisal and mortgage outcomes.

The HVCC was designed to make appraisals more independent and objective primarily by addressing issues related to conflicts of interest in the appraisal process. The HVCC has partly accomplished this by reducing inflated valuations that were prevalent during the subprime boom. But the HVCC also led to a significant increase in low appraisals, which made it more difficult for borrowers to obtain mortgages.

The results demonstrate that the HVCC induced significant changes in the housing market. It seems lenders and appraisers generally responded to the rule by becoming more conservative, especially when market conditions were changing rapidly during the housing crisis. The results should shed light on how to design intervention programs in the future, especially during a crisis that is often characterized by high levels of uncertainty and panic.

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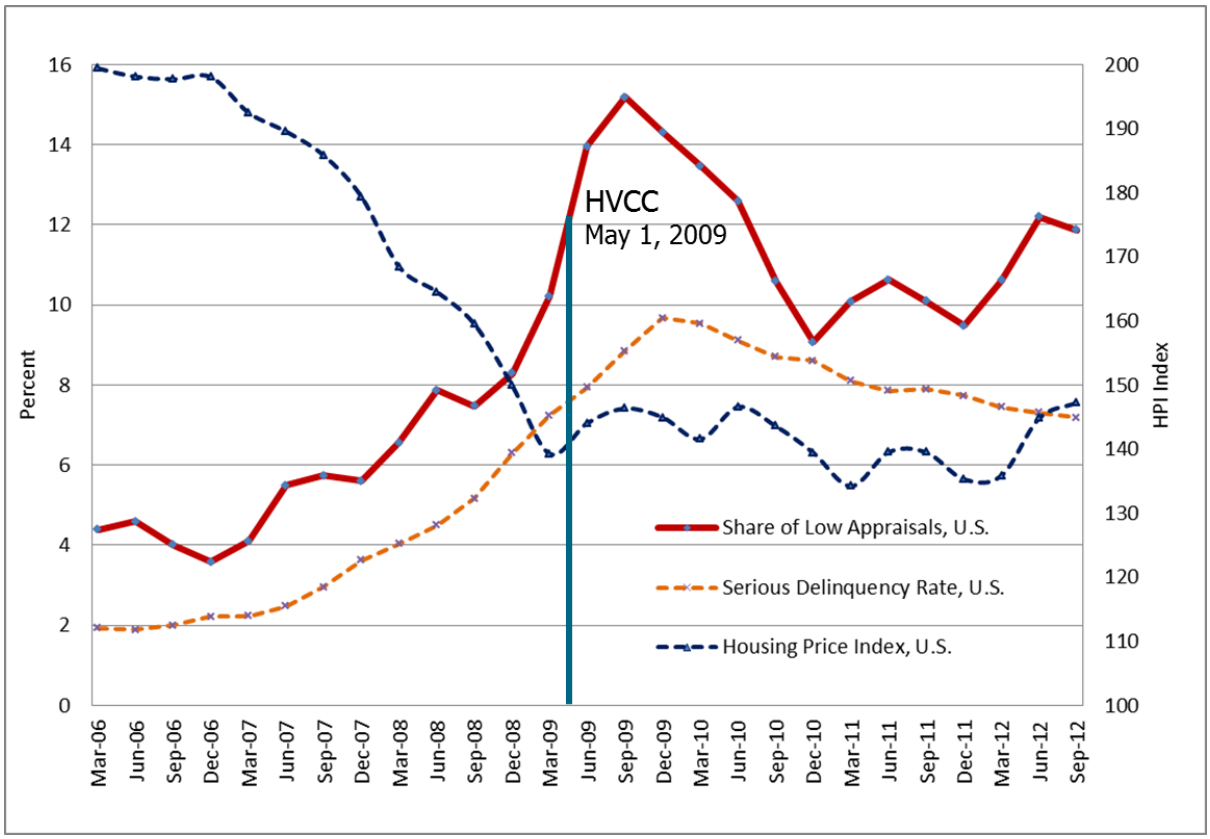
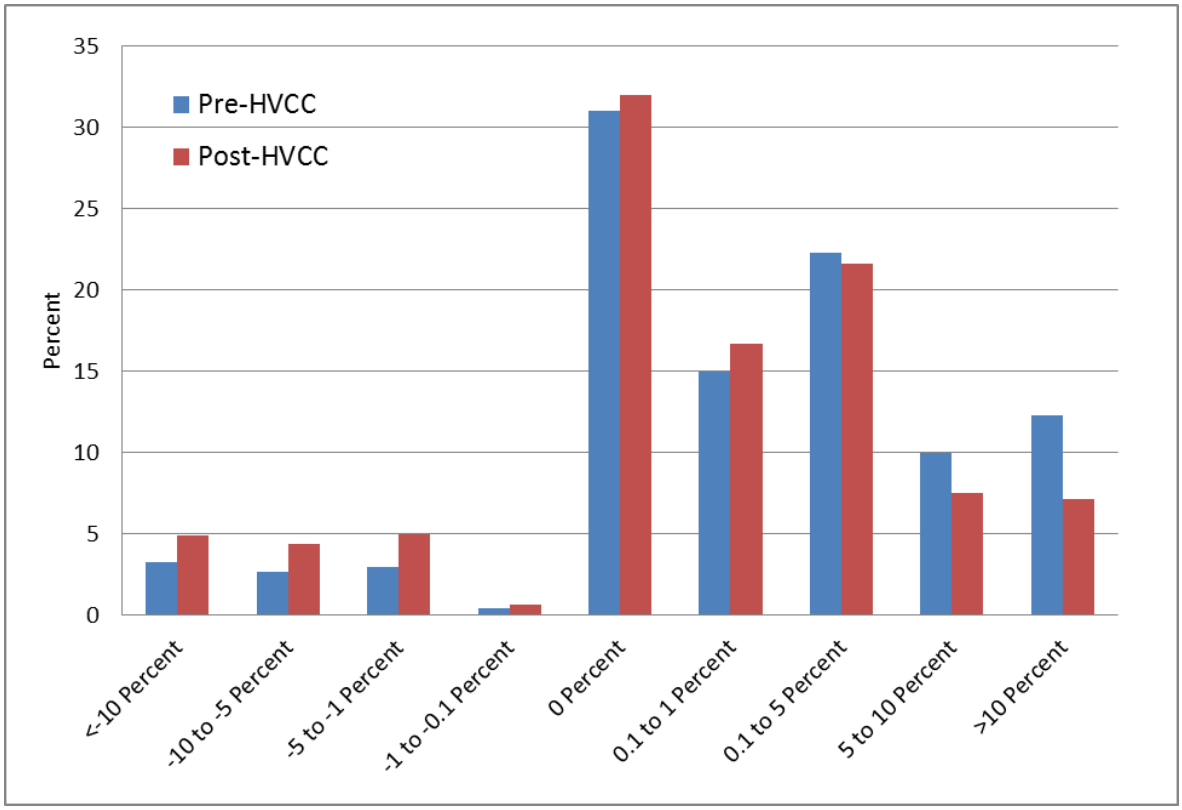
Figure 1. Share of Low Appraisals in the U.S.
First Quarter 2006 to Third Quarter 2012



Note: *Share of low appraisals* represents the share of appraisals with appraised values below the contract prices.
Source: FNC data, Black Knight data (previously LPS data), and CoreLogic HPI

Figure 2. Distribution of Appraisal Ratios Pre- and Post-HVCC



Note: *Appraisal ratio* is defined as the appraised value less the contract price as a percent of the contract price. Pre- and post-HVCC periods are defined here as the six months before and after the HVCC (October 1, 2008, to March 31, 2009, versus June 1, 2009, to November 30, 2009). All appraisals are included.
Source: FNC data

Table 1. Specifications of Study Periods and Treatment/Control Groups

Study Period		
Pre-HVCC	Post-HVCC	Explanations
1/1/2009-3/31/2009	6/1/2009-8/30/2009	3 months before and after HVCC; 4/1/2009-5/31/2009 considered as transitional period
10/1/2008-3/31/2009	6/1/2009-11/30/2009	6 months before and after HVCC; 4/1/2009-5/31/2009 considered as transitional period (preferred)
4/1/2008-3/31/2009	6/1/2009-5/30/2010	12 months before and after HVCC; 4/1/2009-5/31/2009 considered as transitional period
9/1/2007-2/28/2008	6/1/2009-11/30/2009	6 months before the introduction of HVCC and 6 months after the enactment of HVCC; 3/1/2008-5/31/2009 considered as transitional period
Treatment/Control Group (appraisal analysis only)		
Treatment Group	Control Group	
0.5*conforming price limit<price< conforming price limit (1.25*CLL)	price>conforming price limit (1.25*CLL)	appraisals with contract prices over 1.25 times of conforming loan limit are assumed to use nonconforming loans; they do not qualify for a conforming loan with a down payment up to 20% of the contract price (preferred)
0.5*conforming price limit<price< conforming price limit (1.25*CLL)	price>conforming price limit1 (1.43*CLL)	appraisals with contract prices over 1.43 times of conforming loan limit are assumed to use nonconforming loans; they do not qualify for a conforming loan with a down payment up to 30% of the contract price
0.5*conforming price limit<price< conforming price limit (1.25*CLL)	price>conforming price limit2 (1.67*CLL)	appraisals with contract prices over 1.67 times of conforming loan limit are assumed to use nonconforming loans; they do not qualify for a conforming loan with a down payment up to 40% of the contract price

Note: The CLL represents conforming loan limit

Table 2. Appraisal Ratios in the Pre- and Post-HVCC Periods (Percent)

	Appraisal Ratio (Appraised Value-Contract Price)/Contract Price					
Treatment Group (Priced between 0.5*CPL and CPL)	Low Appraisal <0 Percent	Below -5 Percent	Between -5 and -0.1 Percent	0 Percent	Between 0.1 and 5 Percent	Above 5 Percent
Pre-HVCC	10.99	6.39	4.60	34.69	40.69	13.63
Post-HVCC	15.19	8.11	7.08	36.13	39.38	9.31
Change	4.20	1.72	2.48	1.44	-1.31	-4.32
Control Group (Priced above CPL)						
Pre-HVCC	11.43	7.76	3.67	38.04	34.88	15.65
Post-HVCC	14.16	8.89	5.27	39.94	33.99	11.91
Change	2.73	1.13	1.60	1.90	-0.89	-3.74
Difference in Changes	1.47	0.59	0.88	-0.46	-0.42	-0.58

Note: The CPL represents conforming price limit here, which is 1.25 times of conforming loan limit; the pre- and post-HVCC periods here are defined as six months before and after the HVCC; appraisals for single-family properties with contract prices above 50 percent of the confirming price limit only; based on the FNC data.

Table 3. Denial Rates in the Pre- and Post-HVCC Periods (Percent)

	Denial Rate	Collateral Denial Rate
Treatment Group (Loan amounts between 0.5*CLL and CLL)		
Pre-HVCC	16.18	3.20
Post-HVCC	11.38	2.70
Change	-4.80	-0.50
Control Group (Loan amounts above CLL)		
Pre-HVCC	23.31	5.51
Post-HVCC	16.90	4.14
Change	-6.41	-1.37
Difference in Changes	1.61	0.87

Note: The pre- and post-HVCC periods here are defined as six months before and after the HVCC. First-lien, one- to four-family properties, and applications with loan amounts above 50 percent of the confirming loan limit only. Applications that were approved and originated, applications that were denied, and applications that were approved but not accepted by the applicant were included in the calculation of denial rates; based on the HMDA data.

Table 4. Variable Definitions

Appraisal Model	
Parameter	Definition
low appraisal	Indicator variable=1 if appraisal is lower than contract price
significantly low appraisal	Indicator variable=1 if appraisal is at least 5% lower than contract price
prior loan origination (in log)	Number of purchase loan originations in the zip code in the previous year (in log)
prior foreclosure rate	Share of loans in serious delinquency in the zip code in the previous year (from Black Knight)
house price change in 12 months	Zip code house price change in the previous 12 months (from CoreLogic)
housing units (in log)	Number of owner-occupied housing units in the zip code from 2000 census (in log)
hvcc	Indicator variable: Time period post-HVCC=1; 0 otherwise
cpl	Indicator variable: Contract price below CPL=1; 0 otherwise
hvcc*cpl	Indicator variable: Post-HVCC period for appraisals with contract price below CPL=1; 0 otherwise
lender dummies	Dummies for major non-AMC lenders (Lender 1-Lender 4, and other small lenders)
CBSA dummies	Dummies for major MSAs

Mortgage Denial Model	
Parameter	Definition
Denial	Indicator variable=1 if denied; 0 otherwise
collateral_denial	Indicator variable=1 if denied because of insufficient collateral; 0 otherwise
other minority (vs. white)	Indicator variable=1 if other non-African American non-Hispanic; 0 otherwise
African American (vs. white)	Indicator variable=1 for African American borrower; 0 otherwise
Hispanic (vs. white)	Indicator variable=1 for Hispanic borrower; 0 otherwise
owner-occupied property	Indicator variable=1 for owner-occupied property; 0 otherwise
borrower income (relative to area median income, %)	Applicant household income relative to area median income
minority tract (10-30% minority)	Indicator variable=1 for tracts with 10-30% minority; 0 otherwise
high minority tract (>30% minority)	Indicator variable=1 for tracts with 30% or more minority; 0 otherwise
low income tract	Indicator variable=1 for low income tract (<50% AMI); 0 otherwise
moderate income tract	Indicator variable=1 for moderate income tract (50-79% AMI); 0 otherwise
middle income tract	Indicator variable=1 for middle income tract (80-119% AMI); 0 otherwise
tract population (in log)	tract total population (in log) based on 2000 census
0-10 purchase loans in tract	Indicator variable=1 for tracts with 10 or less purchase loans in 2008; 0 otherwise
11-20 purchase loans in tract (vs.>80)	Indicator variable=1 for tracts with 11-20 purchase loans in 2008; 0 otherwise
21-40 purchase loans in tract (vs.>80)	Indicator variable=1 for tracts with 21-40 purchase loans in 2008; 0 otherwise
41-80 purchase loans in tract (vs.>80)	Indicator variable=1 for tracts with 41-80 purchase loans in 2008; 0 otherwise
foreclosure rate 3-7%	Indicator variable=1 for tracts with estimated foreclosure rate of 3.1-7% in 2007-2008; 0 otherwise
foreclosure rate 7-11%	Indicator variable=1 for tracts with estimated foreclosure rate of 7.1-11% in 2007-2008; 0 otherwise
foreclosure rate >11%	Indicator variable=1 for tracts with estimated foreclosure rate >11% in 2007-2008; 0 otherwise
tract denial rate in 2008	Tract purchase loan denial rate in 2008
hvcc	Indicator variable: Time period post-HVCC=1; 0 otherwise
cll	Indicator variable: Loan amount below CLL=1; 0 otherwise
hvcc*cll	Indicator variable: Post-HVCC period for applications with loan amount below CLL=1; 0 otherwise
lender dummies	Dummies for major non-AMC lenders
CBSA dummies	Dummies for major MSAs

Table 5. Impact of Home Valuation Code of Conduct on the Incidence of Low Appraisals (Odds Ratios)

Parameter	3 Months Pre- and Post-HVCC	6 Months Pre- and Post-HVCC	12 Months Pre- and Post-HVCC	6 Months Pre-Release and Post-HVCC
prior loan origination (in log)	0.876***	0.895***	0.907***	0.894***
prior foreclosure rate	1.133***	1.132***	1.101***	1.133***
house price change in 12 months	0.998	0.991***	0.986***	0.992***
housing units (in log)	1.077**	1.055**	1.065***	1.076***
hvcc	1.264***	1.329***	1.373***	1.485***
cpl	0.837**	0.834***	0.790***	0.651***
hvcc*cpl	1.256**	1.171**	1.151***	1.505***
lender 1 (vs. AMCs)	0.767***	0.786***	0.837***	0.762***
lender 2 (vs. AMCs)	0.746***	0.759***	0.812***	0.816***
lender 3 (vs. AMCs)	0.935	0.513***	0.638***	0.524***
lender 4 (vs. AMCs)	0.564***	0.596***	0.607***	0.583***
other lenders (vs. AMCs)	0.727**	0.830*	0.638***	0.504***
cbsa dummies	Yes	Yes	Yes	Yes
Model fit				
Pct Concordant	66.9	66.7	66.2	69.6
Pct Discordant	32.3	32.4	32.9	29.6
Number of observations	42,193	80,997	167,462	82,397

***significant at .001 level; **significant at .01 level; *significant at .05 level

Note: See Table 1 for definitions of pre- and post-HVCC periods. Single-family properties with contract prices above 50 percent of the confirming price limit only; based on the FNC data.

Table 6. Impact of the HVCC on Significantly Low (High) Appraisal (Odds Ratios)

	Six Months Pre- and Post-HVCC	
Parameter	Significantly Low Appraisal (5% below Prices)	Significantly High Appraisal (5% above Prices)
prior loan origination (in log)	0.829***	0.883***
prior foreclosure rate	1.150***	0.973***
house price change in 12 months	0.980***	0.992***
housing units (in log)	1.059**	1.014
hvcc	1.310***	0.802***
cpl	0.689***	0.930
hvcc*cpl	1.163*	0.847**
lender 1 (vs. AMCs)	0.743***	0.889*
lender 2 (vs. AMCs)	0.779***	0.922
lender 3 (vs. AMCs)	0.509***	1.257*
lender 4 (vs. AMCs)	0.493***	1.223**
other lenders (vs. AMCs)	0.832	1.311***
cbsa	Yes	Yes
Model fit		
Pct Concordant	70.5	68.7
Pct Discordant	28.3	30.5
Number of observations	80,997	80,997

***significant at .001 level; **significant at .01 level; *significant at 0.05 level

Note: The pre- and post-HVCC periods here are defined as six months before and after the HVCC; appraisals for single-family properties with contract prices above 50 percent of the confirming price limit only; based on the FNC data.

Table 7. Sensitivity Analysis of the Cut-Off Points of Contract Prices (Odds Ratios)

	Price Cut-Off Points (Control Group), Six Months Pre- and Post-HVCC		
Variables	1.25*CLL (loan limit/80%)	1.43*CLL (loan limit/70%)	1.67*CLL (loan limit/60%)
Parameter			
prior loan origination (in log)	0.895***	0.901***	0.894***
prior foreclosure rate	1.132***	1.129***	1.130***
house price change in 12 months	0.991***	0.991***	0.992***
housing units (in log)	1.055**	1.053**	1.062***
hvcc	1.329***	1.261***	1.179*
cpl	0.834***	0.811***	0.747***
hvcc*cpl	1.171**	1.236***	1.317***
lender 1 (vs. AMCs)	0.786***	0.765***	0.772***
lender 2 (vs. AMCs)	0.759***	0.736***	0.744***
lender 3 (vs. AMCs)	0.513***	0.482***	0.492***
lender 4 (vs. AMCs)	0.596***	0.578***	0.585***
other lenders (vs. AMCs)	0.830*	0.818*	0.859
cbsa	Yes	Yes	Yes
Model fit			
Pct Concordant	66.7	66.6	66.7
Pct Discordant	32.4	32.5	32.5
Number of observations	80,997	77,076	72,819

***significant at .001 level; **significant at .01 level; *significant at 0.05 level

Note: See Table 1 for definitions of different price cut-off points. The pre- and post-HVCC periods here are defined as six months before and after the HVCC; appraisals for single-family properties with contract prices above 50 percent of the confirming price limit only; based on the FNC data.

Table 8. Impact of the Home Valuation Code of Conduct on the Home Purchase Mortgage Denials (Odds Ratios)

Parameter	3 Months Pre- and Post-HVCC		6 Months Pre- and Post-HVCC		12 Months Pre- and Post-HVCC	
	Collateral Denial	Denial	Collateral Denial	Denial	Collateral Denial	Denial
African American (vs. white)	1.072*	1.301***	1.020	1.274***	1.033*	1.277***
Hispanic (vs. white)	1.377***	2.421***	1.233***	2.186***	1.286***	2.243***
other minority (vs. white)	1.204**	1.644***	1.216***	1.640***	1.275***	1.737***
owner-occupied property	0.623***	0.795***	0.653***	0.806***	0.660***	0.813***
borrower income (relative to AMI)	0.981	0.603***	1.014	0.655***	1.008	0.634***
minority tract (10-30% minority vs. <10%)	1.053	1.017	1.038	1.007	0.999	0.992
high minority tract (>30% minority vs. <10%)	1.146*	1.053	1.140**	1.012	1.010	0.958**
low income tract (vs. >120% AMI)	1.449***	1.420***	1.386***	1.338***	1.442***	1.234***
moderate income tract (vs. >120% AMI)	1.335***	1.236***	1.303***	1.195***	1.334***	1.159***
middle income tract (vs. >120% AMI)	1.282***	1.188***	1.259***	1.149***	1.215***	1.119***
tract population (in log)	0.864***	0.918***	0.878***	0.939***	0.898***	0.962***
0-10 purchase loans in tract (vs.>80)	1.058	1.020	0.911	0.904**	0.808***	0.885***
11-20 purchase loans in tract (vs.>80)	0.980	0.960	1.007	0.983	1.020	0.960*
21-40 purchase loans in tract (vs.>80)	1.055	0.955*	1.045	0.950***	1.056**	0.968**
41-80 purchase loans in tract (vs.>80)	1.076*	1.019	1.055*	0.995	1.062***	0.990
foreclosure rate 3-7% (vs. <3%)	1.190***	1.226***	1.180***	1.170***	1.138***	1.146***
foreclosure rate 7-11% (vs. <3%)	1.380***	1.495***	1.342***	1.396***	1.292***	1.308***
foreclosure rate >11% (vs. <3%)	1.525**	1.890***	1.398***	1.748***	1.154**	1.475***
tract denial rate in 2008	1.023***	1.025***	1.035***	1.040***	1.040***	1.050***
hvcc	0.732***	0.713***	0.810***	0.746***	1.315***	1.334***
cll	0.477***	0.448***	0.488***	0.463***	0.543***	0.498***
hvcc*cll	1.173*	1.107*	1.165**	1.087**	1.152***	1.063**
lender dummies	Yes	Yes	Yes	Yes	Yes	Yes
MSA dummies	Yes	Yes	Yes	Yes	Yes	Yes
Model fit						
Percent Concordant	68.9	68.5	69.4	69.9	70.4	70.9
Percent Discordant	28.0	30.7	27.6	29.3	27.1	28.5
Number of observations	200,640	200,640	415,065	415,065	853,417	853,417

***significant at .001 level; **significant at .01 level; *significant at .05 level

Note: See Table 1 for definitions of pre- and post-HVCC periods; first-lien, one- to four-family properties, and applications with loan amounts above 50 percent of the confirming loan limit only; based on the HMDA data.

Table 9. Geographic Representativeness of the FNC Data, Relative to HMDA Data

2008 FNC Data, Compared with HMDA							2009 FNC Data, Compared with HMDA						
State	Number of Appraisals	% of Total (Appraisals)	% of Total (Applications)	% of Total (Originations)	Appraisal/ Application	Appraisal/ Origination	State	Number of Appraisals	% of Total (Appraisals)	% of Total (Applications)	% of Total (Originations)	Appraisal/ Application	Appraisal/ Origination
CA	50,821	21.34	11.82	10.29	1.81	2.07	CA	85,963	23.33	13.34	12.32	1.75	1.89
TX	20,983	8.81	8.96	9.17	0.98	0.96	TX	23,357	6.34	8.39	8.46	0.76	0.75
FL	23,072	9.69	6.71	5.71	1.44	1.70	FL	39,445	10.71	6.22	5.53	1.72	1.94
NY	5,215	2.19	4.50	4.14	0.49	0.53	NY	8,349	2.27	4.14	3.93	0.55	0.58
IL	5,126	2.15	3.76	3.83	0.57	0.56	IL	9,291	2.52	3.53	3.59	0.71	0.70
PA	4,859	2.04	3.57	3.92	0.57	0.52	PA	8,521	2.31	3.59	3.86	0.64	0.60
NC	9,858	4.14	3.53	3.81	1.17	1.09	NC	12,571	3.41	3.16	3.28	1.08	1.04
GA	15,176	6.37	3.38	3.40	1.88	1.87	GA	18,352	4.98	3.04	2.98	1.64	1.67
OH	2,099	0.88	3.13	3.35	0.28	0.26	OH	5,669	1.54	3.11	3.30	0.50	0.47
VA	12,546	5.27	2.88	3.15	1.83	1.67	VA	18,132	4.92	3.00	3.28	1.64	1.50
AZ	6,043	2.54	2.74	2.70	0.93	0.94	AZ	10,847	2.94	2.99	3.02	0.98	0.97
NJ	4,579	1.92	2.65	2.51	0.72	0.76	NJ	8,060	2.19	2.60	2.48	0.84	0.88
MI	5,318	2.23	2.57	2.46	0.87	0.91	MI	9,396	2.55	2.46	2.36	1.04	1.08
CO	2,487	1.04	2.38	2.55	0.44	0.41	CO	6,208	1.69	2.29	2.46	0.74	0.69
WA	7,599	3.19	2.37	2.42	1.35	1.32	WA	9,601	2.61	2.44	2.46	1.07	1.06
TN	6,355	2.67	2.16	2.31	1.23	1.15	TN	8,567	2.33	2.11	2.20	1.10	1.06
IN	3,038	1.28	2.05	2.18	0.63	0.59	IN	6,161	1.67	2.03	2.11	0.83	0.79
MO	3,484	1.46	2.03	2.21	0.72	0.66	MO	4,044	1.10	2.01	2.16	0.55	0.51
MA	3,258	1.37	1.91	1.98	0.72	0.69	MA	6,509	1.77	2.08	2.13	0.85	0.83
U.S.	238,168						U.S.	368,401					

Note: Based on the FNC data and the HMDA data; *Appraisal/Application* represents the ratio between a state's share of appraisals (out of the national total) and its share of applications. If the total is greater than one, then the appraisal is overrepresented in this state, relative to the share of HMDA loan applications in this state. If the ratio is less than one, then it is underrepresented. *Appraisal/Origination* represents the ratio between a state's share of appraisals (out of the national total) and its share of purchase loan originations.