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CODE OF CONDUCT ON APPRAISAL AND
MORTGAGE OUTCOMES**

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The Impact of the Home Valuation Code of Conduct on Appraisal and Mortgage Outcomes

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Abstract

The accuracy of appraisals came into scrutiny during the housing crisis, and a set of policies and regulations was adopted to address the conflict-of-interest issues in the appraisal practices. In response to an investigation by the New York State Attorney General's office, the Home Valuation Code of Conduct (HVCC) was agreed to by Fannie Mae, Freddie Mac, and the Federal Housing Finance Agency. 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 led to a reduction in the probability of inflated valuations, although valuations remained inflated on average, and induced a significant increase in the incidence of low appraisals. The well-intentioned HVCC rule made it more difficult to obtain mortgages to purchase homes during the housing price crash, possibly exacerbating the fall in prices.

Keywords: property valuation, mortgage, regulation, appraisal
JEL Classification Codes: G21, G28, R38

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1. Introduction

The fallout from the housing bubble raised questions about the accuracy of appraisals before the housing crisis, and, as a response, a set of policies and regulations was adopted to address the conflict-of-interest issues in the appraisal practices.¹ With significantly tightened regulations and the decline in housing prices in many areas, there were concerns that more home valuations were underestimated and new mortgages became harder to obtain during the crisis,² though the upward bias in appraisals that had prevailed during the subprime boom has been reduced somewhat in many markets. Despite the controversial role of appraisers before and during the most recent housing crisis, there is a lack of empirical research about the pattern of appraisal outcomes and the effects of the interventions adopted since the crisis on appraisals 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 This study provides the first empirical examination of the impact of a major appraisal rule, the now-superseded Home Valuation Code of Conduct (HVCC), which was adopted in the middle of the housing crisis, on low appraisals and mortgage outcomes.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 adopted on May 1, 2009, as the result of a joint agreement between Fannie Mae and Freddie Mac (government-sponsored enterprises, or GSEs), the Federal Housing Finance Agency (FHFA),⁴ and the New York State Attorney General.⁵ The HVCC was set to

¹ Important regulations and rules related to appraisal include at least the Home Valuation Code of Conduct (HVCC); the Dodd-Frank Wall Street Reform and Consumer Protection Act; revised Interagency Appraisal and Evaluation Guidelines from the federal banking regulators issued in December 2010; and the government-sponsored enterprises' new appraiser independence requirements that replaced the HVCC in October 2010 (U.S. Government Accountability Office, or GAO, 2012).

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

³ Similarly, *significantly low appraisal* is defined as one in which the appraisal is at least 5 percent below the contract price. *Share of low appraisals* represents the share of appraisals with the appraised values below the contract price. 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 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. In July 2008, the Federal Housing

expire in August 2010. The Dodd-Frank Wall Street Reform and Consumer Protection Act (Dodd-Frank Act), enacted on July 21, 2010, declared that the HVCC was no longer in effect, but it actually 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 is an industry standard instead of a federal regulation. In fact, the HVCC was implemented despite opposition from major federal bank regulators (Abernethy and Hollans, 2010). Second, while the HVCC initially covered only 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.⁶ 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, (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.⁷ 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).⁸ AMCs, which act as intermediaries between lenders, only accounted for a small market share

Finance Agency (FHFA) was formed by merging the OFHEO, the Federal Housing Finance Board, and the U.S. Department of Housing and Urban Development's government-sponsored enterprise function.

⁵ 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 government-sponsored enterprises (GSEs) purchased/secured a large portion of their mortgages from Washington Mutual, the legal case pushed the GSEs to issue the HVCC.

⁶ The Federal Housing Administration (FHA) adopted the HVCC on January 1, 2010, eight months after the GSEs did. The 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).

⁷ 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 www.fhfa.gov/Media/PublicAffairs/Documents/HVCCFinalCODE122308_N508.pdf for more details about the HVCC.

⁸ The GAO (2012) suggests that some practitioners reported that the HVCC led some lenders to outsource appraisal functions to appraisal management companies (AMCs) because they thought using AMCs would allow them to demonstrate compliance with these requirements easily.

before the crisis and received little oversight by regulators during the crisis.⁹ 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.

Using 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 can 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 significantly increased incidence of low appraisals and a reduction in the probability of inflated valuations: The probability of low appraisals among HVCC-covered transactions was at least 2.1 percentage points higher than those transactions not covered by the HVCC, while the share of significantly high appraisals (5 percent or higher than contract prices) also decreased. The results are robust when different evaluation periods or different control groups are used.

A higher incidence of low appraisals also induces higher rates of mortgage denials. The overall denial rates in the purchase market started to decline after 2009; however, the decrease in denial rates, especially in the collateral denial rates, was significantly lower for the HVCC-covered applications. The probability of denials due to insufficient collateral increased by 1.2 percentage points post-HVCC, relative to the control group; the control group had a 5.6 percent probability of denial due to insufficient collateral.

The empirical results suggest that the HVCC has done some of what it was supposed to do by partially reducing inflated valuations that were more 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

⁹ One major concern is that more appraisals are being done by AMC appraisers who likely had received more business because of the HVCC. These appraisers may lack the knowledge of the local market because AMCs operate nationwide but do not have appraisers in all local areas. In addition, AMC appraisers are usually paid less, which may induce them to invest less time and introduce more bias (GAO, 2012).

tight since the 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 so they can provide information for assessing the risk of the mortgage and their potential loss exposure if the borrower defaults. 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, an appraisal is 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 Methods other than appraisals, such as broker price opinions, automated valuation models, or other mixed methods, usually take less time and are less expensive but are often less reliable. 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, comparing and contrasting 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 the sales price and the appraisal as the value of the property in calculating LTV ratios (Nakamura, 2010).

estimates when differences between perceived values and transaction prices are substantial. In more than 80 percent of the cases, the appraisal was between 0 percent and 5 percent above the transaction purchase price. 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. However, in a study focusing on the behavior of appraisal professionals, Tzioumis (forthcoming) found only a minority of residential real estate appraisers systematically inflated appraisal values for home purchase loan applications.

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 refinanced 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 and the HVCC

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 that 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 in an effort 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 requiring the use of the lesser of the transaction price and the appraised value in the calculation of LTV ratios results in 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 it as “information loss,” since no precise information is conveyed by these appraisals. Except for this study, the only rigorous empirical

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, resulting in the HVCC.

study on the impact of the HVCC was Agarwal, Ambrose, and Yao (2014), which found the magnitude of the observed appraisal bias in the refinance market was reduced after the HVCC.

It needs to be noted that the housing market was experiencing significant changes when the HVCC was first introduced. The lack of market sales, especially mortgage-financed sales, may lead to high degrees of uncertainty in appraisals (Lang and Nakamura, 1993) and could lead to more mortgage denials (e.g., Blackburn and Vermilyea, 2007). The sharp increase in distressed property sales, which could be recorded and used as a comparable in the appraisals of nondistressed properties,¹³ may cause a downward drag on house value estimates.

2.3 Appraisal and Mortgage Lending Decisions

Appraised values and the difference between appraisals and contract prices have a direct effect on mortgage outcomes. A low appraisal may force a seller to sell the property at a price lower than the agreed-upon amount. 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 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 analysis is related to studies on lending disparities in the mortgage market, which tested the associations among 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

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.

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 adopted during the housing crisis, on appraisal and mortgage outcomes.

3. Data

This analysis used two primary data sets. The first one is FNC, Inc.'s National Collateral Database (FNC data), which provides a national sample of appraisal records, regardless of whether they end 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. Previous 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 that are 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. In addition, 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 nationwide. After increasing slightly in 2008, the share of low appraisals started to increase sharply after the adoption of the HVCC (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 and increase in mortgage defaults 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 9.1 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 became more leptokurtic and 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.

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 (CLL)¹⁵ are eligible for GSE purchase and thus subject to the HVCC. By

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

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 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 www.fhfa.gov/DataTools/Downloads/Pages/Conforming-Loan-Limits.aspx.

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 below the CLL 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 CLL (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 attribute any such differences to the treatment itself, namely, the adoption 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 conventional loans¹⁹ with relatively large loan amounts (above 50 percent of the “conforming loan limit,” or CLL).²⁰ Nonconventional loan applications that were initially not subject to the HVCC — primarily government-guaranteed loans such as Federal Housing Administration

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.

¹⁷ When the CLL changed during the study period in a number of areas, the highest level CLL was used to determine the control group, while the lowest-level CLL was used to identify the treatment group. For example, if the CLL of one county was increased from \$417,000 in 2008 to \$560,000 in 2009, we used the higher limit of \$560,000 to identify non-HVCC-covered appraisals (priced over \$560,000 * 1.25 for our preferred model), while we used the lower limit of \$417,000 to identify HVCC-covered appraisals.

¹⁸ As suggested by Liu, Nowak, and Rosenthal (2014), 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 characteristics of 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.

¹⁹ Only applications that were approved and originated, that were denied, and 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 the 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 of the CLL, were tried, and the results were quite consistent, so this study focuses on this specification only.

(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 adoption 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 this still allowed 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 the CLL, which we call 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 at least 20 percent for a down payment, transactions with contract prices below CPLs are eligible for conforming loans and thus subject to the HVCC. Transactions with contract prices above CPLs will either have a higher proportionate down payment or will be ineligible for treatment as a conforming loan.²¹ As mentioned earlier, transactions with relatively low contract prices (less than 50 percent of 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 group 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.

²¹ As buyers of high-priced homes 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 cutoff prices (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 cutoff points.

3.2 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 0.13 percent decrease 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.

3.3 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 groups experienced a significant decline in denial rates, from 23.94 percent in the pre-HVCC period to 16.73 percent post-HVCC, or a decline of 7.21 percentage points. However, the decline was less for the treatment group, which was subject to the HVCC: The denial rate decreased 4.86 percent for the treatment group, or 2.35 percentage points lower than the 7.21 percent decline for the control group. A similar pattern can be found for the collateral denial rates: The collateral denial rate decreased by 0.51 percent for the treatment group after the HVCC, lower than the 1.48 percent decline for the control group, with a difference of 0.97 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 adopted. 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 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 linear probability models, in which the dependent variable is equal to 100 percent if the appraisal is below contract price and zero otherwise. The unit of the estimated coefficients is a percentage point (of the probability of low appraisals):

$$Pr(Low_Appraisal_i) = \beta_0 + \beta_1 * HVCC_i + \beta_2 * BCPL_i + \beta_3 * (HVCC_i * BCPL_i) + \gamma * CBSA_i + \delta * LENDER_i + \varepsilon * X_i$$

(1)

where

- *HVCC* is the time dummy to identify the pre- and post-HVCC time periods.
- *BCPL* is equal to one if the contract price is below the conforming price limit and equal to zero if the contract price is above the limit.
- *HVCC * BCPL* 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* is the metro dummy (major metros only). We restrict metro areas to those with more than 5,000 appraisals in the appraisal analysis and to 10,000 applications in the decision analysis.
- *LENDER* is the lender dummy (major lenders only). The reference group comprises all AMCs, which are a means for satisfying the requirements of the HVCC and thus are a useful base group.

- X represents the control variables that include major lender dummies and a few neighborhood characteristics such as prior mortgage originations, recent house price change,²² prior foreclosure rate, and neighborhood size. The variable definitions are provided in Table 4.

Here appraisals with prices below the CPL became subject to the HVCC after the rule was adopted ($HVCC*BCPL$ is equal to one). The coefficient of interest, β_3 , represents the HVCC effect on the incidence of low appraisal by capturing the change in the probability of a low appraisal of covered applications after the HVCC.

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. We estimate linear probability models, in which the dependent variable is equal to 100 percent if the application is denied (or denied because of insufficient collateral) and zero otherwise. The unit of the estimated coefficients is percentage points (of the probability of denial or collateral denial):

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

where

- $BCLL$ is equal to one if the loan amount is below the “conforming loan limit” and to zero if the loan amount is above the CLL.
- $HVCC * BCLL$ is the two-way interaction of the time and below conforming loan limit variables, which is used to assess the impact of the HVCC on denial probabilities.

²² We used the county-level CoreLogic house price index by segment (jumbo and conforming market) to construct the measure of house price change (change in the 12 months prior to the appraisal date).

- X represents the control variables that may influence mortgage application decisions including borrower demographic information, neighborhood risk characteristics, as well as metropolitan and lender dummies (see Table 4).

4.3. Potential Concerns

To implement the identification strategy effectively, the control group needs to have a stable legal environment during the study period. But 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. 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. This measurement issue may bias the results. However, our identification strategy to isolate the effect of the HVCC should still be valid for the following two reasons. First, the fact that a significant share of transactions in the control group was actually subject to the HVCC would only lead to an underestimate of the HVCC effect.²³ As long as the share of transactions in the control group that was subject to the HVCC remained unchanged or was increasing over the study period, the identification strategy to isolate the effect of the HVCC should not overestimate the HVCC effect. In fact, during the study period, the use of jumbo loans had been actually quite stable. Our estimation based on the Lender Processing Services (LPS) data suggests that about 23.7 percent of mortgage-financed purchases of higher-priced properties (with purchase prices above 1.25 times the CLLs) used jumbo loans during the 12 months before the HVCC, compared with 22.8 percent in the 12 months after the HVCC.²⁴

Another reason that homes with prices above the conforming price limit could be a useful comparison group to measure the impact of the HVCC is that such homes are likely to have less appraisal bias. The reason goes to the heart of why appraisals are biased in the first place as discussed in Calem, Lambie-Hanson, and Nakamura. (2015). In that analysis, appraisal bias arises because an appraisal below the transaction price reduces the price upon which the loan's LTV is calculated according to GSE rules, and the LTV is forced higher, endangering the loan.

²³ Since only a proportion of appraisals in the control group was immune from the HVCC, the results should be interpreted in an instrumental variables sense (Fuster and Vickery, 2014; Kaufman, 2014) and an estimate that eliminates this source of bias should be bigger.

²⁴ For transactions with purchase prices higher than 1.67 times the CLL, the ratio of using jumbo loans was 42.2 percent and 43.9 percent for 12 months pre- and post-HVCC. The estimation is based on eligible first-lien conventional purchase loan originations in Lender Processing Services (LPS).

But in cases in which the LTV is substantially lower than 80 percent, this concern loses much of its force.

Consider the following stylized case. Suppose the conforming loan limit is \$300,000, the conforming price limit is \$375,000, and the home price in question is \$400,000. Either the borrower seeks a jumbo loan of \$320,000 (with an LTV of 80 percent) or seeks a conforming loan of \$300,000, with an LTV of 75 percent. In the former case, the HVCC does not apply; in the latter case, an appraisal of \$375,000 still leaves an LTV of 80 percent and does not threaten the loan. As Calem et al. (2015) point out, the bias of appraisals is primarily because of a concern that the loan is threatened, and thus, in these cases, there is less likely to be bias. Cho and Megbolugbe (1996) present evidence that as LTVs fall, appraisal bias diminishes.

Thus, the conforming price limit may be a valid control group either because the HVCC does not apply or because the LTV is not a binding constraint, and as a result, bias is likely to be lower to begin with. In this latter case, the HVCC may be affecting the appraisal but to a lesser degree. This represents a case in which the control group may be artificially biasing downward the impact of the HVCC, and our estimates are lower bounds of the HVCC impact.

In addition, 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: 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 in 2009.

5. Multivariate Analysis Results

This section presents multivariate results for each of the models outlined in the previous section. The multivariate results in Tables 5 through 8 strongly support the descriptive analysis

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), which usually have lower denial rates. And reporting institutions may cite up to three reasons for each denied application, although most of those that provide this information cite only one.

results that the HVCC led to an increased incidence of low appraisals and mortgage denials. The R squares and goodness-of-fit are generally low, which is not surprising for linear probability models. 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 concentrates 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 (about 2.8 percentage points higher in six months; see the HVCC coefficient in Table 5) that is likely because of the general market trend influenced by factors other than the HVCC. Appraisals in the treatment group, which generally have lower contract prices, are generally less likely to have low appraisals (about 2.8 percentage points lower; see the BCPL coefficient) than those in the control group, which is consistent with the expectation the share 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 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 probability of low appraisals for the treatment group increases by 3.0 percentage points in three months, 2.1 percentage points in six months, and 1.9 percentage points in 12 months post-HVCC (the HVCC*BCPL coefficients).²⁷ Put in context, the share of low appraisals was 11.4 percent for the control group and 11.0 percent for the treatment group before the HVCC. The increase in the share of low appraisals was quite significant. The magnitude of the HVCC effect diminishes slightly over time likely because lenders and regulators have gradually adjusted to the new system. However, the HVCC effect on low appraisals is even greater when compared with the period before the HVCC proposal was first announced in March 2008: The probability of low appraisals increases by 3.6

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).

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 like the HVCC, was not included in the analysis.

percentage points compared with the pre-release period. The results suggest lenders and appraisers may have started to adjust their practices during the transitional period. We also found that the HVCC has a more pronounced effect in the hardest hit states (California, Arizona, Florida, and Nevada): an increase of 4.7 percentage points in the share of low appraisals in the six months after HVCC, higher than the 2.1 percentage point increase at the aggregate level.²⁸ The results suggest significant spatial heterogeneity of the HVCC effect.

The HVCC also leads to more significantly low appraisals as well (Table 6): For the treatment group, the probability of significantly low appraisals increases by 1.2 percentage points post-HVCC, while the effect of the HVCC on the probability of significantly high appraisals decreases by 1.2 percent (significant at 0.1 level).²⁹

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 that buyers of high-priced homes may have the incentive to use cash to bridge the gap to do a conforming loan. As a robustness check, a set of different thresholds was used to test the sensitivity of the results to price cutoff points. The results listed in Table 7 suggest that the HVCC effect becomes greater when higher price limits are used: The probability of low appraisals increases by 2.7 percentage points and 3.3 percentage points if the CPL is set as 1.43 times the CLL and 1.67 times the CLL, respectively, both of which are higher than the 2.1 percentage point increase when CPL is equal to 1.25 times the CLL.³⁰ 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 increases the incidence of low appraisals. What would be the effect of the HVCC on mortgage lending decisions? Regression results suggest that the overall probability of collateral denial decreases (by about 1.3 percentage points) after the HVCC (Table 8). However, there are significant

²⁸ The magnitude of the HVCC effect is smaller in non-sand states (0.93 for the preferred model; significant at the 0.1 level).

²⁹ The lower level of statistical significance of the shift in high appraisals is largely due to the smaller sample size.

³⁰ The price limit to identify the control group has been kept the same here (1.25 times the CLL).

variations between the declines for the treatment group and the control group; the decline in the control group is much sharper. The probability of mortgage denials because of insufficient collateral is about 1.2 percentage points higher in the treatment group post-HVCC.³¹ Considering the collateral denial rate was only 5.6 for the control group and 3.2 for the treatment group, an increase of 1.2 percent is quite significant for the treatment group. The probability of any denial is also 3.3 percentage points higher in the treatment group than the control group after the HVCC. The HVCC is explicitly designed to address the appraisal issues, so it is expected to have a significant impact on collateral denials and the overall denial rate as well. 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.

For different study periods (three months or 12 months), the results are quite consistent: a 1.2 percentage point increase in the probability of collateral denials in three months and a smaller increase of 0.5 percentage point increase in 12 months, respectively. The pattern for the HVCC effect on overall denial rates is quite similar.

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 could 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 for not-owner-occupied properties and those in less desirable neighborhoods (e.g., those with high foreclosure rates, low income, or fewer prior originations) are more likely to be denied. Note also that applications for minority borrowers are also more likely to be denied, but this should not be taken as evidence that minorities are being discriminated against. Rather, because we do not have creditworthiness variables in this regression, it is well known that minorities tend to have lower credit scores, and

³¹ Denial for collateral may also be because of technical issues with the collateral, but we believe such measurement errors to be small and orthogonal to the HVCC.

this typically accounts for much of their higher denial rates (Ross and Yinger, 2002). 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 lower levels of market activities. The results are generally consistent for different cohorts and when different outcome measures are used. The results confirm that an insufficient number of mortgage-financed sales leads to 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 adoption of the HVCC and enactment of the Dodd-Frank Act, appraisal management companies, which act as intermediaries between lenders and appraisers and manage appraisals for lenders, have taken a greater market share.³² 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 2.5 percentage points to 7.4 percentage points lower in our preferred model). While the incidence of low appraisals 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.

³² The FNC 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. The estimate from another source was that the share of AMC appraisals increased from less than half (15 percent to 50 percent) before the HVCC to between 60 percent and 80 percent in 2011, according to some appraisal industry participants (GAO, 2011).

6. Conclusion and Policy Implications

Appraisers are expected to provide unbiased opinions about the value of assets. However, appraisers have been criticized for the often inflated home values that occurred during the housing boom, as well as 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, impacts appraisal and mortgage outcomes.

The HVCC was designed to make appraisals more independent and objective primarily by addressing issues related to the conflicts of interest in the appraisal process. The HVCC has done part of what it was supposed to do by reducing inflated valuations that were prevalent during the subprime boom. At the same time, the HVCC rule led to a significant increase in low appraisals and caused the origination of purchase mortgages to be more difficult.

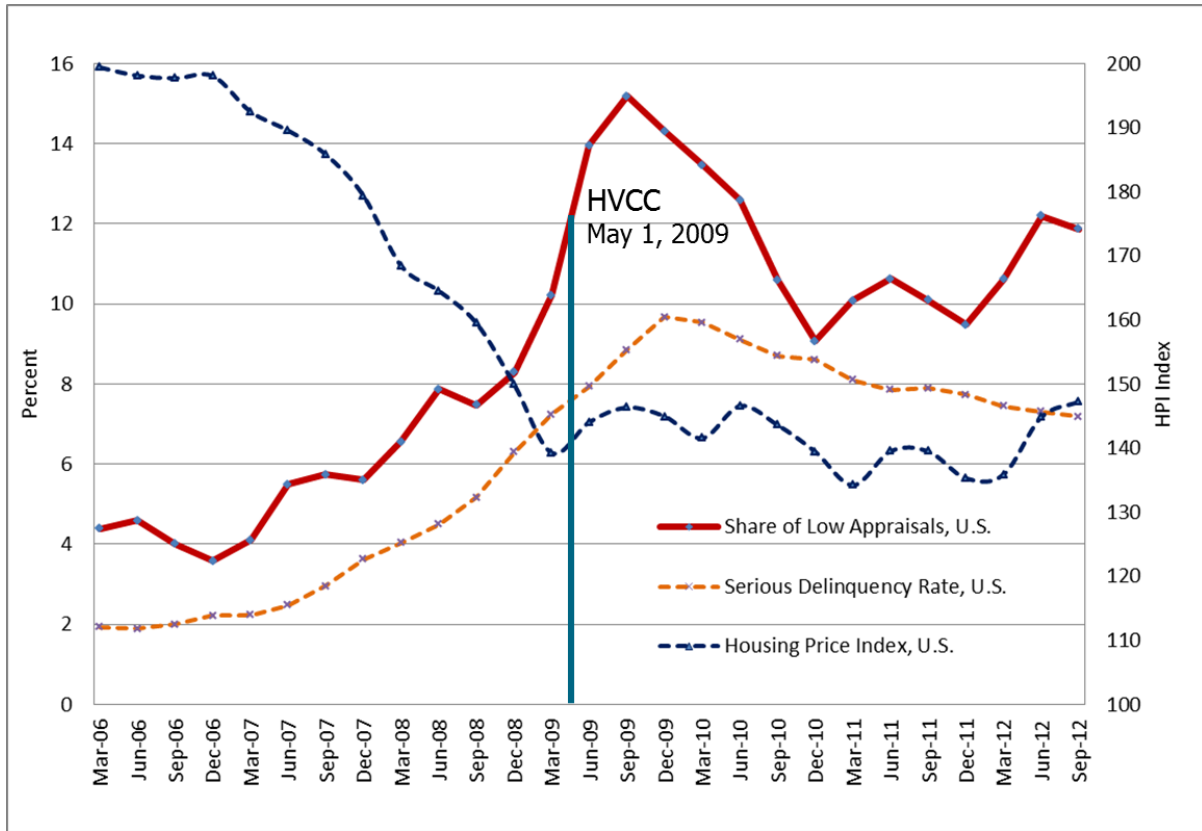
The results demonstrate that, in an effort to prevent appraisal frauds and artificially inflated home valuations, the HVCC, which attempted to change the entire appraisal industry fundamentally when the market was in turmoil, had quickly induced significant changes in the housing market. It seems lenders 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 a high level of uncertainty and panic.

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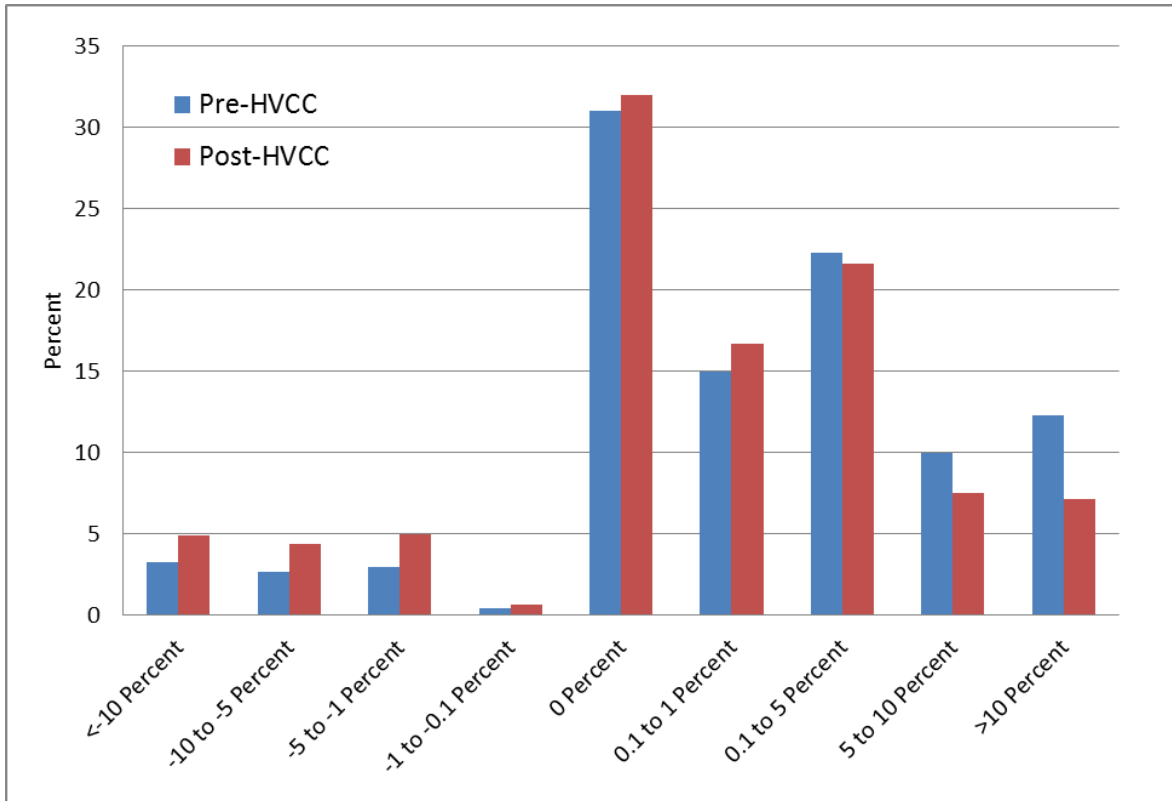
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Figure 1. Share of Low Appraisals for the U.S. First Quarter 2006 to Third Quarter 2012



Note: *Share of low appraisals* represents the share of appraisals with appraised values below the contract price.
 Sources: FNC data, LPS data, and CoreLogic HPI

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



Note: *Appraisal ratio* is defined as appraised value less contract price as a percent of 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 the HVCC; 4/1/2009–5/31/2009 was considered a transitional period
10/1/2008–3/31/2009		6/1/2009–11/30/2009 (preferred)	6 months before and after the HVCC; 4/1/2009–5/31/2009 was considered a transitional period (preferred)
4/1/2008–3/31/2009		6/1/2009–5/30/2010	12 months before and after the HVCC; 4/1/2009–5/31/2009 was considered a transitional period
9/1/2007–2/28/2008		6/1/2009–11/30/2009	6 months before the introduction of the HVCC and 6 months after the adoption of HVCC; 3/1/2008–5/31/2009 was considered a transitional period
<hr/>			
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 the conforming loan limit are assumed to use nonconforming loans; they do not qualify for conforming loans 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 the conforming loan limit are assumed to use nonconforming loans; they do not qualify for conforming loans 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 the conforming loan limit are assumed to use nonconforming loans; they do not qualify for conforming loans with a down payment up to 40% of the contract price

Note: CLL represents conforming loan limit.

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

Treatment Group (priced between 0.5°C/PL and CPL)	Appraisal Ratio = (Appraised Value-Contract Price)/Contract Price					
	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
<hr/>						
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
<hr/>						
Difference in Changes	1.47	0.59	0.88	-0.46	-0.42	-0.58

Note: CPL represents conforming price limit here, which is 1.25 times the 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 conforming price limit only; based on 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	16.07	3.19
Post-HVCC	11.21	2.68
Change	-4.86	-0.51
Control Group (loan amounts above CLL)		
Pre-HVCC	23.94	5.57
Post-HVCC	16.73	4.09
Change	-7.21	-1.48
Difference in Changes	2.35	0.97

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, applications with loan amounts above 50 percent of the conforming loan limit only. 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 calculation of denial rates; based on the HMDA data.

Table 4. Variable Definitions

<i>Appraisal Model</i>	
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
significantly high appraisal	Indicator variable = 1 if appraisal is at least 5% higher 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 LPS)
house price change in 12 months	County-level 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
bcpl	Indicator variable: Contract price below CPL = 1; 0 otherwise
hvcc*bcpl	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)
MSA dummies	Dummies for major MSAs
<i>Mortgage Denial Model</i>	
Parameter	Definition
denial	Indicator variable=1 if denied; 0 otherwise
collateral_denial	Indicator variable=1 if denied due to 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 the previous year; 0 otherwise
11–20 purchase loans in tract	Indicator variable=1 for tracts with 11–20 purchase loans in the previous year; 0 otherwise
21–40 purchase loans in tract	Indicator variable=1 for tracts with 21–40 purchase loans in the previous year; 0 otherwise
41–80 purchase loans in tract	Indicator variable=1 for tracts with 41–80 purchase loans in the previous year; 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 the previous year
hvcc	Indicator variable: Time period post-HVCC = 1; 0 otherwise
bcll	Indicator variable: Loan amount below CLL = 1; 0 otherwise
hvcc*bcll	Indicator variable: Post-HVCC period for applications with loan amount below CLL = 1; 0 otherwise
lender dummies	Dummies for major non-AMC lenders
MSA dummies	Dummies for major MSAs

Table 5. Impact of Home Valuation Code of Conduct on the Probability of Low Appraisals

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		6 Months Pre- and Post-HVCC in Sand States	
	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
hvcc	2.810**	0.917	2.757***	0.776	2.284***	0.592	3.236**	1.049	5.345**	1.560
below conforming price limit (bcpl)	-2.723**	0.833	-2.755***	0.514	-3.188***	0.473	-4.183***	0.703	-5.018**	1.101
hvcc*bcpl	3.003***	0.861	2.142**	0.669	1.898**	0.656	3.606***	0.631	4.661***	1.232
controls										
prior loan origination (in log)	-1.601***	0.391	-1.363***	0.296	-1.138***	0.245	-1.190***	0.290	-0.726	0.564
prior foreclosure rate	2.011***	0.221	2.146***	0.166	1.718***	0.166	2.155***	0.221	1.876***	0.214
house price change in previous 12 months	-0.151**	0.058	-0.140**	0.044	-0.166***	0.042	-0.134**	0.051	-0.348***	0.075
housing units (in log)	1.041*	0.509	0.800*	0.400	0.854*	0.332	0.835*	0.401	0.299	0.804
lender 1 (vs. AMCs)	-3.498*	1.452	-3.118**	1.084	-2.041**	0.637	-2.879**	0.952	-1.954	1.292
lender 2 (vs. AMCs)	-3.657*	1.466	-3.341**	1.172	-2.184**	0.662	-1.942*	0.978	-2.398*	1.129
lender 3 (vs. AMCs)	-1.289	5.763	-7.424***	1.593	-4.986***	0.772	-6.866***	1.384	-6.958	4.079
lender 4 (vs. AMCs)	-6.891***	1.758	-5.988***	1.367	-5.208***	0.902	-5.435***	1.405	-3.699	1.985
other lenders	-4.076*	1.781	-2.546	1.382	-4.369***	0.767	-5.239***	1.062	-0.731	1.751
MSA dummy (CBSA)	yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Model fit										
Adjusted R ²	0.0478		0.0483		0.0429		0.0568		0.0523	
Number of observations	42,193		80,997		167,462		82,397		34,900	

***Significant at 0.001 level; **significant at 0.01 level; *significant at 0.05 level; errors are clustered at the MSA level.

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

Table 6. Impact of the HVCC on Probability of Significantly Low (High) Appraisals

Parameter	Significantly Low Appraisal (5% below prices)		Significantly High Appraisal (5% above prices)	
	Coef.	Std. Err.	Coef.	Std. Err.
hvcc	1.377*	0.599	-2.884***	0.593
below conforming price limit (bcpl)	-3.213***	0.464	-1.024	0.756
hvcc*bcpl	1.167*	0.532	-1.231	0.671
controls				
prior loan origination (in log)	-1.489***	0.307	-0.913***	0.260
prior foreclosure rate	1.758***	0.113	-0.215*	0.101
house price change in previous 12 months	-0.142***	0.036	0.015	0.036
housing units (in log)	0.633	0.349	-0.215	0.313
lender 1 (vs. AMCs)	-2.357**	0.898	-1.057	0.679
lender 2 (vs. AMCs)	-1.893	0.991	-0.836	0.644
lender 3 (vs. AMCs)	-4.645***	1.154	1.754	0.917
lender 4 (vs. AMCs)	-4.783***	1.039	3.439*	1.637
other lenders	-1.546	1.120	4.048*	1.691
MSA dummy		Yes		Yes
Model fit				
Adjusted R ²	0.0498		0.0395	
Number of observations	80,997		80,997	

***:Significant at 0.001 level; **:significant at 0.01 level; *:significant at 0.05 level; errors are clustered at MSA level. hvcc*bcpl is significant at 0.1 level for the significantly high appraisal model.

Note: Single-family properties with contract prices above 50 percent of the conforming price limit only; treatment group includes appraisals with contract prices below 1.25 times the conforming loan limits (maximum price to get a conventional loan with 80 percent LTV).

Table 7. Sensitivity Analysis of the Cutoff Points of Contract Prices

Variables	Price Cutoff Points (Control Group), Six Months Pre- and Post-HVCC			
	1.25*CLL (loan limit/80%)	1.43*CLL (loan limit/70%)	1.67*CLL (loan limit/60%)	
Parameter	Coef.	Std. Err.	Coef.	Std. Err.
hvcc	2.757***	0.776	2.183**	0.770
below conforming price limit (bcpl)	-2.755***	0.514	-3.071***	0.578
hvcc*bcpl	2.142**	0.669	2.744***	0.640
controls				
prior loan origination (in log)	-1.363***	0.296	-1.285***	0.309
prior foreclosure rate	2.146***	0.166	2.087***	0.165
house price change in previous 12 months	-0.140**	0.044	-0.141***	0.042
housing units (in log)	0.800*	0.400	0.775	0.424
lender 1 (vs. AMCs)	-3.118**	1.084	-3.417**	1.080
lender 2 (vs. AMCs)	-3.341**	1.172	-3.696**	1.152
lender 3 (vs. AMCs)	-7.424***	1.593	-8.047***	1.572
lender 4 (vs. AMCs)	-5.988***	1.367	-6.349***	1.400
other lenders	-2.546	1.382	-2.719	1.448
MSA dummy	Yes		Yes	
Model fit				Yes
Adjusted R ²	0.0483		0.0473	0.0474
Number of observations	80,997		77,076	72,819

***Significant at 0.001 level; **significant at 0.01 level; *significant at 0.05 level; errors are clustered at the MSA level.

Note: See Table 1 for definitions of different price cutoff points. Single-family properties with contract prices above 50 percent of the conforming price limit only.

Table 8. Impact of the Home Valuation Code of Conduct on the Probability of Purchase Mortgage Denials

Parameter	3 Months Pre- and Post-HVCC			6 Months Pre- and Post-HVCC			12 Months Pre- and Post-HVCC					
	Collateral Denial	Denial	Denial	Collateral Denial	Denial	Denial	Collateral Denial	Denial	Denial			
	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.		
hvcc	-1.464***	0.351	-5.848***	0.701	-1.260***	0.191	-5.615***	0.508	0.678**	0.212	2.633***	0.473
below conforming loan limit (bcll)	-2.540***	0.409	-10.063***	0.710	-2.600***	0.276	-10.033***	0.546	-2.149***	0.204	-8.918***	0.474
hvcc*bcll	1.166**	0.365	3.441***	0.704	1.151***	0.199	3.254***	0.445	0.506**	0.205	0.910*	0.411
controls												
other minority (vs. White)	0.165	0.108	2.603***	0.288	0.023	0.076	2.501***	0.285	0.061	0.066	2.911***	0.281
African American (vs. White)	1.354***	0.325	12.995***	0.799	1.038***	0.255	11.974***	0.600	1.269***	0.160	13.780***	0.649
Hispanic (vs. White)	0.782***	0.243	6.625***	0.410	0.754***	0.233	7.132***	0.437	0.971***	0.172	9.029***	0.418
owner_occupied property	-1.904***	0.269	-2.586***	0.514	-1.782***	0.213	-2.680***	0.517	-2.033***	0.167	-3.237***	0.446
borrower income (relative to AMI, %)	0.154	0.145	-3.614***	0.243	0.249**	0.084	-3.396***	0.229	0.213***	0.057	-3.910***	0.241
minority tract (10--30% vs. <10%)	-0.019	0.107	-0.005	0.204	-0.009	0.106	0.008	0.168	-0.099	0.108	-0.113	0.186
high minority tract (>30% vs. <10%)	0.371	0.292	0.485	0.647	0.380	0.321	0.536	0.538	0.020	0.272	0.152	0.438
low income tract (vs. upper income)	2.579***	0.666	6.484**	1.156	3.273***	0.768	7.549***	1.062	3.277***	0.560	7.342***	0.739
moderate income tract (vs. upper income)	1.137***	0.222	2.847***	0.589	1.217***	0.183	2.945***	0.482	1.555***	0.196	3.553***	0.460
middle income tract (vs. upper income)	0.677***	0.108	1.777***	0.238	0.654***	0.108	1.623***	0.207	0.688***	0.088	1.783***	0.221
tract population (in log)	-0.357***	0.103	-0.763***	0.181	-0.337**	0.113	-0.734***	0.160	-0.162*	0.084	-0.166	0.144
0-10 purchase loans in tract (vs. > 80)	0.919	0.577	2.026*	0.851	0.976	0.714	1.083	0.663	1.618**	0.512	3.424***	0.596
11-20 purchase loans in tract (vs. > 80)	-0.054	0.268	0.094	0.414	0.138	0.236	-0.033	0.290	0.682**	0.227	1.582***	0.334
21-40 purchase loans in tract (vs. > 80)	0.016	0.173	-0.615*	0.319	0.079	0.146	-0.587*	0.244	0.432***	0.125	0.587**	0.205
41-80 purchase loans in tract (vs. > 80)	0.083	0.134	0.064	0.226	0.090	0.119	-0.163	0.199	0.223**	0.087	0.299	0.162
foreclosure rate 3-7% (vs. < 3%)	0.278*	0.125	1.817***	0.304	0.420***	0.118	1.909***	0.276	0.474***	0.121	2.423***	0.245
foreclosure rate 7-11% (vs. < 3%)	1.321***	0.406	5.736***	0.900	1.828***	0.357	7.004***	0.787	2.149***	0.328	8.346***	0.824
foreclosure rate > 11% (vs. < 3%)	3.570**	1.255	13.682***	2.867	5.273***	1.018	17.970***	3.136	4.292***	0.905	18.180***	2.404
tract denial rate in previous year	0.094***	0.009	0.311***	0.020	0.086***	0.008	0.302***	0.016	0.070***	0.008	0.277***	0.020
Lender dummy	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
MSA dummy	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Model fit												
Adjusted R ²	0.019		0.054		0.019		0.068		0.021		0.070	
Number of observations	258,890		258,890		540,885		540,885		1,108,204		1,108,204	

***Significant at 0.001 level; **significant at 0.01 level; *significant at 0.05 level; errors are clustered at the MSA level.
 Note: See Table 1 for definitions of pre- and post-HVCC periods; first-lien, one- to four-family properties, with loan amounts above 50 percent of the conforming loan limit only; based on the HMDA data.

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

State	2008 FNC Data, Compared with HMDA				2009 FNC Data, Compared with HMDA			
	Number of Appraisals	% of Total (Appraisal)	% of Total (Application)	% of Total (Origination)	Number of Appraisals	% of Total (Appraisal)	% of Total (Application)	% of Total (Origination)
California	50,821	21.34	11.82	10.29	85,963	23.33	13.34	12.32
Texas	20,983	8.81	8.96	9.17	23,357	6.34	8.39	8.46
Florida	23,072	9.69	6.71	5.71	39,445	10.71	6.22	5.53
New York	5,215	2.19	4.50	4.14	8,349	2.27	4.14	3.93
Illinois	5,126	2.15	3.76	3.83	9,291	2.52	3.53	3.59
Pennsylvania	4,859	2.04	3.57	3.92	8,521	2.31	3.59	3.86
North Carolina	9,858	4.14	3.53	3.81	12,571	3.41	3.16	3.28
Georgia	15,176	6.37	3.38	3.40	18,352	4.98	3.04	2.98
Ohio	2,099	0.88	3.13	3.35	5,669	1.54	3.11	3.30
Virginia	12,546	5.27	2.88	3.15	18,132	4.92	3.00	3.28
Arizona	6,043	2.54	2.74	2.70	10,847	2.94	2.99	3.02
New Jersey	4,579	1.92	2.65	2.51	8,060	2.19	2.60	2.48
Michigan	5,318	2.23	2.57	2.46	9,396	2.55	2.46	2.36
Colorado	2,487	1.04	2.38	2.55	6,208	1.69	2.29	2.46
Washington	7,599	3.19	2.37	2.42	9,601	2.61	2.44	2.46
Tennessee	6,355	2.67	2.16	2.31	8,567	2.33	2.11	2.20
Indiana	3,038	1.28	2.05	2.18	6,161	1.67	2.03	2.11
Missouri	3,484	1.46	2.03	2.21	4,044	1.10	2.01	2.16
Massachusetts	3,258	1.37	1.91	1.98	6,509	1.77	2.08	2.13
Other States	46,252	19.42	26.91	27.89	69,358	18.83	27.47	28.13
U.S. (Total)	238,168				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.