When Appraisers Go Low
Contracts Go Lower:
The Impact of Expert Opinions on Transaction Prices

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Abstract

Using home purchase loan application data, we study buyer responses to the uncommon occurrence of the appraised value coming in below the contract price (i.e. a low appraisal), which sharply raises the probability of downward price renegotiation. We propose that two mechanisms drive the higher renegotiation rates. First, a liquidity channel, visible for financially constrained borrowers for whom a low appraisal impacts financing costs. Second, for financially unconstrained borrowers, we identify a news channel whereby the information content of the low appraisal alone induces borrower renegotiation. Importantly, we show that low appraisals result in lower renegotiated prices through these channels without a substantially lower likelihood of a loan application leading to loan origination or notably longer times from contract signing to sale.

1. INTRODUCTION

The requirement to have a home appraisal is almost universal when home buyers require a mortgage to purchase a home.[1] The residential mortgage appraisal is presumed to be an independent assessment of home value; but as Eriksen, Fout, Palim, and Rosenblatt (2019, 2020) show, it is likely not. The value provided by the appraiser is anchored to the contract price, precisely equal to contract almost a third of the time and equal to or surpassing contract for more than ninety percent of purchase mortgage applications. The rationalization for this, given in Eriksen et al. (2019) and Calem, Lambie-Hanson, and Nakamura (2015) is that appraisers, who are required to give a single value, and are provided by lenders with the sales contract prior to appraisal, feel they must support the contract unless they have a strong reason to reject it. But does this evident tendency to provide an appraised value equal to or above contract price serve the buyer, who, after all, ultimately pays for the appraisal? As we shall see, an appraised value below contract price, or low appraisal, triggers most buyers to renegotiate a lower price, often lowering the new price down to the appraised value. Borrowers who are never told they have overbid typically miss out on this potential chance to renegotiate.

While others have noted the greater likelihood of sale price renegotiation when a low appraisal occurs (Fout and Yao, 2016; Shui and Murthy, 2019), we are able to identify specific borrower subgroups that appear most likely to renegotiate, and thus infer the channels through which the low appraisal may trigger renegotiation. Downward renegotiation given a low appraisal is more common among borrowers that are deemed financially constrained, for whom the low appraisal, absent a renegotiation, would imply higher financing costs or difficulties in closing the

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[1] Exceptions to requirement for appraisal are applications that receive a Property Inspection Waiver (PIW), available to about five percent of Fannie Mae purchases after January 2017. Loans with PIWs do not appear in the analysis in this paper, as the focus here is on the relationship between the appraised value and the contract price.

loan. Nonetheless, even borrowers that are entirely unconstrained from a financing perspective, still exhibit substantial renegotiation rates when facing low appraisals. This suggests that the news or information effect of receiving an expert opinion on the property valuation (by the appraiser) has a significant implication for the renegotiation likelihood. Together, these results suggest there is both a liquidity effect and an information effect that impact the likelihood of renegotiation when facing a low appraisal, a novel finding in the literature.

We also show that this strong impact of a low appraisal on renegotiation is not accompanied by a significantly lower likelihood of a loan being delivered to Fannie Mae; there is only a slight reduction in loan delivery rates when a low appraisal occurs. Nor are there markedly longer closing times, measured from contract signing to sale dates, with timelines increasing by an additional two or three days for appraised values well below contract. As such, our results also contribute to the literature by suggesting that low appraisals have a relatively small cost to the lender or real estate broker in terms of foregone business. This is a particularly important finding given the overwhelming evidence of appraisers' propensity to confirm contract price, partly in order to prevent delays or the cancellation of a sale which may impact their future business relationships with lenders (Eriksen et al., 2019).

The next section provides a literature review. Section 3 provides an overview of the appraisal process and its role in the broader underwriting process. Section 4 describes the data. Section 5 presents evidence on the extent, causes, and effects of low appraisals. Section 6 concludes.

2. LITERATURE REVIEW

A significant share of the literature on residential appraisals focuses on refinances, for which the appraisal is the sole determinant of value. Authors of those papers point out that average median refinance values exceed and, in the lead up to the 2007-2009 housing crisis, far exceed, the values assigned by automated valuation models (hereafter AVMs refer to the value from the automated valuation model). They deem such systematic overvaluations compared to AVMs "appraisal bias" and argue that this played a role in the house price run-up of the mid-2000s (Abernethy and Hollans 2010; Agarwal, Ben-David, and Yao 2015; Ben-David 2011; Calem, Lambie-Hanson, and Nakamura 2017; Duca, Muellbauer, and Murphy 2010; Hendershott, Hendershott, and Shilling 2010; Kelly 2006; Mian and Sufi 2010; Murray 2010).

Other authors observe the same tendency towards valuations being above contract price in purchase appraisals. Chinloy, Cho, and Megbolugbe (1997), Horne and Rosenblatt (1996), Nakamura (2010), and Zhu and Pace (2012), and Eriksen et al. (2019) have all documented confirmation bias in purchase appraisals. Ding and Nakamura (2016), show that the share of low appraisals rises from the four to six percent range in 2006 and 2007 to a peak of about 15 percent in 2009 before dropping to the ten to 12 percent range by 2012. It has since fallen to less than ten percent (Eriksen et al. 2019). Thus, as these works suggest, the introduction of the Home Value Code of Conduct (HVCC), a change in appraisal standards, that went into effect in 2009 (and was subsequently codified in the Dodd-Frank Act of 2010), has not resulted in a sustained reduction in the rate of appraisal contract price confirmation. That being said, others have assessed the impact of the HVCC on appraisals and have generally shown a reduction in the instances of appraised values equal to or above contract price (Abernethy and Hollans 2010, Agarwal, Ambrose, and Yao 2017, Calem et al. 2015, Shi and Zhang 2015).

The work that most closely relates to the analysis in this paper is Fout and Yao (2016). These authors look at the housing market effect of a low appraisal using data from September 2011 to August 2012. Akin to our analysis, they find that a low appraisal is associated with a higher likelihood of renegotiation from contract to sale and an increase in the probability that a sale is delayed or cancelled. Relative to Fout and Yao's (2016) work, our paper delves further into the process that leads to higher renegotiation rates when a low appraisal occurs, evaluating how different borrower groups react differently to the "low appraisal" news, as well as expanding the time period of the analysis by including data from 2013 to 2018.

Shui and Murthy (2019) similarly find a higher likelihood of renegotiation when the appraised value is not exactly equal to contract price. In addition, these authors find there is an appraiser effect on the likelihood of renegotiation. Appraisers that are more likely to make mistakes in the appraisal process, more likely to confirm contract price, or overvalue the property contribute towards greater renegotiation rates.

Our finding of increased renegotiation rates with a low appraisal relates to both the house price bargaining literature and the literature related to deviations from the assumption of efficient markets. The former includes papers studying the role of time on market (Taylor 1999 or Merlo and Ortalo-Magné 2004), asking price (Han and Strange 2016), and equity position (Genesove and Mayer 1997) on house prices. The latter focuses on factors related to deviations from traditional efficient market hypothesis valuation in housing markets. One such factor is seller loss aversion, which Genesove and Mayer (2001) find leads to higher asking prices, higher selling prices, and a lower likelihood of a sale in real estate transactions.

As first highlighted by Stigler (1961), deviations from perfect market efficiency tend to originate in information asymmetries. One such asymmetry is visible in the role of real estate

agents in the property selling process. Real estate agents potentially have a financial incentive to sell their clients' homes at a relative discount in order to speed up the transaction time or to ensure the transaction occurs. Agents can leverage their comparative knowledge of market conditions relative to the sellers in order to do this. Both Levitt and Syverson (2008) and Rutherford, Springer, and Yavas (2005) find evidence that real estate agents obtain comparatively higher prices when selling their own homes than they do for their clients. Another information asymmetry that is capitalized in house prices is that of school grades (Figlio and Lucas, 2004) or failing school designations (Bogin and Nguyen-Hoang, 2014), which these authors show act as a noisy signal for the comparatively less informed buyers and impact house prices over and above other concrete measures of school performance or quality that might be more visible to the existing home owner/seller.

The papers in the preceding paragraph highlight the role of both information asymmetries and of having a third-party view or re-framing of information that homebuyers likely already possess (e.g. school quality) on house prices. Our finding that the valuation from a third-party appraiser impacts the likelihood of renegotiation is an example of both new information and re-framing of information impacting home prices. Appraisers, a third-party in the transaction, have an information asymmetry relative to both the buyer and the seller. Appraisers will typically better ascertain the quality or condition of a property, or the local market's valuation of different property features than the buyer may be able to. This second factor pertaining to greater knowledge of market valuation of property features is also evident for the appraiser relative to the sellers, who tend to have an overly optimistic view of the current market valuation of their property (see Goodman and Ittner 1992 or Kiel and Zabel 1999).

3. APPRAISAL PROCESS

Theoretically, appraisers can follow one of three approaches in valuing a property: the comparable sales approach, the income-generating approach (for investment properties), and the cost approach (for new constructions). Practically, however, only the comparable sales approach is used by appraisers.[2] Under the comparable sales approach, there are numerous places where appraiser judgement comes into play in determining the final appraised value. The first step of four is to inspect the property for size, condition, quality and number of rooms, for instance. In the second step, appraisers identify several comparable recent real estate sales and listings. The third step requires appraisers to adjust the prices of the comparable sales for the differences between the subject and comps. In the fourth and last step, the appraiser applies weights to the adjusted prices of the comparable sales to settle on a value for the subject property that is rarely below contract, even when the average value of adjusted comparable sales is below contract (Eriksen et al. 2019).

Why does the appraiser go to all this trouble to support the contract? One reason appears to be alignment with the lender, who potentially influences the appraiser's future business opportunities (Eriksen et al. 2019). All else equal, lenders and borrowers prioritize both the lower cost and uncertainty of a speedy closing, which could be adversely affected by a low appraisal. Though the borrower ultimately bears the fees for the appraisal, the lender chooses the Appraisal Management Company (AMC), and the AMC selects the appraiser, who often operates as a self-employed entity who can be replaced with little effort. The lender appears as the "lender/client" or "intended user" on the 1004 appraisal form that the appraisers must complete.

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[2] See Pagourtzi et al. (2003) or Vandell (1991) for an overview of the appraisal valuation methods and the comparable sales approach.

The appraiser faces the challenging task of coming up with a single appraised value. Since the sale is the result of a complicated and heterogeneous negotiation, there is at best a range of potential market clearing prices, but the appraiser is required by regulation to pick a single price for the home. Also, by regulation, appraisers are provided with the contract price before conducting the appraisal and are expected to review this contract price. The appraiser is literally not allowed to perform the appraisal without consulting the contract and even transcribes some of the contract information into the appraisal form. If appraisers believe that any result below contract will extend timelines and create additional frictions, they may be more inclined to provide support for the contract price. Presumably partly as a result of this process, a low appraisal occurs less than one time in ten times, while most appraised values are above the contract price.

A mathematical expectation that is truly independent of the contract and the mortgage would arguably judge as many contracts high as low. This is seen in the pre-contract appraisals in Eriksen et al. (2020). As a practical issue, buyers are often as anxious for the home to appraise at least at contract as any other party. In our 2018 data, the median number of days between contract-signed date and appraisal-signed date is 16 days. This is a period when the buyer has probably had to suppress worries about the agreed-upon price and been occupied in many parts of the moving preparation. It is not a point when buyers want to hear they likely overpaid and now have unanticipated problems to solve, such as mortgage adjustments or renegotiation of the sale contract.

The appraisal has a decisive role in the underwriting process, though an asymmetric one. In the case of purchase transactions, the denominator in the loan-to-value ratio (LTV) is calculated as the minimum of the appraised value and the contract price. Therefore, when a low appraisal occurs, it lowers the mortgageable home value and raises the LTV. When a buyer is faced with a

low appraisal there can only be three possible outcomes. One option is that the buyer can renegotiate a lower sale price, lowering the required loan amount if the down payment amount remains unchanged and thus the LTV decreases. Alternatively, the buyer could eventually delay or call off the bid if renegotiation efforts fail, particularly if the borrower faces binding liquidity constraints. The third option is that the buyer can proceed with the transaction and close, under the original contract price, with either a now higher LTV (and in many cases a larger loan cost) or the same LTV with a lower loan balance (i.e. an increase in the down payment from the borrower).

As we shall see in Section 5, the most common response to a low appraisal is for the contract to be renegotiated down and for the mortgage to close at the new price in roughly the same time frame. It is easy to see why the buyer would prefer a lower price, but it is unclear why the seller allows for this downward renegotiation. It seems that at this point the buyer gains substantial bargaining power because the buyer can dissolve the contract by simply failing to pursue the mortgage, getting all earnest money back and avoiding most financing costs.

Most contracts associated with this dataset are unavailable to the authors, but we were able to obtain 100 random contracts through Fannie Mae's Loan Quality Center. A review of the 100 contracts reveals the following: 90 mention that a mortgage is required to purchase the home; 87 state that the buyer must dutifully or promptly seek a mortgage; 85 specify earnest money returns to the buyer if the mortgage does not close; 80 specify that the contract is void if the mortgage does not close; and 32 specify that the contract is void if a low appraisal occurs.

Thus, the right to dissolve the contract when a low appraisal occurs is often explicitly stated, but even when not explicit, it is the general rule, given a low appraisal would fall under reasons a mortgage did not close. In all cases, even in the minority of application LTVs where a low appraisal would not reduce the amount that could be borrowed, the amount of down payment, nor

the price of borrowing, the borrower can halt the mortgage by failing to bring in or sign the required documents.[3] Additionally, perhaps because low appraisals are rare, sellers may well realize that the contract is indeed rich, softening their resistance to a lower contract price. They may be reluctant to incur the costs of re-listing their homes and might believe they are not likely to obtain a better match in terms of sale price, and thus are more likely to give in to current buyer demands for a lower sale price.

As the buyer is not required to provide the seller with the appraised value, when this value is above the contract price there is no similar spike in upward price negotiation. However, there is a much smaller observed increase in the rate of upward negotiation when the appraised value (and often AVM) are well above contract.

4. DATA AND STATISTICS

We combine four data sets for the analysis in this paper which provide information on applications, appraisals, and delivered loans during the period of our analysis, January 2013 to December 2018.

The first is the Uniform Appraisal Data (UAD) set, which contains appraisals for one-to-four-unit properties and condominiums submitted to Fannie Mae and Freddie Mac. The appraiser can say which Government Sponsored Enterprise (GSE, i.e. Fannie Mae or Freddie Mac) can see the appraisal, but most of the time the lender requires appraisers to make the appraisal available to both GSEs, to keep options open for where lenders deliver the loan. For this paper, we will only

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[3] Discussing the consequences of a low appraisal with realtors, we established that, in practice, there is virtually never legal resistance by sellers to a borrower withdrawing from the contract in the case of a low appraisal and obtaining a return of their earnest money deposit.

address appraisals that accompany applications made in the Fannie Mae underwriting system Desktop Underwriter (DU). This allows for all necessary data to be collected. The fields we take from the UAD are contract price, appraised value, address, date of appraisal, and name of appraiser. The contract price is originally taken from a sales contract that the buyer provides to the lender when seeking a loan to buy the house and is forwarded to the appraiser, for example via the AMC.

In three percent of cases, there are multiple appraisals for the same loan application. This could be due to some policy of the lender requiring two appraisals for some properties or loan programs (e.g. high balance or jumbo loans), or perhaps some other issue with the first appraisal. Fannie Mae does not require multiple appraisals for its one-to-four-unit properties, which are the only ones that appear in this set. In cases of multiple appraisals, we drop the sale entirely from our study, since we cannot be sure which appraisal is being used for the purposes of underwriting.

More common than multiple appraisals are multiple submissions by the same appraiser, in order to add data or change some field. These occur for one-third of applications. A small percentage of the time (4.5 percent of those with multiple submissions,1.5 percent of overall applications) the appraised amount changes between submissions. As this creates uncertainty about which appraised value is used in the underwriting process, we drop those cases too. All remaining submissions on the same property have the same appraised value in all submissions.

The paper is focused, in part, on buyer and seller renegotiations when the appraisal does not support the pre-appraisal contract. No contract is truly finalized until the sale is consummated. Renegotiations are detectable primarily because in the delivery record we can observe that the sale occurs at a different price than the contract price indicated on the appraisal. But in three percent of appraisal resubmissions (one percent of all cases), the contract price is observed to be different between submissions. This does not appear to be simply error correction, as in 45 percent of these

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cases the appraised values are below contract (five times the population rate) and in 83 percent of contract changes, the price drops. The strong directionality seems to indicate that borrowers are renegotiating for lower prices and the appraiser is finding out about it, probably from the lender. As we are interested in what happens as a result of the difference between contract and appraised values, we use first submission of the appraisal in this paper to determine contract price, which is the submission where the contract price is least likely to have been altered as a result of the appraisal.

The second data set used comes from DU records. We rely only on conventional, first-lien mortgages, without additional financing. Like the UAD, but far more regularly, DU contains multiple submissions (in 2018 75% of applications had multiple submissions), and data changes often as the lender and borrower converge on the final terms. We use the first DU submission to determine the LTV that the borrower intended based on the contract price, prior to any renegotiations that may be a result of an appraised value differing from the contract price. We match UAD appraisals to DU, requiring address to match, dates to be within some small tolerance of each other, and values of the appraisal to match the appraised value of DU within 100 dollars (to allow for rounding). By only choosing approve-eligible DU cases with appraisals and removing cases where the buyer/loan underwriting credit profile would not allow for delivery to Fannie Mae, we can be confident that every party has the opportunity to close the loan, provided the appraisal supports the contract price or, if not, an accommodation can be worked out.[4] Our DU-matched sample of appraisals for owner-occupied properties used in the analysis has 3,192,221 properties

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[4] We also remove cases where the appraisal does not occur at least one day after the data is initially entered into DU. This is in many cases just a matter of delayed entry of the DU underwriting data, however a key statistic in this paper is the effect of a low appraisal on time to close the loan from initial application date. Additionally, we want to be confident that the appraiser was selected by the same lender (potentially through an AMC) who closes the loan and that, for instance, a lender is not using an appraisal provided by the borrower from another pre-existing loan application.

and associated loan applications, per Table 1, which provides summary statistics for all the variables used in the analysis. These applications have an average contract value of $305,690 and an average appraised value of $308,189.

The third data set, the Delivery File Data (DFD), is used primarily to make sure that the final sale price of the home is accurate, but also to correct a small share of any DU file errors. The DFD is a system of business record, very nearly 100 percent accurate, and always open to corrections by lenders or servicers. We are fastidious about the final sale price because if it differs from the contract price on the initial appraisal submission, we will deem that a renegotiation has occurred. The difference between the contract price and the sale is the amount of renegotiation. As can be seen in Table 1, delivered loans number 2,228,620 and have an average appraised value of $301,859 and an average sale value of $298,660.

Finally, we bring in AVM information from a fourth data set, Fannie Mae's AVM file, which assigns a value to most DU properties. This valuation is not based on the sale in question, or on the appraisals in the UAD, and as such provides an alternative view of the property value that will not be biased by any additional information from the appraisal.

By contrasting the number of observations for each variable in Table 1 one can observe the source dataset for that variable. Variables numbering above 3.1 million observations come from the main dataset of appraisals matched to DU, these include both applications that lead to deliveries and applications that do not. Variables numbering around 2.2 million observations come from the DFD for delivered loans. Lastly, the weeks-on-market variable is obtained from the appraisal data but is a field that may be incomplete, hence the number of observations for this variable numbers just below 2.8 million. This data element identifies the number of weeks from the time the property is listed to the time it is under contract. A value of zero indicates that the property went under

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contract on the day that it was officially listed, this occurs for 4.5 percent of our sample. A value of one indicates that the property sold after the first day but within one week of listing (20.9 percent of the time), and so on.

Our four key dependent variables in the analysis are the first four listed in Table 1. *Low Appraisal* is an indicator of the appraised value coming in below contract price and occurs 8.5 percent of the time. *Delivered* is and indicator that an application is delivered as a Fannie Mae loan and occurs for 58.8 percent of applications. *Days-to-Close* is the number of days from contract signed to sale, and averages approximately 40 days for our sample of delivered loans. *Renegotiated Down* is an indicator of the final sales price coming in lower than the contract price, occurring for 9.5 percent of delivered loans.

From Table 1 we can also observe that on average appraised values are higher than contract price by 0.93 percent of contract price (calculated as appraisal minus contract as a percent of contract), with a standard deviation of 2.7 percent. This is also evident in Figure 1A, which plots the share of appraisals in each appraisal minus contract bucket and will be discussed in greater detail in Section 5. By contrast, the AVM minus contract variable (as a percent of contract) has a mean of 0.36 percent, which is closer to zero, and a higher standard deviation of 9.2 percent. This confirms our view and approach in this paper that the AVM is a more unbiased but noisier estimate of property valuation compared with the appraised value.

Other variables included in Table 1 are the LTV ratio at first underwriting (*LTV at 1st Und.*) and categorical indicators for the FICO score at first underwriting and final delivery, as well as cash reserves, measured as how many months of principal, interest, taxes and insurance payments reserves account for. We observe that there are small differences between the FICO at first underwriting and final delivery. These can be due to either changes in FICO between the point of

application and delivery or due to the sample of applications being different than the sample of delivered loans. We do not view these differences in FICO as meaningful and choose to use the broader application FICO set to model the incidence of low appraisals and delivery rates and use the more narrow but accurate view of delivery FICO (from the DFD) to model days-to-close and the likelihood of renegotiation.

Table 1 also includes Census tract-level variables obtained from the 2010 Census summary tables. These variables are the share of the population in the Census tract that are white non-Hispanic, as well as the median income, median house value, and median house-value-to-income ratio for the Census tract. We include these in modeling the likelihood of a low appraisal occurring in order to control for local geographic attributes.

5. RESULTS

Figure 1A presents the most important effects of low appraisals for the purposes of this paper , based on based on all appraisals in our analysis dataset.[5] The bars in Figure 1A show that for 29.3 percent of cases, appraised value exactly equals the contract value provided to the appraiser. For 24.8 percent of appraisals, the appraised value exceeds the contract value but by no more than one percent. The most common appraisal minus contract categories for low appraisals are [-2%, -1%) and [-3%, -2%), occurring in 1.5 percent and 1.4 percent of cases, respectively.

The lighter gray line in Figure 1A is the percent of applications where contract exceeds the AVM. The AVM is a noisy but less biased estimate for home value than the appraised value that is nonetheless highly correlated with the appraised value. Among the instances where a low

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[5] Figures A1A to A1F provide the same data by year. Effects are stable throughout this period.

appraisal occurs, the AVM is also below contract price in at least 68 percent of cases. Additionally, as the appraised value's shortfall relative to contract becomes greater, so does the incidence of the AVM falling below contract price. This is consistent with Calem et al. (2015), who argue appraisers can accurately value homes but are biased high in their reporting by approximately one standard deviation.

The darker gray line in Figure 1A measures the delivery rate to Fannie Mae. We can think of the delivery rate as a proxy for loan closing rates. A portion of the loans that do not get delivered to Fannie Mae still close and are either kept as part of a lender's portfolio or sold to another secondary market participant. We can observe that delivery rates fall moderately as the appraised value's shortfall from contract increases. Conversely, when the appraised value is greater than or equal to contract, the delivery rate is mostly unchanged. The highest rate of delivery is about 60 percent and is mostly constant whenever the appraised value is greater than contract. Delivery falls off to 59 percent with appraised values precisely equal to contract and then, moving left, are not below 58 percent until the appraised value falls below contract by more than four percent.

The median days-to-close, timed from contract to sale, is shown in black dashed lines in Figure 1A and shows small deviations for most of the appraisal minus contract range. In fact, for appraisal minus contract buckets that account for 95 percent of cases, where appraised values are not more than eight percent above or below the contract price, the median time to close is within one day of 39, the sample median. We also see that in the five percent of cases where appraised values deviate from contract by more than eight percent, above or below, median days-to-close increase up to five days above the sample median.

Finally, the black line in Figure 1A represents the rate of downward renegotiation for delivered loans. When the contract is supported exactly or exceeded by the appraised value,

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downward renegotiation rates are consistently about four percent. When the appraised value falls below contract, however, even by a small amount, renegotiation rates rise to over 50 percent; and rates of renegotiation continue to increase, up to 80 percent, as appraised values fall further below contract. Figure 1B contrasts the rates of upward renegotiation and of downward renegotiation. Rates of upward negotiation when appraised values are above contract are dwarfed by rates of downward negotiation when a low appraisal occurs. Note that the right-hand scale for the upward renegotiation rates is one-tenth the magnitude of the left-hand scale for downward renegotiation. Upward renegotiation increases as the appraised value exceeds contract price, reaching just below five percent when appraised values are more than ten percent above contract.

Changes in either closing rates (proxied by delivery rates) and days-to-close can significantly impact the likelihood a home sale is delayed or cancelled, and thus impact the parties directly involved in the transaction, i.e. buyers and sellers, but can also have an impact on both lender and real estate broker revenues. Figure 1A suggests that there are only small effects of low appraisals on closing rates and times to close, with most of the impact on higher renegotiation rates. This is a point we will return to later in our regression analysis.

The remainder of this results section discussion presents our econometric model analysis of the likelihood of a low appraisal and of how low appraisals impact the likelihood that an application is delivered to Fannie Mae, the time taken from contract to sale, and the likelihood of downward renegotiation.

5.1 Probability of a low appraisal

We model the probability of a low appraisal occurring using a linear probability model (OLS), with the following specification:

$$Prob\ (low\ appraisal)_{i,t} = f(AVM\ minus\ Contract, FICO\ at\ 1st\ Und., weeks\ on\ market,$$

$$LTV\ at\ 1st\ Und. FEs, Census\ Tract\ Vars., App. Year-Quarter\ FEs, MSA\ FEs)_{i,t} \tag{1}$$

The last two variables indicated in equation (1) are application year and quarter and Metropolitan Statistical Area (MSA) fixed effects and are employed to capture unobserved time and location specific factors, respectively, that impact the likelihood of a low appraisal. Throughout the analysis, the first model presented in each of the regression tables includes only the main explanatory variable of interest for that regression; the second version of the model includes that same main variable of interest as well as the application year/quarter and MSA fixed effects; the third version of the model includes the full set of covariates; and lastly, for all but Table 2, the final version of the model additionally includes some of the covariates interacted with the low appraisal indicator. This strategy allows us to ascertain how much added explanatory power is obtained in each model in the sequence, in addition to detecting whether there are differential responses to a low appraisal (in the final version of the model) based on the values of covariates.

Per regression results in Table 2, the probability of a low appraisal, a relatively rare event occurring in 8.5 percent of cases, falls roughly eight-tenths of a percent with every percent increase in AVM relative to contract. Additionally, there are clear non-linearities in this correlation visible in the coefficient estimates for the squared and cubed AVM-minus-contract variable.

While we believe the AVM is a less biased yet noisy estimate of the property value (compared with the appraised value), there are factors that the AVM may not take into consideration which nonetheless have an impact on the likelihood of a low appraisal occurring.

The inclusion of 2010 Census-tract level socio-demographic variables tries to address some of this concern. These are effectively geographic-level controls that would not be captured in the MSA fixed effects, since they are at a smaller level of geography. In Table 2 we see that properties located in Census tracts with a higher share of white Non-Hispanic population, higher incomes, higher house values, and higher house values relative to income all correlate with lower likelihoods of a low appraisal. The finding of a negative correlation with low appraisals and higher incomes/higher house values is in line with LaCour-Little and Green (1998) who showed that the likelihood of a low appraisal is correlated with measures of neighborhood characteristics such as the share of boarded-up homes in the neighborhood.

Results in Table 2 show that borrowers with a FICO score below 740 are more likely to receive a low appraisal than those with a FICO score of 740 or higher. This suggests that these lower credit score borrowers may potentially purchase homes that are systematically different, in a manner not picked up by the AVM specification in the model, that makes it more likely that a low appraisal occurs. The negative relationship with credit score and low appraisals is also consistent with higher credit score buyers negotiating lower contract prices that are more likely, all else equal, to be confirmed by the appraiser. In Table 2 we can also see that homes that are on the market longer are less likely to have a low appraisal. This is visible in the positive coefficients for homes that sell in less than six weeks.

Lastly, the impact of LTVs at first underwriting on the probability of a low appraisal is also significant. Figure 2 displays the coefficient estimates associated with LTVs and shows that at LTV notches where low appraisals would lead to an increase in financing costs through higher mortgage insurance costs (80, 85, 90, 95% LTV) coefficient estimates are markedly lower than for neighboring LTVs. In other words, low appraisals are significantly less likely at these LTV

notches than just above or just below these LTV values. So, appraisers seem aware of this aspect of the mortgage and are responsive to it. This is similar to results in Calem et al. (2015) who find greater likelihood of information loss, i.e. an appraised value that is equal to or within one percent above contract price, at financially significant LTV notches.

5.2 Probability loan is delivered

As indicated earlier, in order to gauge potential low appraisal effects on loan fallout (i.e. loan does not go through), we estimate the impacts of a low appraisal on the probability that a loan is delivered to Fannie Mae. The probability of loan delivery to Fannie Mae can be viewed as a proxy for the likelihood that a loan closes, recognizing that loans may still close and not be delivered to Fannie Mae. We also view the delivery rate as a proxy for loss of income from the transaction for all parties that have a financial interest in the transaction being completed. Here we are implicitly assuming that a low appraisal does not affect the likelihood of delivery to Fannie Mae, conditional on the loan being made. In other words, the conditional probability that a loan with a low appraisal is delivered to Fannie Mae is not significantly different from the conditional probability that any other comparable loan is delivered to Fannie Mae. We model the probability that an application is delivered as a Fannie Mae loan using linear probability model regressions with the following specification:

$$Prob\ (Delivery)_{i,t} = f(Appraisal\ minus\ Contract\ Category, FICO\ at\ 1st\ Und.,$$

$$FICO * low\ appraisal, LTV\ at\ 1st\ Und.FEs,$$ (2)

$$LTV * low\ appraisal, App.Year\text{–}Quarter\ FEs, MSA\ FEs)_{i,t}$$

The specification in equation (2) is similar to the one employed in modeling the probability of a low appraisal. The primary difference is that here the appraisal minus contract categorical

variable is the main explanatory variable of interest. Additionally, we interact FICO and LTV at first underwriting with the indicator of a low appraisal to assess whether a low appraisal has a differential impact on delivery based on a borrower's LTV and FICO. We follow the same modeling approach used in modeling low appraisals of including only the main explanatory variable of interest in the first model, adding in time and location fixed effects in the second, and the full set of covariates in the third. We also add a final version that additionally includes the low appraisal variable interacted with FICO and LTV at first underwriting.

In the regressions (Table 3) time and location increase the explanatory power of the model for delivery rates. The R-squared rises to 0.038 when fixed effects for application year and quarter and MSA are introduced in Model 2, from the R-squared of 0.001 with in Model 1, which only contains, contract minus appraisal categorical variables as the explanatory variables. Adding borrower characteristics in Model 3 further increases the R-squared, to 0.0476.

As indicated in the discussion of Figure 1A, the impact of appraised value deviation from contract on the probability of delivery is small for most of the appraisal minus contract distribution. Nonetheless, there is a larger impact on the probability of delivery among appraised values that come in significantly below contract, though these represent a small share of overall applications. We observe that as the shortfall between the appraised value and contract price increases, the likelihood of delivery decreases. For applications where the appraised value's shortfall from contract is more than six percent, the reduction in the likelihood of delivery is ten percent or higher (coefficient estimate of -0.060 or lower from a sample mean of 0.588 in Model 3 of Table 3).

At this point it is worth revisiting the analysis of sale contracts we referred to earlier in the paper. In that analysis we saw that 32 percent of contracts in the sample indicated that a low appraisal would void the contract. That may seem like it contradicts the results presented here

which show a smaller impact on the likelihood a loan is delivered when a low appraisal occurs. Even though around a third of contracts in the sample of 100 analyzed have this feature that the contract is void with a low appraisal, contracts will typically be modified or drawn up again when buyer and seller renegotiate the sale terms following a low appraisal. These changes will then also be reflected in the loan application so that the loan delivery or acquisition rate is less impacted by the low appraisal than would be implied by the general prevalence of the appraisal-related contingencies across the contracts analyzed.

Recall that we assume the values given for information on the sale price and loan amount provided in the initial appraisal are taken from the initial contract and that these terms may change with renegotiations and subsequent application edits. By contrasting the initial loan appraisal information (i.e. contract price) with the final information present in the delivery file (i.e. sales price) for the originated loans delivered to Fannie Mae, we gauge whether renegotiation of terms occurred, which we explicitly analyze in Section 5.4. If an initial contract is cancelled and re-drawn but the loan application still gets originated and delivered to Fannie Mae, there is no way for us to ascertain the fact that the initial contract was cancelled. As such, it is possible for a contract to be cancelled and for the loan to still be delivered to Fannie Mae under a new contract. As our interest here is on the effect of low appraisals on the ultimate consummation of the loan and sale between a given buyer and seller, this distinction is of little relevance for our analysis of delivery rates here. As far as changes to contract cause delays in closing the loan or result in changes to the ultimate sales price, however, these will matter for the time-to-close or the rate of renegotiation, the subjects of the next two respective subsections.[6]

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[6] Analysis of the randomly selected 100 contracts was done manually. As such, this is not a method that is replicable for the entire sample of loan applications used in the analysis in order to specifically assess whether the contract is actually cancelled or just renegotiated.

Generally, applications from lower FICO borrowers are seen to have a greater likelihood of delivery. The positive coefficients for lower FICO score borrowers (notably large coefficients for FICO scores below 680) may reflect the fact that lower FICO borrowers are likely to have a lower probability of any given loan application being approved, hence greater motivation by the borrower and thus greater likelihood of the loan being delivered once it is approved relative to higher FICO borrowers.[7]

Figure 3 displays the coefficients on LTV, showing that as LTV increases above 80 so does the probability of delivery. In addition, there is a distinct spike at LTV of 97. During this period Fannie Mae has a significantly larger share of purchase mortgages with LTVs greater than 95 than Freddie Mac, the main alternative outlet for conventional conforming loans, hence this significant positive uptick in delivery probability for applications with this level of LTV.[8]

Lastly, models with interactions of FICO and LTV with the indicator of a low appraisal do not reveal meaningful differences in the impact of a low appraisal for borrowers at different points of the FICO (shown in Table 3 Model 4) or LTV distribution (not shown).

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[7] Recall that our sample only includes loan applications that were approved hence, once a lower FICO score borrower's loan is in our sample, it is more likely to lead to a delivery.

[8] Analysis of mortgage-backed securities (MBS) issuance data from 2013-2018 reveals that 7.6 percent of Fannie Mae purchase mortgages in MBS issuance during this period had LTVs above 95 percent. This is markedly larger than the share with LTVs above 95 percent for Freddie Mac issuance, at 3.9 percent.

5.3 Days-to-close

We model days-to-close, i.e. days from contract to sale, using OLS regressions with the following specification:

$$Days\text{--}to\text{--}Close_{i,t} = f(Appraisal\ minus\ Contract\ Category, Final\ FICO,$$

$$FICO * Low\ Appraisal, Final\ LTV, LTV * Low\ Appraisal, Reserves,$$

$$Reserves * Low\ Appraisal, Weeks\ on\ Mkt, \tag{3}$$

$$Weeks\ on\ Mkt * Low\ Appraisal, App.Year\text{--}Quarter\ FEs, MSA\ FEs)_{i,t}$$

The regressions in Table 4 show that appraised values above contract largely do not change the days-to-close, though low appraisals do exhibit a delay in closing times, increasing in the extent to which the appraised value falls short of contract price. For applications with appraisals more than four percent but less than or equal to seven percent below contract, the increase is approximately one day. Time-to-close increases as the appraised value falls further below contract, reaching as high as four days for appraisals that are more than 10 percent below contract. Contrasting R-squared across models reveals the importance of time and location fixed effects on closing times. In particular, R-squared increases from 0.001 to 0.2209 from Model 1 to Model 2, with a further, though smaller, increase in explanatory power in the third and fourth models.

Results in Table 4 also show that lower FICO and lower reserve borrowers take slightly longer to close, likely indicating a more laborious verification and documentation process for these borrowers. Interacting the low appraisal indicator with FICO reveals that for borrowers with a FICO below 680, there is a greater positive correlation between closing times and low appraisals relative to higher FICO borrowers. The impact of weeks-on-market is non-monotonic. Properties that go under contract the day of listing and those on the market for six or more weeks have the longest closing times. Interacting low appraisal with weeks-on-market also indicates a non-

monotonic effect, with the relatively longest closing times for properties that sell within one day of listing and those on the market for four or more weeks.

Not shown in Table 4 are the impacts of LTV on days-to-close, which indicate that LTVs above 80 tend to close a little quicker; and that LTVs at notches associated with higher financing costs (LTVs of 80, 90, or 95) have slightly longer closing times than neighboring LTVs. The slightly longer processing times for loans exactly at these LTV notches could indicate that lenders may be more careful in the documentation process for these loans in order to guarantee that the loan does not fall through due to some incorrectly reported information, or it could indicate that the borrowers may be more likely to be stretching their finances in order to stay below the higher mortgage insurance premium plateau and thus there could be a more time-intensive income or asset verification process.

5.4 Probability of downward renegotiation

When an application is converted into an origination and delivered to Fannie Mae, we know that the sale was successfully concluded. In such instances, one potential outcome is that there is a difference between the contract price and the final sale price, i.e. a renegotiation occurred, possibly due to a low appraisal. Another alternative is that no renegotiation occurred and therefore, if faced with a low appraisal, the buyer simply ended up with a higher LTV or downpayment for the loan. Lastly, a sale could not occur, either due to a low appraisal or some other reason, which in our data would be seen as a loan application that ends up not being delivered to Fannie Mae. In this section we model the probability that an application is renegotiated down from contract to sale, i.e. that sale price is lower than contract price, using a linear probability model framework with the following specification:

$$Prob\ (Renegotiated\ Down)_{i,t} = f(Appraisal\ minus\ Contract\ Category, Final\ FICO,$$

$$FICO * Low\ Appraisal, Final\ LTV, LTV * Low\ Appraisal, Reserves,$$

$$Reserves * Low\ Appraisal, Weeks\ on\ Mkt, WksMkt * Low\ Appraisal, \qquad (4)$$

$$MSA * Year\text{--}Qtr\ Low\ Appraisal\ Share,$$

$$MSAQtrLowAppShare * Low\ Appraisal, App.\ Quarter\ FEs, MSA\ FEs)_{i,t}$$

The R-squared statistics for these downward renegotiation models are far larger than for any of the other dependent variables analyzed thus far. The R-squared is 0.4535 in Model 1 alone, where the only explanatory variable is the appraisal minus contract categorical variable. Further increases in the R-squared in Models 2, 3 and 4 are much smaller than the initial model R-squared, thus emphasizing the importance of the appraised value's deviation from contract in the predicting the likelihood of a downward renegotiation occurring.

When the appraised value is at least equal to contract, as in the vast majority of cases, downward renegotiation averages 3.9 percent, and there appears to be little impact of the deviation from contract, provided the deviation is in the direction of an appraised value being above contract, on the probability of downward renegotiation. On the other hand, when a low appraisal occurs, per Figure 1A, the probability of downward renegotiation rises to 55.8 percent and continues steadily to rise as appraised value falls further short of contract, reaching 79.9 percent when appraised value is short of contract by seven to eight percent. Accordingly, coefficient estimates for appraisal minus contract categories are large and statistically significant, ranging from an impact of 54.1 percentage points for appraised values with a shortfall from contract of up to one percent, to 78.0 percentage points for appraised values in the [-9%, -8%) range (seen in Model 3 of Table 5).

Low appraisals trigger renegotiations most often when the buyer is constrained. This can be seen both graphically and in the regression results in Table 5. Figure 4 shows that higher LTV borrowers renegotiate more often, in more than 93 percent of cases for applications with an LTV of 97 when the appraised value's shortfall from contract is greater than two percent (see dotted line in Figure 4). Renegotiation likelihood drops much lower for LTVs of 70 or less, where the low appraisal is less likely to jeopardize the loan, and even more for a small group we define as unconstrained, which we discuss shortly.[9] Figure 5 shows that high LTV borrowers usually recapture the entire difference between contract and appraised value.[10] Borrowers with lower LTV, including unconstrained borrowers, split this difference, giving up more to the seller as constraints loosen. From Figure 6, which plots the coefficient estimates for LTV from Table 5's Model 3, we see that there are large upticks in downward renegotiation rates when facing a low appraisal at all LTV notches associated with either higher financing costs (i.e. through mortgage insurance premiums) or LTV-based loan eligibility cut-offs (these include the LTVs of 80, 90, 95, and 97).

One alternative measure of a borrower's financial capacity is the level of residual assets after loan closing, or reserves. In using reserves as a measure of financial capacity, we see a similar picture of more constrained borrowers being more likely to respond to a low appraisal by renegotiating the contract price downwards. Borrowers with less than 12 months of reserves are more likely to renegotiate when faced with a low appraisal. This is shown in Figure 7 and supported by regressions coefficients shown in Model 4 of Table 5. We observe a similar effect

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[9] Appendix Figure A2 shows analogous charts indicating the rate of upward renegotiation by LTV categories and we can observe that upward renegotiation rates are not related to LTV level in the same way that downward rates are.

[10] Appendix Figure A3 shows analogous charts displaying the percent of the difference between appraised value and contract price that is yielded by the buyer for appraised values that are above contract for different LTV categories. No evident relationship exists between LTV category and a willingness to yield or agree to a higher transaction price.

of constrained borrowers with lower FICO scores more likely to renegotiate given a low appraisal. Figure 8 shows that borrowers with a FICO score in the highest credit score range [740,850], seen in the gray line, are less likely to renegotiate. This is also visible in the regression results displayed in Table 5's Model 4, where there is a progressive increase in the likelihood of a renegotiation as borrower credit score decreases.

The fact that borrowers with lower FICO scores or lower reserves are more likely to renegotiate emphasizes that these are borrowers who may be stretching more to obtain funds for a down payment. Therefore, absent a renegotiation, these borrowers would face an increase in the financing cost (through a higher LTV) or an increase in the down payment amount, that may be infeasible or otherwise particularly difficult to deal with. As such, these borrowers have a greater incentive to try and renegotiate the sale price downwards. It is important however to note here that these interactions of the low appraisal indicator with FICO, LTV or reserves will only capture the differential average effect of a low appraisal based on the value of the given covariate. In reality, these three credit variables interact with each other in terms of a borrower's ability to obtain a mortgage. For example, borrowers with both a low FICO and a high LTV are likely to have a different reaction to a low appraisal than borrowers with a low FICO but low LTV, who may be more willing to move up the LTV distribution in the face of a low appraisal.

While mortgage constraints drive up the rate of renegotiation, it is noteworthy there is still material renegotiation in the absence of any financing constraint. The black line in Figure 4 shows the decisions of 102,690 "unconstrained" borrowers, which we define as post-appraisal LTV

(calculated based on a value that is the lower of contract or appraised value) under 60 percent and FICO of 740 or higher.[11,12]

Requiring the final LTV to be under 60 percent requires even lower initial LTVs (based on contract) if the appraised value comes in below contract. For example, assume a borrower puts down $50 thousand on a contract to buy a house priced at $100 thousand. If the home is appraised for $100 thousand or more, then the cost to purchase, without renegotiation, is $100 thousand, the down-payment is $50 thousand, the loan is $50 thousand, the LTV is 50 percent, and the borrower pays the lender's lowest risk interest rate. If the home is appraised for $90 thousand, then the cost to purchase, without renegotiation, is still $100 thousand (the contract price), the down-payment is still $50 thousand, the loan is still $50 thousand, but the LTV is 50/90 = 55.6 percent, and the borrower still pays the lender's lowest risk interest rate. However, the low appraisal does imply that the buyer has potentially bid more than the underlying supportable property value, information that is now apparent to the buyer.

This is an entirely unconstrained buyer as nothing is changed in terms of financial costs or requirements because of the low appraisal. Figure 4 shows that unconstrained borrowers renegotiate at a little more than half the rate of all borrowers facing low appraisals, over forty percent of the time when the appraised value is below the contract price by more than one percent. Although mechanically the low appraisal itself alters none of the financing costs for this group of borrowers, the low appraisal does present these borrowers with a signal that they may have overbid and therefore apparently induces them to renegotiate.[13]

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[11] Appendix Table A1 presents the regression results for the downward renegotiation probability for this subset of borrowers. The impact of relevant explanatory variables is similar to those for the main estimation sample.

[12] The 60 percent LTV is chosen because these borrowers have no additional Fannie Mae Loan-Level Pricing Adjustments for purchase mortgages. There is no additional charge for purchase borrowers with a FICO score of 660 or higher at this LTV value. 740, and up is obviously a subset of 660 and up and is chosen to obtain borrowers who are even less likely to face financing constraints.

[13] We tested various definitions of "unconstrained", with little difference in estimated effects.

In fact, it is notable that over half the borrowers in this group who receive a low appraisal do not renegotiate. The fact that no renegotiation occurs may indicate these borrowers are reticent to renegotiate in case the sale falls through because the seller does not agree to a renegotiation, potentially more likely in markets where the seller has greater bargaining power. Alternatively, these buyers may not renegotiate due to the time and effort that renegotiation may entail, which could be greater than the potential cost savings associated with obtaining a lower transaction price for the home. Ultimately, the appraisal is just one signal of how much the property is worth and having agreed upon a price with the seller, the buyer may place more stock in that agreed upon price and think that they cannot obtain a lower price if they renegotiate. It is important to emphasize that us not seeing a change in the sale price doesn't mean that no renegotiation attempts were carried out, simply that the price was not renegotiated, potentially because any renegotiation attempt was unsuccessful or that there were other features of the transaction outside of price that were altered with the renegotiations. For example, a low appraisal may point to a specific defect in the property that the seller agrees to fix before the sale is concluded, thus not altering the final sale price.

The effect of a property going quickly under contract on the likelihood of a downward renegotiation occurring when facing a low appraisal is also noteworthy. Results in Table 5's Models 3 and 4 show that borrowers purchasing properties that go under contract two or more weeks after being listed are more likely to renegotiate than those properties that sell faster. Furthermore, low appraisals are more likely to lead to renegotiation for properties that have been on the market at least five weeks versus those that sold faster. The fact that properties transact within a few weeks of listing likely indicates these are property transactions where the bargaining

power is more pronounced on the seller side. As such, a low appraisal is less likely to be correlated with a downward renegotiation in these cases.

A last point is that the rarity of low appraisals may add to their power in downward negotiations. In MSAs and years where appraising below contract is less common, there is a 0.6 percentage point increase in renegotiation given a low appraisal for every one percent drop in the share of homes appraised below contract in the MSA for the quarter (Table 5 Model 4). Our interpretation is that the information value of the appraisal coming in below contract is more, when low appraisals are less common.

To this point, we have focused on analyzing the impact of a low appraisal on the likelihood of a downward price renegotiation, focusing on the low appraisal as a signal to buyers that they may have overbid. However, a low appraisal is a potentially downward biased indicator of overbidding, since the vast majority of appraised values are at or above contract price (91.5 percent of cases, per Table 1), consistent with the idea that appraisers will only arrive at a low appraisal when there is a serious concern that the contract price is not supported. As such, the inclusion of an alternative fair market value estimate of the property would help to distinguish cases where overbidding occurs but is not reflected in a low appraisal from instances where a low appraisal occurs. As indicated earlier, we believe the AVM can be considered a less biased estimate of the property value compared with the appraised value. Therefore, we can include an indicator of the AVM being below contract (or low AVM) into the regressions in order to distinguish between a potential overbidding effect and a low appraisal effect on the likelihood of a downward renegotiation. In other words, we can investigate whether the low appraisal is necessary for renegotiation or whether the low appraisal is only picking up extreme cases of overbidding and it is the extreme overbidding, not the low appraisal, that is resulting in increased renegotiation rates.

Table 6 presents models where we include an indicator of both a low appraisal and a low AVM in regressing the likelihood of a downward price renegotiation. Model 1 in Table 6 is analogous to Model 4 in Table 5. The only difference between these two specifications is that in Table 6 Model 1, we include a simple low appraisal indicator, and in Table 5 Model 4, a series of indicators for the deviation between appraised value and contract price. Just as in Table 5 Model 4, we find in Table 6 Model 1 that a low appraisal significantly boosts the likelihood of downward renegotiation.

The remaining columns in Table 6 are: Model 2, which includes both a low appraisal and low AVM indicator; Model 3, which interacts the low AVM indicator with the low appraisal indicator; and Model 4, which interacts the low AVM indicator with the low appraisal indicator and with other covariates. The first thing to note from Table 6 is that the low AVM indicator has no statistically significant impact on the likelihood of a downward renegotiation after controlling for the presence of a low appraisal, as seen in Table 6 Model 2. Secondly, Model 3 in Table 6 shows that when both a low AVM and low appraisal occur, the likelihood of renegotiating is marginally higher than if the low appraisal occurs without a low AVM. Thus, there is evidence that a small portion of the low appraisal effect results from buyers given a low appraisal more effectively renegotiating in cases where there is evidence of potential overbidding (i.e. low AVM). This could be consistent, for instance, with cases where sellers possess asymmetric information and know the initial contract price represents a premium over their expected transaction price and thus would be more likely to accept a downward price renegotiation.

The last thing to note in the results displayed in Table 6 is that the inclusion of a low AVM indicator, both by itself and by interacting it with the other covariates, does not meaningfully alter the impact of a low appraisal for different groups of borrowers. One may have worried that the

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greater likelihood of renegotiation for a given group when facing a low appraisal was simply proxying for a greater likelihood of such a group overbidding. Yet the results show even after controlling for possible overbidding, borrowers that are more financially constrained (lower FICO, higher LTV, less reserves) are more likely to renegotiate when faced with a low appraisal. Figure 9 contrasts the impact of a low appraisal and a low AVM by FICO. Low appraisal coefficient estimates, shown in gray, are similar to those displayed in Figure 6, with a low appraisal having a greater impact on renegotiation likelihood as LTV increases and discontinuously so at LTV notches associated with greater financing costs. By contrast, all the low AVM coefficient estimates, shown in black, are small and all but one are not different from zero in a statistically significant manner.

Overall, the results in this section show that a low appraisal is correlated with a greater likelihood of a downward price renegotiation. We see that this correlation is more pronounced for financially constrained borrowers yet is still evident for borrowers that are entirely unconstrained from a financing perspective. Additionally, a simple indicator that a borrower may have overbid does not produce similar impacts on the likelihood of renegotiation. Together these results suggest that the informational impact for a buyer of being told he/she may have overbid is an important driver of the renegotiation decision. Put differently, it is not the fact that one has overbid that triggers renegotiation but instead being told that overbidding occurred that seems to drive renegotiation.

6. CONCLUSION

While the appraised value coming in below contract price may be a concern for borrowers due to the potential implications for their ability to obtain a mortgage, we find that low appraisals

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provide enormous leverage to renegotiate the contract to a lower price. When buyers do renegotiate, subsequent to a low appraisal, they usually lower price by a significant share of the difference between contract price and appraised value. The new lower price reduces credit risk, costs to the borrower, and ultimately results in greater wealth for the buyer. Of course, these benefits come at the cost of sellers, but the appraisal is performed on behalf of the buyer, who ultimately pays for the appraisal, and not the seller. That being said, we. find that a low appraisal has only a modest negative effect on the likelihood of loan closing (as proxied by the likelihood of the loan being delivered to Fannie Mae) and thus the income of parties involved in the transaction, such as lenders or real estate brokers. We also find that low appraisals result in a small effect on the time from contract signed to sale, with timelines increasing by only a few days even for appraised values that are well below contract price.

Highly-constrained borrowers, for whom lending rules would effectively result in mortgage cancelation in the absence of renegotiation, nearly always achieve a lower sale price through renegotiation. But less constrained and, notably, borrowers that are completely unconstrained from a financing perspective, also often achieve a lower renegotiated price. This indicates the news or information value of expert signaling (by the appraiser) that buyers have overbid is an additional important feature of the low appraisal.

When appraised values are at least equal to contract, prices are highly sticky and renegotiation is uncommon. It is only when faced with a low appraisal that buyers meaningfully increase their rates of renegotiation. Furthermore, while low appraisals are rare, their very rarity potentially adds to their impact on renegotiation rates. We estimate that each percentage point decrease in the share of low appraisals in an MSA in a quarter brings a 0.6 percentage point higher renegotiation rate in response to a low appraisal.

The ability to renegotiate sales price to more accurately reflect the value of the underlying collateral potentially puts the borrower in a better position to sustain homeownership and allow for more effective management of the associated mortgage risk. A low appraisal gives buyers an opportunity to carry out such a renegotiation. As such, more accurate appraisals in the case of evidence of buyer overbidding support better decision making and more effective assessment of mortgage credit risk and pricing.

REFERENCES

Agarwal, Sumit, Brent Ambrose and Vincent Yao, 2017, The Effects and Limits and Regulation: Appraisal Bias in the Mortgage Market, SSRN Working Paper.

Agarwal, Sumit, Itzhak Ben-David and Vincent Yao, 2015, Collateral Valuation and Borrower Financial Constraints: Evidence from the Residential Real Estate Market, *Management Science*, 61(9): 2220-2240.

Abernethy, Avery and Harris Hollans, 2010, The Home Valuation Code of Conduct and Its Potential Impacts, *Appraisal Journal*, 78(1): 81–93.

Ben-David, Itzhak, 2011. Financial Constraints and Inflated Home Prices during the Real Estate Boom, *American Economic Journal: Applied Economics*, 3: 55-67.

Bogin, Alexander and Phuong Nguyen-Hoang, 2014, Property Left Behind: An Unintended Consequence of a No Child Left Behind "Failing" School Designation, *Journal of Regional Science*, 54(5): 788-805.

Calem, Paul, Lauren Lambie-Hanson and Leonard Nakamura, 2015, Information Losses in Home Purchase Appraisals, Federal Reserve Bank of Philadelphia Working Paper 15-11.

Calem, Paul, Lauren Lambie-Hanson and Leonard Nakamura, 2017, Appraising Home Purchase Appraisals, Federal Reserve Bank of Philadelphia Working Paper 17-23.

Chinloy, Peter, Man Cho and Isaac Megbolugbe, 1997, Appraisals, Transaction Incentives, and Smoothing, *Journal of Real Estate Finance and Economics*, 14: 89–111.

Ding, Lei, and Leonard Nakamura, 2016, The Impact of the Home Valuation Code of Conduct on Appraisal and Mortgage Outcomes, *Real Estate Economics*, 44(3): 658-690.

Duca, John, John Muellbauer and Anthony Murphy, 2010, Housing Markets and the Financial Crisis of 2007 – 2009: Lessons for the Future, *Journal of Financial Stability*, 6: 203–217.

Eriksen, Michael, Hamilton Fout, Mark Palim, and Eric Rosenblatt, 2019, The Influence of Contract Prices and Relationships on Appraisal Bias, *Journal of Urban Economics*, 111: 132-143.

Eriksen, Michael, Hamilton Fout, Mark Palim, and Eric Rosenblatt, 2020, Contract Price Confirmation Bias: Evidence from Repeat Appraisals, *Journal of Real Estate Finance and Economics*, 60(1): 77-98.

Figlio, David and Maurice Lucas, 2004, What's in a Grade? School Report Cards and the Housing Market, *American Economic Review*, 94 (3): 591-604.

Fout, Hamilton and Vincent Yao, 2016, The Housing Market Effects of Appraising Below Contract, working paper, March 2016.

Genesove, David and Christopher Mayer, 1997, Equity and Time to Sale in the Real Estate Market, *American Economic Review*, 87(3): 255–269, June.

Genesove, David and Christopher Mayer, 2001, Loss Aversion and Seller Behavior: Evidence from the Housing Market, *Quarterly Journal of Economics*, 116: 1233-1260.

Goodman, John and John Ittner, 1992, The accuracy of homeowners' estimates of house value. *Journal of Housing Economics*, 2(4): 339-357.

Han, Lu and William Strange, 2016, What is the role of the asking price for a house? *Journal of Urban Economics*, 93: 115-130.

Hendershott, Patric, Robert Hendershott, and James Shilling, 2010, The Mortgage Finance Bubble: Causes and Corrections, *Journal of Housing Research*, 19(1): 1–16.

Horne, David and Eric Rosenblatt, 1996, Property Appraisals and Moral Hazard, SSRN Working Paper.

Kelly, Austin, 2006, Appraisals, Automated Valuation Models, and Mortgage Default, Working Paper, Federal Housing Finance Agency.

Kiel, Katherine and Jeffrey Zabel, 1999, The accuracy of owner-provided house values: The 1978–1991 American Housing Survey, *Real Estate Economics*, *27*(2): 263-298.

LaCour-Little, Michael and Richard Green, 1998, Are minorities or minority neighborhoods more likely to get low appraisals? *Journal of Real Estate Finance and Economics*, 16(3): 301-315.

Levitt, Steven and Chad Syverson, 2008, Market distortions when agents are better informed: The value of information in real estate transactions, *Review of Economics and Statistics*, 90(4): 599-611.

Merlo, Antonio and François Ortalo-Magné, 2004, Bargaining over residential real estate: evidence from England, *Journal of Urban Economics*, 56(2): 192–216.

Mian, Atif, and Amir Sufi, 2010, Household Leverage and the Recession of 2007 to 2009, *IMF Economic Review*, 58(1): 74-117.

Murray, John K, 2009, Issues in Appraisal Regulation: The Cracks in the Foundation of the Mortgage Lending Process, *Loy. LAL Review*, 43: 1301–1338.

National Association of Realtors, 2012, Low Valuation in Home Appraisals Causing Steady Level of Contract Glitches, October 2012.

Nakamura, Leonard, 2010, How Much is That Home Really Worth? Appraisal Bias and Home Price Uncertainty, *Business Review*, Federal Reserve Bank of Philadelphia, 2010 Q1: 11-22.

Pagourtzi, Elli, Vassilis Assimakopoulos, Thomas Hatzichristos and Nick French, 2003, Real estate appraisal: a review of valuation methods, *Journal of Property Investment & Finance* 21(4): 383–401.

Rutherford, Ronald, Tom Springer, and Abdullah Yavas, 2005, Conflicts between principals and agents: evidence from residential brokerage, *Journal of Financial Economics*, 76(3): 627-665.

Shi, Lan and Yan Zhang, 2015, Appraisal Inflation: Evidence from the 2009 GSE HVCC Intervention, *Journal of Housing Economics* 27: 71–90.

Shui, Jessica and Shriya Murthy, 2019, Under What Circumstances do First-time Homebuyers Overpay? — An Empirical Analysis Using Mortgage and Appraisal Data, *Journal of Real Estate Research*, 41(1): 107-145.

Stigler, George, 1961, The economics of information, *Journal of Political Economy*, 69(3): 213–225.

Taylor, Curtis, 1999, Time-on-the-market as a sign of quality, *Review of Economic Studies*, 66(3): 555-578.

Vandell, Kerry D., 1991, Optimal Comparable Selection and Weighting in Real Property Valuation, *AREUEA Journal*, 19(2): 213-239.

Zhu, Shuang and R. Kelley Pace, 2012, Distressed Properties: Valuation Bias and Accuracy, *Journal of Real Estate Finance and Economics*, 44: 153–166.

FIGURES AND TABLES

Figure 1A: Appraised value minus contract price and delivery rate, renegotiation rate, days-to-close, and incidence of AVM greater than contract price
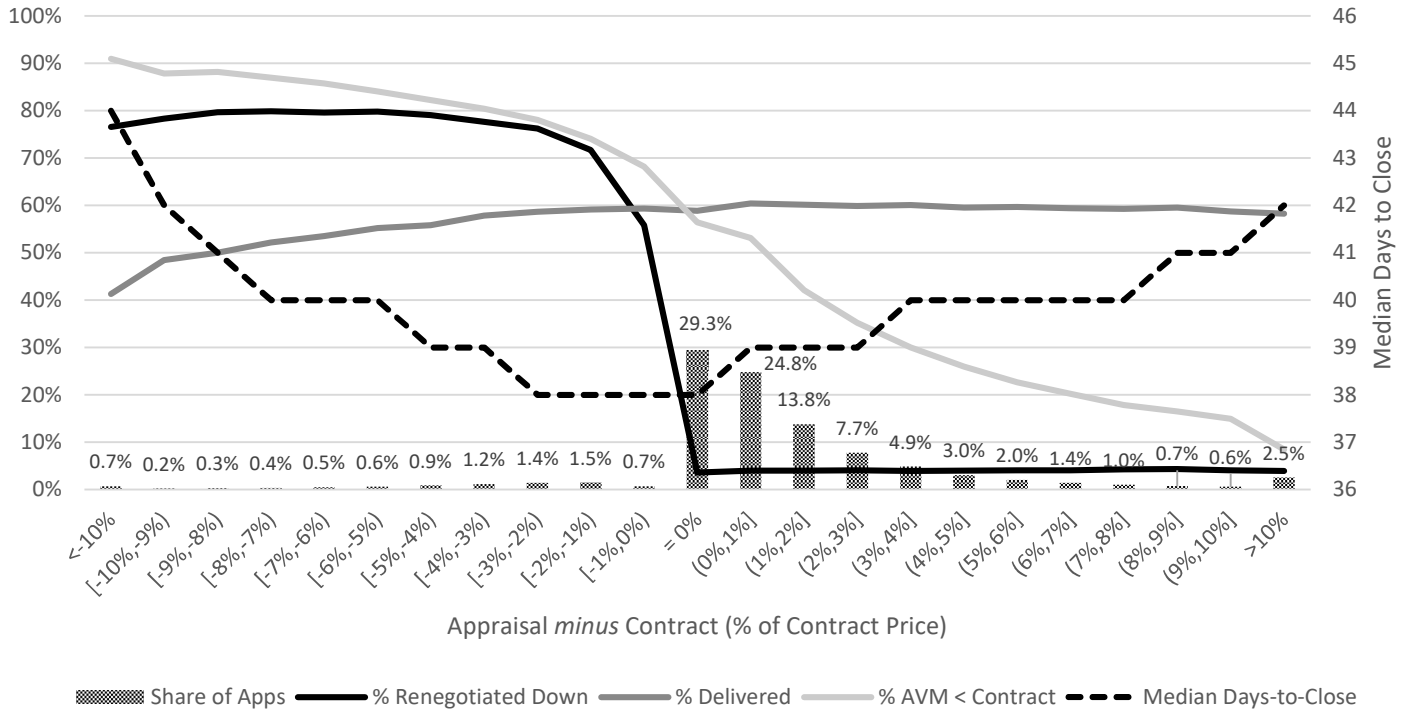
Figure 1B: Upward and downward renegotiation rates by appraised value minus contract

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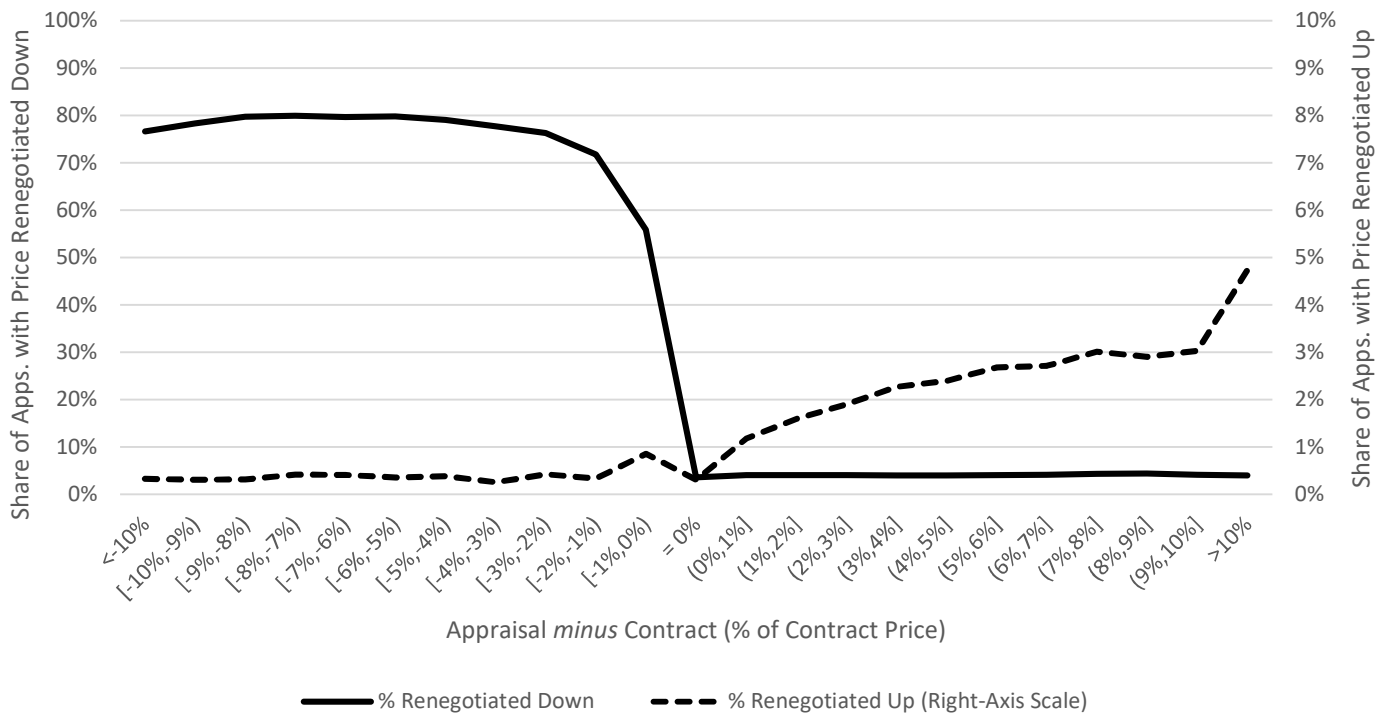
Figure 2: LTV parameter estimates from model predicting the likelihood of a low appraisal
(Error bars display 95% confidence bands)
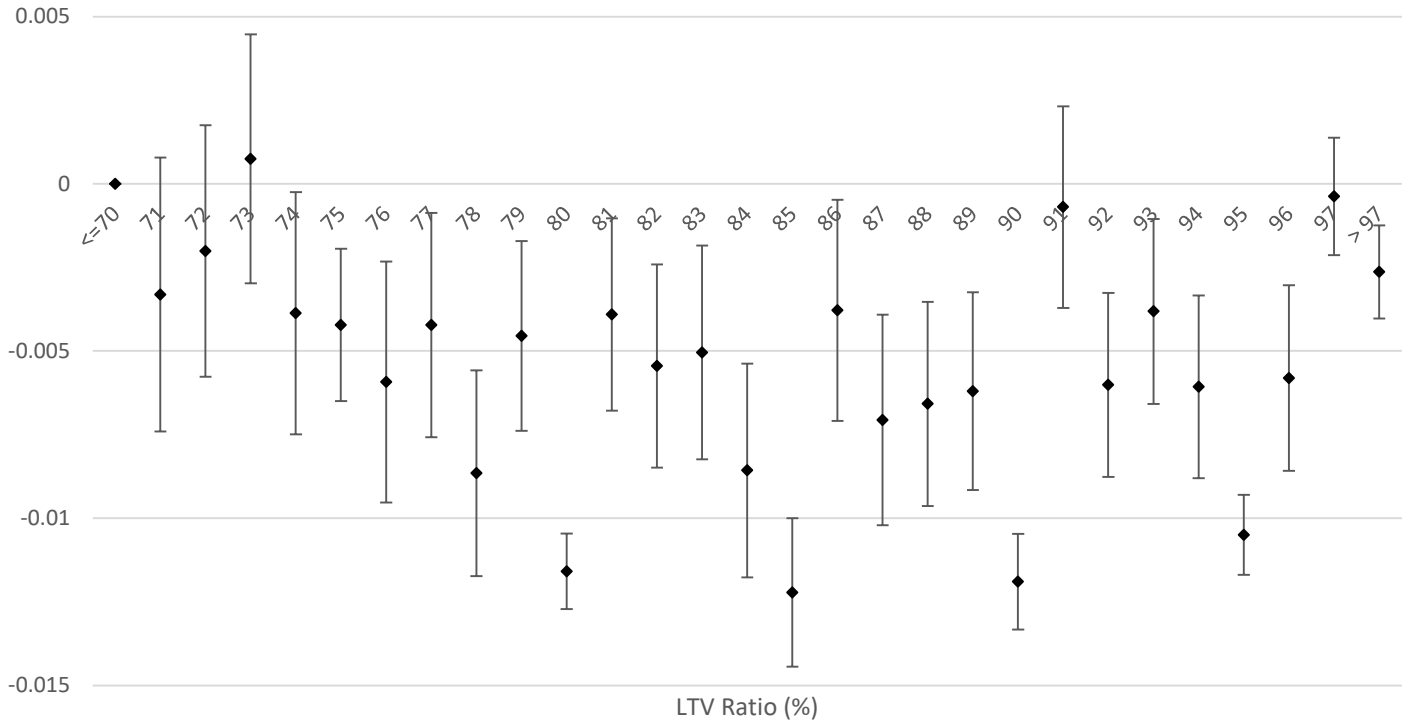
Figure 3: LTV parameter estimates from model predicting likelihood that loan is delivered
(Error bars display 95% confidence bands)
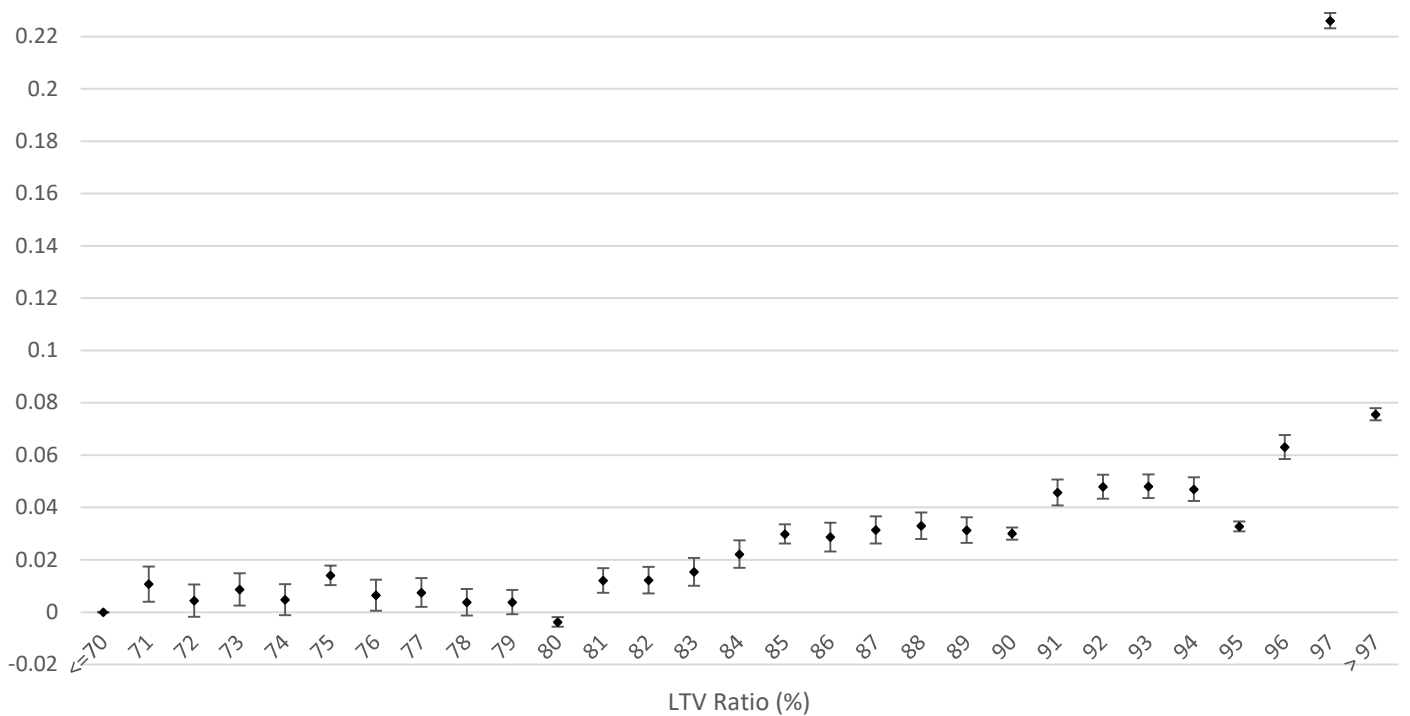
Figure 4: Renegotiation rates by LTV and appraised value minus contract
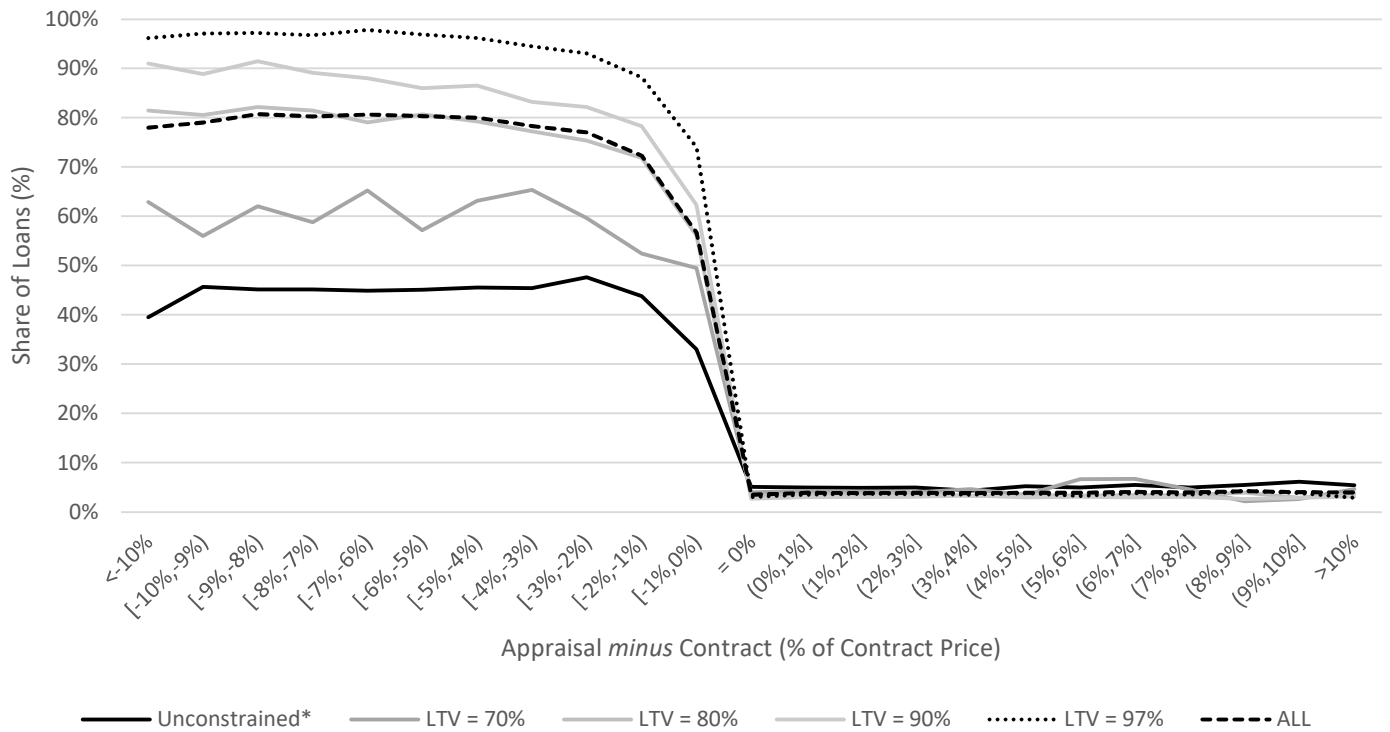
* "Unconstrained" borrowers defined as those with a post-appraisal LTV below 60% and FICO of 740 or higher.

Figure 5: Median percent of difference between contract and appraised value recaptured by buyers who renegotiate in cases where downward renegotiation occurs
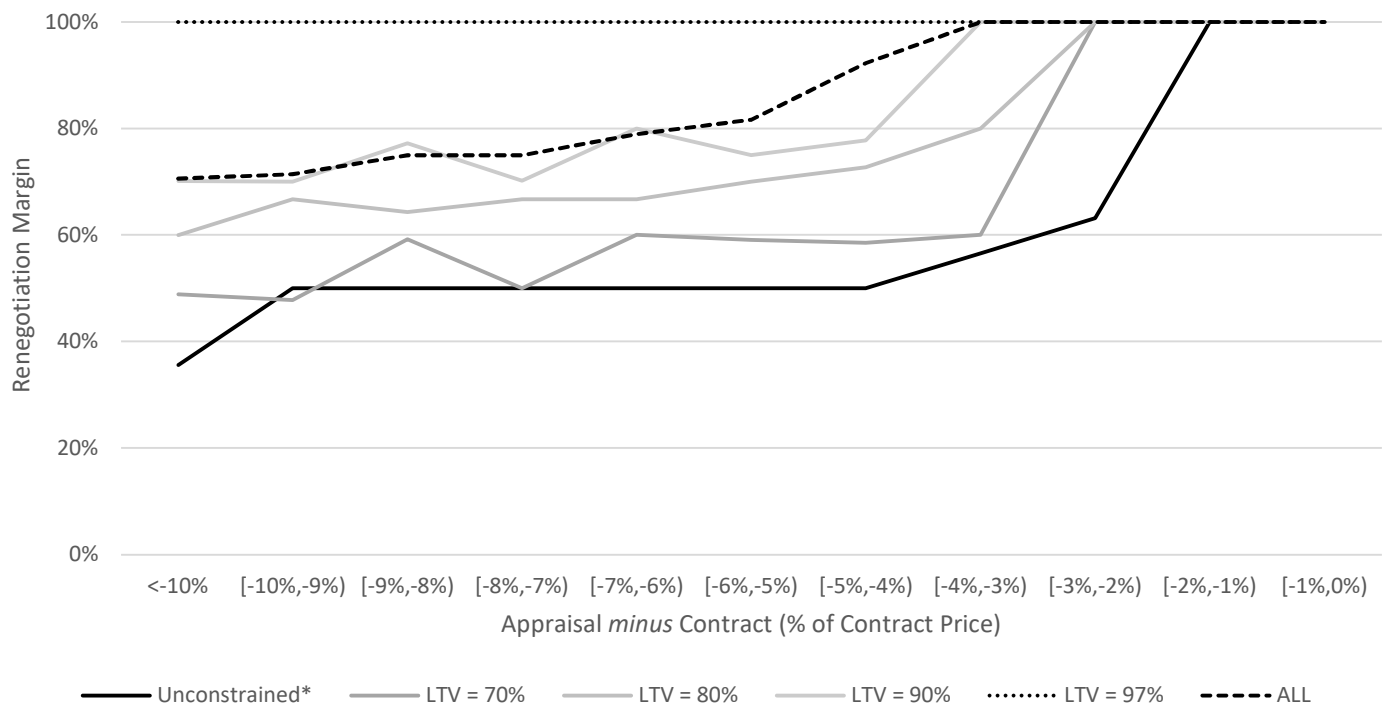
* "Unconstrained" borrowers defined as those with a post-appraisal LTV below 60% and FICO of 740 or higher.

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Figure 6: Model estimates for low appraisal impact on likelihood of renegotiation by LTV
(LTV*low appraisal coefficient estimates displayed. Error bars display 95% confidence bands.)
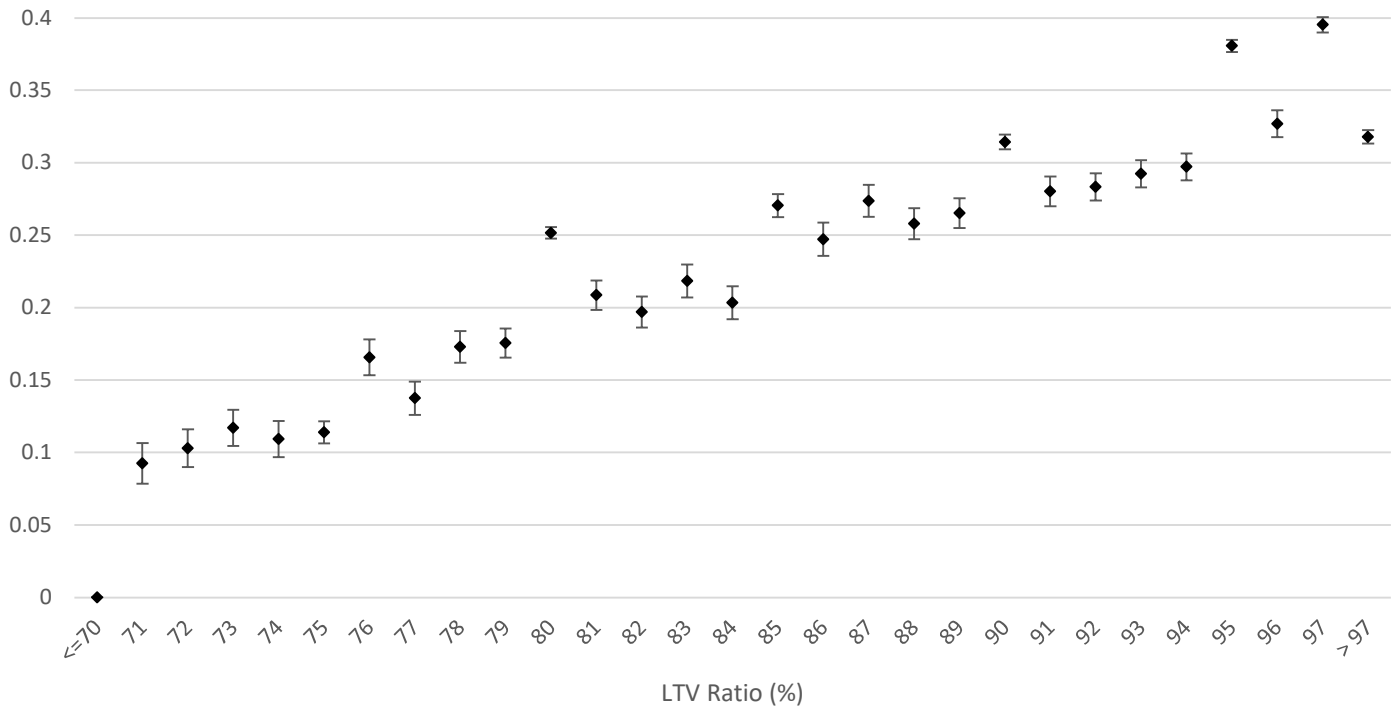
Figure 7: Renegotiation rates by number of monthly payments in reserves
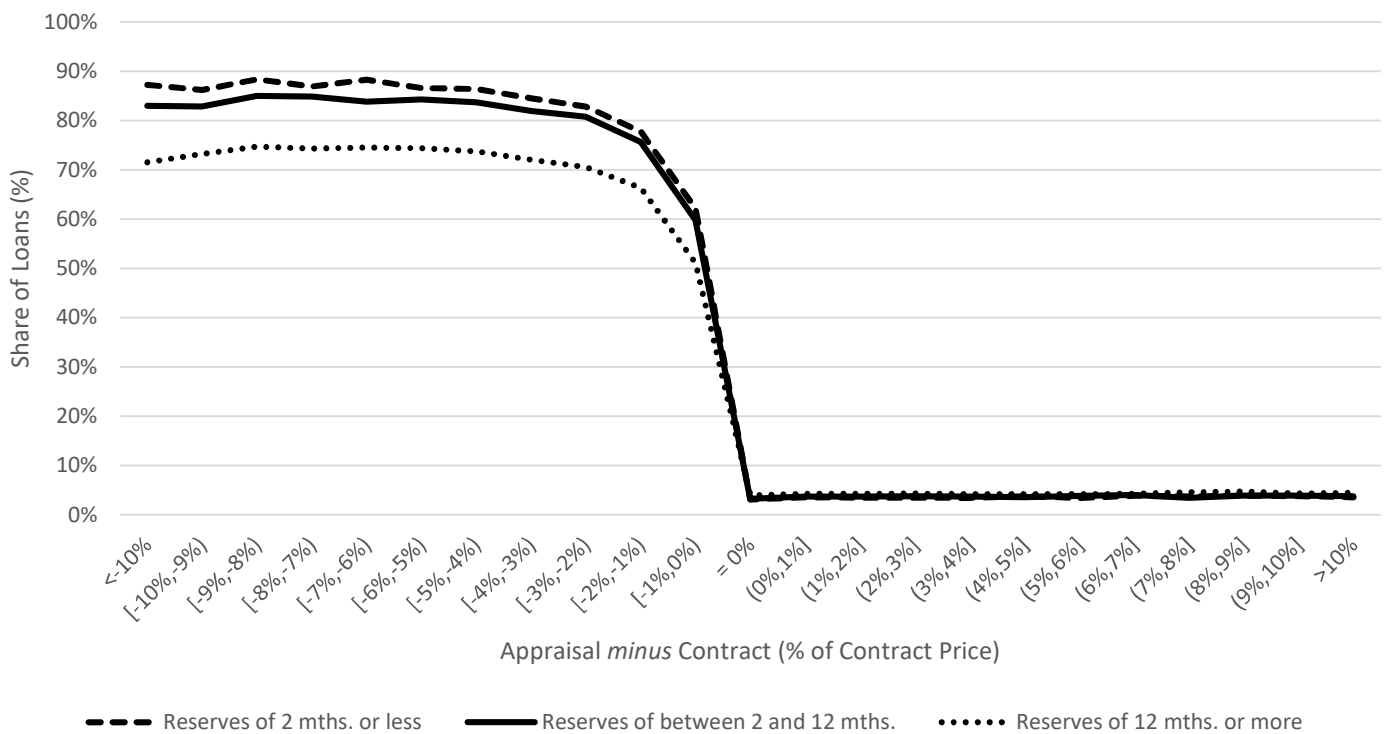
Figure 8: Renegotiation rates by FICO score
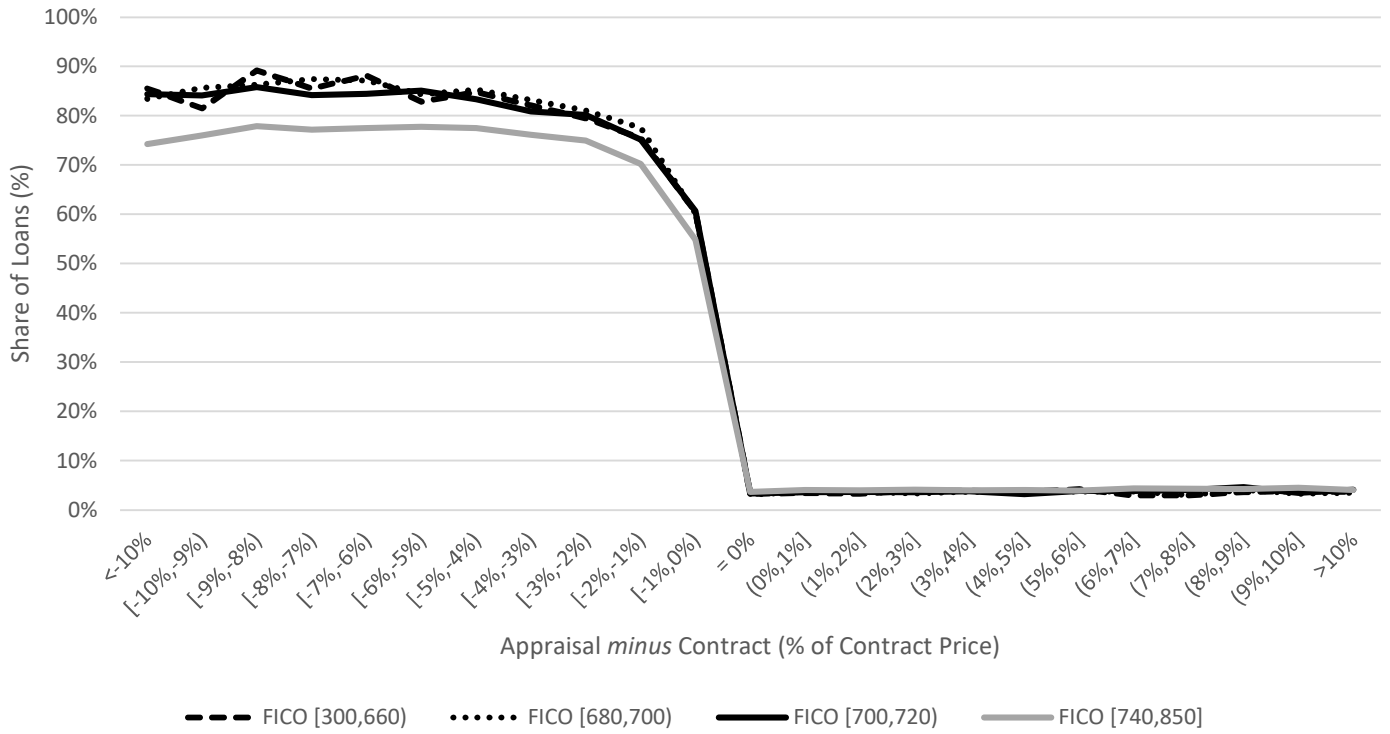
Figure 9: Parameter estimates for differences in low appraisal and low AVM impact by LTV
(LTV * low appraisal and LTV * low AVM coefficient estimates displayed. Error bars display 95% confidence bands.)

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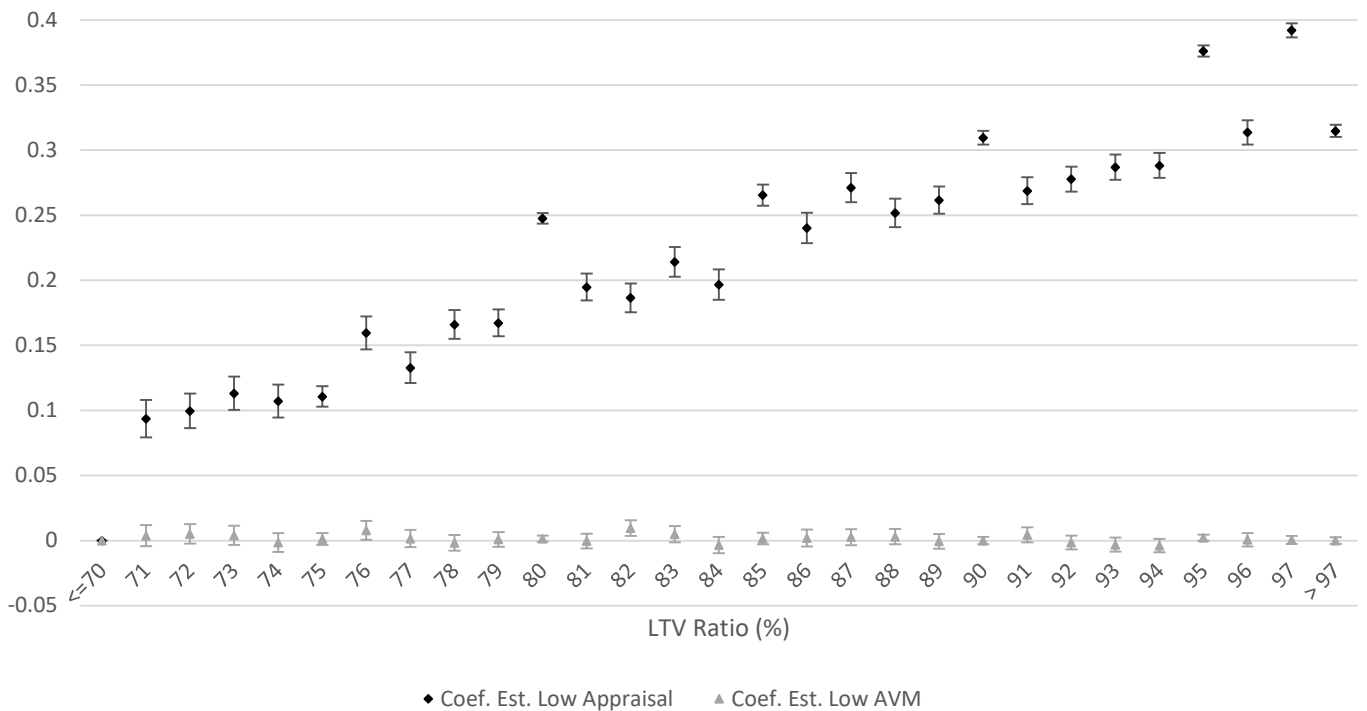
Table 1: Summary statistics

Variable	N Obs.	Mean	Std. Dev.	Min.	Max.
Low Appraisal	3,192,221	0.085	0.278	0	1
Renegotiated Down	2,228,620	0.095	0.293	0	1
Days-to-Close	2,135,369	40.40	14.23	10	90
Delivered	3,192,221	0.588	0.492	0	1
Appraised Amount	3,192,221	$308,189	$159,922	$40,000	$7,900,000
Contract Price	3,192,221	$305,690	$159,135	$42,000	$7,850,000
AVM Value	3,192,221	$306,332	$161,707	$36,873	$8,182,802
Loan Amount at 1st Underwriting	3,192,221	$247,578	$115,875	$10,000	$1,100,000
Final Loan Amount	2,228,620	$242,056	$112,359	$14,803	$800,000
Sale Price	2,228,620	$298,660	$153,138	$28,000	$4,265,000
Appraised Amount for Delivered Loans	2,228,620	$301,859	$154,044	$40,000	$3,100,000
Appraisal *minus* Contract (% of Contract)	3,192,221	0.93%	2.86%	-20.00%	20.00%
AVM *minus* Contract (% of Contract)	3,192,221	0.36%	9.17%	-25.00%	25.00%
LTV at 1st Underwriting	3,192,221	83.81%	15.29%	4%	125%
Census Tract % Pop. White Non-Hispanic*	3,184,941	73.60%	21.63%	0%	100%
Census Tract Median Income*	3,184,735	$70,728	$25,789	$5,000	$243,417
Census Tract Median Home Value*	3,178,726	$270,806	$142,017	$11,000	$1,000,000
Cen. Tract Median H. Value-to-Income Ratio*	3,178,716	3.92	1.84	0.34	10.54
FICO at 1st Und. [300,660)	3,192,221	0.037	0.190	0	1
FICO at 1st Und. [660,680)	3,192,221	0.041	0.198	0	1
FICO at 1st Und. [680,700)	3,192,221	0.071	0.256	0	1
FICO at 1st Und. [700,720)	3,192,221	0.095	0.293	0	1
FICO at 1st Und. [720,740)	3,192,221	0.114	0.318	0	1
FICO at 1st Und. [740,850]	3,192,221	0.642	0.480	0	1
Final FICO [300,660)	2,227,447	0.041	0.198	0	1
Final FICO [660,680)	2,227,447	0.043	0.204	0	1
Final FICO [680,700)	2,227,447	0.075	0.263	0	1
Final FICO [700,720)	2,227,447	0.098	0.297	0	1
Final FICO [720,740)	2,227,447	0.118	0.323	0	1
Final FICO [740,850]	2,227,447	0.624	0.484	0	1
Reserves <= 2 Months	2,226,810	0.247	0.432	0	1
Reserves (2,12) Months	2,226,810	0.326	0.469	0	1
Reserves >= 12 Months	2,226,810	0.427	0.495	0	1
0 Wks. On Market	2,776,033	0.045	0.208	0	1
1 Wks. On Market	2,776,033	0.209	0.406	0	1
2 Wks. On Market	2,776,033	0.134	0.340	0	1
3 Wks. On Market	2,776,033	0.102	0.303	0	1
4 Wks. On Market	2,776,033	0.077	0.267	0	1
5 Wks. On Market	2,776,033	0.062	0.240	0	1
6+ Wks. On Market	2,776,033	0.371	0.483	0	1

* Census-tract-level variables are obtained from 2010 Census Summary Tables.

Table 2: Modeling low appraisal

	Model 1		Model 2		Model 3	
Dependent variable is indicator of appraised value < contract price						
	Coef.	(Std. Err.)	Coef.	(Std. Err.)	Coef.	(Std. Err.)
Intercept	0.077***	(0.0002)	-0.0002	(0.0097)	0.049***	(0.0098)
AVM *Minus* Contract	-0.0084***	(0.00003)	-0.0085***	(0.00003)	-0.0082***	(0.00003)
AVM *Minus* Contract squared	0.0001***	(0.000001)	0.0002***	(0.000001)	0.0002***	(0.000001)
AVM *Minus* Contract cubed	0.000007***	(0.0000001)	0.000007***	(0.0000001)	0.000006***	(0.0000001)
2010 Census Tract-Level Vars.						
% Pop White Non-Hisp.					-0.065***	(0.001)
Median Income ($1,000s)					-0.00007***	(0.000016)
Med. Home Value ($1,000s)					-0.00002***	(0.000004)
Home Value-to-Income Ratio					-0.004***	(0.0002)
FICO at First Underwriting						
[300,660)					0.0018*	(0.0009)
[660,680)					0.0017*	(0.0008)
[680,700)					0.0002	(0.0006)
[700,720)					0.0004	(0.0006)
[720,740)					0.0011*	(0.0005)
[740,850]					0	.
Weeks-on-Market						
0 wks					0.016***	(0.001)
1 wk					0.034***	(0.0005)
2 wks					0.026***	(0.0005)
3 wks					0.019***	(0.001)
4 wks					0.012***	(0.001)
5 wks					0.010***	(0.001)
6+ wks					0	.
LTV at 1st Und. FEs	0		0		29	
App. Year & Quarter FEs	0		24		24	
MSA FEs	0		453		453	
R-Squared	0.049		0.078		0.082	
N Obs.	2,763,885		2,763,885		2,763,885	
Mean Low Appraisal			0.085			

* denotes statistically significant at 10% level, ** at 5% level, *** at 1% level.

Table 3: Modeling delivery

	Dependent variable is indicator of application being delivered to Fannie Mae							
	Model 1		Model 2		Model 3		Model 4^	
	Coef.	(Std. Err.)	Coef.	(Std. Err.)	Coef.	(Std. Err.)	Coef.	(Std. Err.)
Intercept	0.583***	(0.0005)	0.203***	(0.016)	0.154***	(0.016)	0.152***	(0.016)
Appraisal *minus* Contract								
<-10%	-0.171***	(0.004)	-0.174***	(0.004)	-0.174***	(0.004)	-0.152***	(0.004)
[-10%,-9%)	-0.111***	(0.006)	-0.113***	(0.006)	-0.114***	(0.006)	-0.092***	(0.006)
[-9%,-8%)	-0.090***	(0.005)	-0.093***	(0.005)	-0.093***	(0.005)	-0.071***	(0.006)
[-8%,-7%)	-0.068***	(0.005)	-0.072***	(0.005)	-0.072***	(0.004)	-0.050***	(0.005)
[-7%,-6%)	-0.056***	(0.004)	-0.059***	(0.004)	-0.060***	(0.004)	-0.038***	(0.005)
[-6%,-5%)	-0.036***	(0.003)	-0.040***	(0.003)	-0.041***	(0.003)	-0.019***	(0.004)
[-5%,-4%)	-0.029***	(0.003)	-0.033***	(0.003)	-0.035***	(0.003)	-0.012**	(0.004)
[-4%,-3%)	-0.010***	(0.003)	-0.014***	(0.003)	-0.016***	(0.002)	0.007*	(0.003)
[-3%,-2%)	-0.001	(0.002)	-0.005*	(0.002)	-0.007**	(0.002)	0.016***	(0.003)
[-2%,-1%)	0.004*	(0.002)	-0.0003	(0.002)	-0.002	(0.002)	0.021***	(0.003)
[-1%,0%)	0.006*	(0.003)	-0.0007	(0.003)	-0.001	(0.003)	0.022***	(0.004)
= 0%	0	.	0	.	0	.	0	.
(0%,1%]	0.016***	(0.001)	0.009***	(0.001)	0.010***	(0.001)	0.01***	(0.001)
(1%,2%]	0.012***	(0.001)	0.007***	(0.001)	0.008***	(0.001)	0.008***	(0.001)
(2%,3%]	0.010***	(0.001)	0.005***	(0.001)	0.006***	(0.001)	0.006***	(0.001)
(3%,4%]	0.012***	(0.001)	0.009***	(0.001)	0.009***	(0.001)	0.009***	(0.001)
(4%,5%]	0.005**	(0.002)	0.003*	(0.002)	0.003*	(0.002)	0.003*	(0.002)
(5%,6%]	0.008***	(0.002)	0.005*	(0.002)	0.005*	(0.002)	0.005*	(0.002)
(6%,7%]	0.003	(0.003)	0.001	(0.002)	0.0002	(0.002)	0.0001	(0.002)
(7%,8%]	0.006*	(0.003)	0.004	(0.003)	0.003	(0.003)	0.003	(0.003)
(8%,9%]	0.010**	(0.004)	0.008*	(0.004)	0.007*	(0.004)	0.007*	(0.004)
(9%,10%]	-0.0001	(0.004)	-0.001	(0.004)	-0.003	(0.004)	-0.003	(0.004)
>10%	-0.001	(0.003)	-0.003	(0.003)	-0.006*	(0.002)	-0.006*	(0.002)
FICO at 1st Und. [300,660)					0.051***	(0.001)	0.050***	(0.002)
FICO at 1st Und. [660,680)					0.033***	(0.001)	0.034***	(0.001)
FICO at 1st Und. [680,700)					0.008***	(0.001)	0.008***	(0.001)
FICO at 1st Und. [700,720)					-0.002*	(0.001)	-0.002*	(0.001)
FICO at 1st Und. [720,740)					0.002*	(0.001)	0.002*	(0.001)
FICO at 1st Und. [740,850]					0	.	0	.
[300,660)* Low Appraisal							0.007	(0.005)
[660,680)* Low Appraisal							-0.005	(0.005)
[680,700)* Low Appraisal							-0.001	(0.004)
[700,720)* Low Appraisal							0.001	(0.003)
[720,740)* Low Appraisal							-0.004	(0.003)
[740,850]* Low Appraisal							0	.
LTV at 1st Und. FEs	0		0		29		29	
App. Year & Quarter FEs	0		24		24		24	
MSA FEs	0		453		453		453	
R-Squared	0.001		0.038		0.0476		0.0476	
N Obs.	3,191,116		3,191,116		3,191,116		3,191,116	
Mean Delivered				0.588				

^ Model 4 also includes the interaction of LTV at 1st und. and the low appraisal indicator. * denotes statistically significant at 10% level, ** at 5% level, *** at 1% level.

Table 4: Modeling days-to-close

	Dependent variable is number of days from contract to sale							
	Model 1		Model 2		Model 3		Model 4^	
	Coef.	(Std. Err.)	Coef.	(Std. Err.)	Coef.	(Std. Err.)	Coef.	(Std. Err.)
Intercept	39.6***	(0.02)	34.3***	(0.51)	34.5***	(0.51)	34.53***	(0.51)
Appraisal *minus* Contract								
<-10%	3.77***	(0.16)	3.55***	(0.15)	3.50***	(0.15)	3.67***	(0.17)
[-10%,-9%)	2.52***	(0.25)	2.55***	(0.22)	2.56***	(0.22)	2.73***	(0.24)
[-9%,-8%)	2.10***	(0.22)	2.34***	(0.19)	2.40***	(0.19)	2.59***	(0.22)
[-8%,-7%)	1.67***	(0.18)	1.92***	(0.16)	1.96***	(0.16)	2.14***	(0.19)
[-7%,-6%)	1.39***	(0.15)	1.70***	(0.14)	1.74***	(0.13)	1.91***	(0.17)
[-6%,-5%)	1.09***	(0.13)	1.39***	(0.12)	1.47***	(0.11)	1.65***	(0.15)
[-5%,-4%)	0.71***	(0.11)	1.21***	(0.1)	1.30***	(0.1)	1.47***	(0.14)
[-4%,-3%)	0.38***	(0.09)	0.86***	(0.08)	0.97***	(0.08)	1.14***	(0.13)
[-3%,-2%)	0.04	(0.08)	0.62***	(0.07)	0.73***	(0.07)	0.90***	(0.12)
[-2%,-1%)	-0.48***	(0.08)	0.34***	(0.07)	0.46***	(0.07)	0.63***	(0.12)
[-1%,0%)	-0.53***	(0.12)	0.10	(0.11)	0.20*	(0.11)	0.36*	(0.15)
= 0%	0	.	0	.	0	.	0	.
(0%,1%]	0.48***	(0.03)	0.07**	(0.02)	0.04*	(0.02)	0.05*	(0.02)
(1%,2%]	0.70***	(0.03)	0.02	(0.03)	-0.07*	(0.03)	-0.06*	(0.03)
(2%,3%]	0.73***	(0.04)	-0.04	(0.04)	-0.17***	(0.04)	-0.16***	(0.04)
(3%,4%]	0.75***	(0.05)	-0.04	(0.05)	-0.21***	(0.05)	-0.19***	(0.05)
(4%,5%]	0.80***	(0.07)	0.08	(0.06)	-0.12*	(0.06)	-0.10*	(0.06)
(5%,6%]	0.87***	(0.08)	0.13*	(0.07)	-0.10	(0.07)	-0.08	(0.07)
(6%,7%]	0.96***	(0.1)	0.14	(0.09)	-0.12	(0.09)	-0.09	(0.09)
(7%,8%]	0.97***	(0.12)	0.21*	(0.1)	-0.10	(0.1)	-0.07	(0.1)
(8%,9%]	1.15***	(0.14)	0.28*	(0.13)	-0.04	(0.13)	-0.02	(0.13)
(9%,10%]	1.16***	(0.16)	0.30*	(0.15)	-0.07	(0.15)	-0.04	(0.15)
>10%	1.72***	(0.11)	0.76***	(0.09)	0.34***	(0.09)	0.36***	(0.09)
Final FICO [300,660)					1.92***	(0.05)	1.85***	(0.05)
Final FICO [660,680)					1.63***	(0.05)	1.56***	(0.05)
Final FICO [680,700)					1.13***	(0.04)	1.12***	(0.04)
Final FICO [700,720)					0.79***	(0.03)	0.77***	(0.03)
Final FICO [720,740)					0.44***	(0.03)	0.42***	(0.03)
Final FICO [740,850]					0	.	0	.
[300,660)* Low Appraisal							0.68***	(0.16)
[660,680)* Low Appraisal							0.75***	(0.16)
[680,700)* Low Appraisal							0.17	(0.13)
[700,720)* Low Appraisal							0.12	(0.11)
[720,740)* Low Appraisal							0.25*	(0.1)
[740,850]* Low Appraisal							0	.

Table 4: Modeling days-to-close (cont.)

	Model 1		Model 2		Model 3		Model 4^	
Dependent variable is number of days from contract to sale								
	Coef.	(Std. Err.)	Coef.	(Std. Err.)	Coef.	(Std. Err.)	Coef.	(Std. Err.)
Reserves <= 2 Mths					0.62***	(0.02)	0.61***	(0.02)
Reserves (2,12) Mths					0.12***	(0.02)	0.10***	(0.02)
Reserves >= 12 Mths					0	.	0	.
<=2 Mths*Low Appraisal							0.08	(0.09)
(2,12)Mth*Low Appraisal							0.23**	(0.08)
>=12 Mth*Low Appraisal							0	.
Weeks-on-Market								
0 wks					2.26***	(0.05)	2.32***	(0.05)
1 wk					-1.38***	(0.03)	-1.23***	(0.03)
2 wks					-1.33***	(0.03)	-1.22***	(0.03)
3 wks					-0.96***	(0.03)	-0.89***	(0.03)
4 wks					-0.48***	(0.04)	-0.43***	(0.04)
5 wks					-0.12**	(0.04)	-0.10*	(0.04)
6+ wks					0	.	0	.
0 wks * Low Appraisal							-0.95***	(0.18)
1 wk * Low Appraisal							-1.82***	(0.09)
2 wks* Low Appraisal							-1.44***	(0.1)
3 wks * Low Appraisal							-1.12***	(0.12)
4 wks* Low Appraisal							-0.83***	(0.13)
5 wks * Low Appraisal							-0.52***	(0.15)
6+ wks * Low Appraisal							0	.
LTV at 1st Und. FEs	0		0		29		29	
App. Year & Quarter FEs	0		24		24		24	
MSA FEs	0		453		453		453	
R-Squared	0.0010		0.2209		0.2269		0.2272	
N Obs.	1,871,037		1,871,037		1,871,037		1,871,037	
Mean Days-to-Close				40.40				

^ Model 4 also includes the interaction of LTV at 1st und. and the low appraisal indicator. * denotes statistically significant at 10% level, ** at 5% level, *** at 1% level.

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Table 5: Modeling downward renegotiation

	Model 1		Model 2		Model 3		Model 4^	
Dependent variable is indicator of sale price < contract price								
	Coef.	(Std. Err.)	Coef.	(Std. Err.)	Coef.	(Std. Err.)	Coef.	(Std. Err.)
Intercept	0.036***	(0.0003)	0.033***	(0.009)	0.022*	(0.009)	0.044***	(0.009)
Appraisal *minus* Contract								
<-10%	0.751***	(0.003)	0.751***	(0.003)	0.755***	(0.003)	0.596***	(0.003)
[-10%,-9%)	0.765***	(0.004)	0.765***	(0.004)	0.768***	(0.004)	0.594***	(0.004)
[-9%,-8%)	0.780***	(0.003)	0.779***	(0.003)	0.781***	(0.003)	0.604***	(0.004)
[-8%,-7%)	0.774***	(0.003)	0.773***	(0.003)	0.776***	(0.003)	0.596***	(0.003)
[-7%,-6%)	0.777***	(0.002)	0.776***	(0.002)	0.778***	(0.002)	0.591***	(0.003)
[-6%,-5%)	0.777***	(0.002)	0.776***	(0.002)	0.778***	(0.002)	0.588***	(0.003)
[-5%,-4%)	0.771***	(0.002)	0.77***	(0.002)	0.771***	(0.002)	0.575***	(0.003)
[-4%,-3%)	0.755***	(0.001)	0.753***	(0.001)	0.754***	(0.001)	0.555***	(0.002)
[-3%,-2%)	0.741***	(0.001)	0.739***	(0.001)	0.740***	(0.001)	0.538***	(0.002)
[-2%,-1%)	0.694***	(0.001)	0.691***	(0.001)	0.692***	(0.001)	0.490***	(0.002)
[-1%,0%)	0.542***	(0.002)	0.540***	(0.002)	0.541***	(0.002)	0.339***	(0.003)
= 0%	0	.	0	.	0	.	0	.
(0%,1%]	0.004***	(0.0004)	-0.001	(0.0004)	-0.001	(0.0004)	0.0006	(0.0004)
(1%,2%]	0.004***	(0.0005)	-0.001	(0.0005)	-0.001*	(0.0005)	0.0005	(0.0005)
(2%,3%]	0.005***	(0.001)	0.00003	(0.001)	-0.0002	(0.001)	0.001*	(0.001)
(3%,4%]	0.004***	(0.001)	-0.0005	(0.001)	-0.0007	(0.001)	0.001	(0.001)
(4%,5%]	0.005***	(0.001)	0.00001	(0.001)	-0.00008	(0.001)	0.002	(0.001)
(5%,6%]	0.004**	(0.001)	-0.001	(0.001)	-0.001	(0.001)	0.001	(0.001)
(6%,7%]	0.007***	(0.002)	0.003*	(0.002)	0.003*	(0.002)	0.004**	(0.001)
(7%,8%]	0.007***	(0.002)	0.003	(0.002)	0.003	(0.002)	0.005**	(0.002)
(8%,9%]	0.011***	(0.002)	0.006**	(0.002)	0.006**	(0.002)	0.008***	(0.002)
(9%,10%]	0.007**	(0.003)	0.002	(0.003)	0.003	(0.003)	0.004*	(0.002)
>10%	0.007***	(0.002)	0.003*	(0.002)	0.003*	(0.002)	0.005**	(0.002)
Final FICO [300,660)					0.001	(0.001)	-0.005***	(0.001)
Final FICO [660,680)					0.001	(0.001)	-0.003***	(0.001)
Final FICO [680,700)					0.001	(0.001)	-0.003***	(0.001)
Final FICO [700,720)					0.0005	(0.001)	-0.002***	(0.001)
Final FICO [720,740)					0.001	(0.0005)	-0.001*	(0.001)
Final FICO [740,850]					0	.	0	.
[300,660)* Low Appraisal							0.067***	(0.003)
[660,680)* Low Appraisal							0.044***	(0.003)
[680,700)* Low Appraisal							0.044***	(0.002)
[700,720)* Low Appraisal							0.029***	(0.002)
[720,740)* Low Appraisal							0.022***	(0.002)
[740,850]* Low Appraisal							0	.

Table 5: Modeling downward renegotiation (cont.)

	Model 1		Model 2		Model 3		Model 4^	
Dependent variable is indicator of sale price < contract price								
	Coef.	(Std. Err.)	Coef.	(Std. Err.)	Coef.	(Std. Err.)	Coef.	(Std. Err.)
Reserves <= 2 Mths					-0.003***	(0.0004)	-0.007***	(0.0004)
Reserves (2,12) Mths					-0.002***	(0.0004)	-0.005***	(0.0004)
Reserves >= 12 Mths					0	.	0	.
<=2 Mths*Low Appraisal							0.031***	(0.002)
(2,12)Mth*Low Appraisal							0.028***	(0.001)
>=12 Mth* Low Appraisal							0	.
Weeks-on-Market								
0 wks					-0.016***	(0.001)	-0.010***	(0.001)
1 wk					-0.006***	(0.0005)	-0.002***	(0.0005)
2 wks					-0.0006	(0.0005)	0.001**	(0.001)
3 wks					0.002**	(0.001)	0.002**	(0.001)
4 wks					0.002**	(0.001)	0.001	(0.001)
5 wks					0.003***	(0.001)	0.002**	(0.001)
6+ wks					0	.	0	.
0 wks * Low Appraisal							-0.087***	(0.003)
1 wk * Low Appraisal							-0.039***	(0.002)
2 wks* Low Appraisal							-0.023***	(0.002)
3 wks * Low Appraisal							-0.004*	(0.002)
4 wks* Low Appraisal							0.008***	(0.002)
5 wks * Low Appraisal							0.010***	(0.003)
6+ wks * Low Appraisal							0	.
MSA by Quarter Mean Low Appraisal Share					-0.002***	(0.0001)	-0.001***	(0.0001)
MSA*Qtr Low App. Share * Low Appraisal							-0.006***	(0.0001)
LTV at 1st Und. FEs	0		0		29		29	
App. Year & Quarter FEs	0		24		24		24	
MSA FEs	0		453		453		453	
R-Squared	0.4535		0.4576		0.4585		0.4752	
N Obs.	1,934,452		1,934,452		1,934,452		1,934,452	
Mean Sale Price < Contract Price				0.095				

^ Model 4 also includes the interaction of LTV at 1st und. and the low appraisal indicator. * denotes statistically significant at 10% level, ** at 5% level, *** at 1% level.

Table 6: Modeling downward renegotiation with indicator for low appraisal and low AVM

	Dependent variable is indicator of sale price < contract price							
	Model 1		Model 2		Model 3		Model 4^	
	Coef.	(Std. Err.)	Coef.	(Std. Err.)	Coef.	(Std. Err.)	Coef.	(Std. Err.)
Intercept	0.045***	(0.009)	0.045***	(0.009)	0.046***	(0.009)	0.047***	(0.009)
Low Appraisal	0.526***	(0.002)	0.526***	(0.002)	0.500***	(0.002)	0.501***	(0.002)
Low AVM			-0.0002	(0.0003)	-0.002***	(0.0003)	-0.003*	(0.001)
Low Appraisal*Low AVM					0.033***	(0.001)	0.033***	(0.001)
Final FICO [300,660)	-0.005***	(0.001)	-0.005***	(0.001)	-0.005***	(0.001)	-0.005***	(0.001)
Final FICO [660,680)	-0.003***	(0.001)	-0.003***	(0.001)	-0.003***	(0.001)	-0.003**	(0.001)
Final FICO [680,700)	-0.003***	(0.001)	-0.003***	(0.001)	-0.003***	(0.001)	-0.003***	(0.001)
Final FICO [700,720)	-0.002***	(0.001)	-0.002***	(0.001)	-0.002***	(0.001)	-0.002**	(0.001)
Final FICO [720,740)	-0.001*	(0.001)	-0.001*	(0.001)	-0.001*	(0.001)	-0.002**	(0.001)
Final FICO [740,850]	0	.	0	.	0	.	0	.
[300,660)* Low Appraisal	0.071***	(0.003)	0.071***	(0.003)	0.072***	(0.003)	0.072***	(0.003)
[660,680)* Low Appraisal	0.048***	(0.003)	0.048***	(0.003)	0.048***	(0.003)	0.048***	(0.003)
[680,700)* Low Appraisal	0.045***	(0.002)	0.045***	(0.002)	0.045***	(0.002)	0.045***	(0.002)
[700,720)* Low Appraisal	0.031***	(0.002)	0.031***	(0.002)	0.031***	(0.002)	0.030***	(0.002)
[720,740)* Low Appraisal	0.022***	(0.002)	0.022***	(0.002)	0.022***	(0.002)	0.022***	(0.002)
[740,850]* Low Appraisal	0	.	0	.	0	.	0	.
[300,660)* Low AVM							-0.002	(0.002)
[660,680)* Low AVM							0.0005	(0.002)
[680,700)* Low AVM							-0.0001	(0.001)
[700,720)* Low AVM							0.0007	(0.001)
[720,740)* Low AVM							0.002*	(0.001)
[740,850]* Low AVM							0	.
Reserves <= 2 Mths	-0.007***	(0.0004)	-0.007***	(0.0004)	-0.007***	(0.0004)	-0.006***	(0.001)
Reserves (2,12) Mths	-0.005***	(0.0004)	-0.005***	(0.0004)	-0.005***	(0.0004)	-0.005***	(0.001)
Reserves >= 12 Mths	0	.	0	.	0	.	0	.
<=2 Mths* Low Appraisal	0.028***	(0.002)	0.028***	(0.002)	0.027***	(0.002)	0.028***	(0.002)
(2,12)Mth*Low Appraisal	0.024***	(0.001)	0.024***	(0.001)	0.024***	(0.001)	0.024***	(0.001)
>=12Mth* Low Appraisal	0	.	0	.	0	.	0	.
<= 2 Mths* Low AVM							-0.0007	(0.001)
(2,12)Mth* Low AVM							-0.0003	(0.001)
>=12Mth* Low AVM							0	.
Weeks-on-Market								
0 wks	-0.009***	(0.001)	-0.009***	(0.001)	-0.009***	(0.001)	-0.011***	(0.001)
1 wk	-0.002***	(0.0005)	-0.002***	(0.0005)	-0.002***	(0.0005)	-0.002**	(0.001)
2 wks	0.001**	(0.001)	0.001**	(0.001)	0.002**	(0.001)	0.002***	(0.001)
3 wks	0.002**	(0.001)	0.002**	(0.001)	0.002**	(0.001)	0.003***	(0.001)
4 wks	0.001	(0.001)	0.001	(0.001)	0.001	(0.001)	0.002*	(0.001)
5 wks	0.002**	(0.001)	0.002**	(0.001)	0.002**	(0.001)	0.002*	(0.001)
6+ wks	0	.	0	.	0	.	0	.

Table 6: Modeling downward renegotiation with indicator for low appraisal and low AVM (Cont.)

	Model 1		Model 2		Model 3		Model 4^	
Dependent variable is indicator of sale price < contract price								
	Coef.	(Std. Err.)	Coef.	(Std. Err.)	Coef.	(Std. Err.)	Coef.	(Std. Err.)
0 wks * Low Appraisal	-0.083***	(0.003)	-0.083***	(0.003)	-0.084***	(0.003)	-0.085***	(0.003)
1 wk * Low Appraisal	-0.040***	(0.002)	-0.040***	(0.002)	-0.042***	(0.002)	-0.042***	(0.002)
2 wks* Low Appraisal	-0.023***	(0.002)	-0.023***	(0.002)	-0.025***	(0.002)	-0.024***	(0.002)
3 wks * Low Appraisal	-0.005*	(0.002)	-0.005*	(0.002)	-0.007***	(0.002)	-0.006**	(0.002)
4 wks* Low Appraisal	0.007**	(0.002)	0.007**	(0.002)	0.006**	(0.002)	0.007**	(0.002)
5 wks * Low Appraisal	0.009***	(0.003)	0.009***	(0.003)	0.008**	(0.003)	0.008**	(0.003)
6+ wks * Low Appraisal	0	.	0	.	0	.	0	.
0 wks * Low AVM							0.004*	(0.002)
1 wk * Low AVM							-0.001	(0.001)
2 wks* Low AVM							-0.002*	(0.001)
3 wks * Low AVM							-0.003**	(0.001)
4 wks* Low AVM							-0.002	(0.001)
5 wks * Low AVM							0.0004	(0.001)
6+ wks * Low AVM							0	.
MSA by Quarter Mean Low Appraisal Share	-0.001***	(0.0001)	-0.001***	(0.0001)	-0.001***	(0.0001)	-0.001***	(0.0001)
MSA by Qtr Low App. Share * Low Appraisal	-0.005***	(0.0001)	-0.005***	(0.0001)	-0.005***	(0.0001)	-0.005***	(0.0001)
MSA by Qtr Low App. Share * Low AVM							0.0001	(0.0001)
LTV at 1st Und. FEs	29		29		29		29	
App. Year & Quarter FEs	24		24		24		24	
MSA FEs	453		453		453		453	
R-Squared	0.4706		0.4706		0.4707		0.4707	
N Obs.	1,934,452		1,934,452		1,934,452		1,934,452	
Mean Sale Price < Contract Price				0.095				

^ Model 4 also separately includes the interaction of LTV at 1st und. and the low appraisal and low AVM indicators, respectively. * denotes statistically significant at 10% level, ** at 5% level, *** at 1% level.

APPENDIX

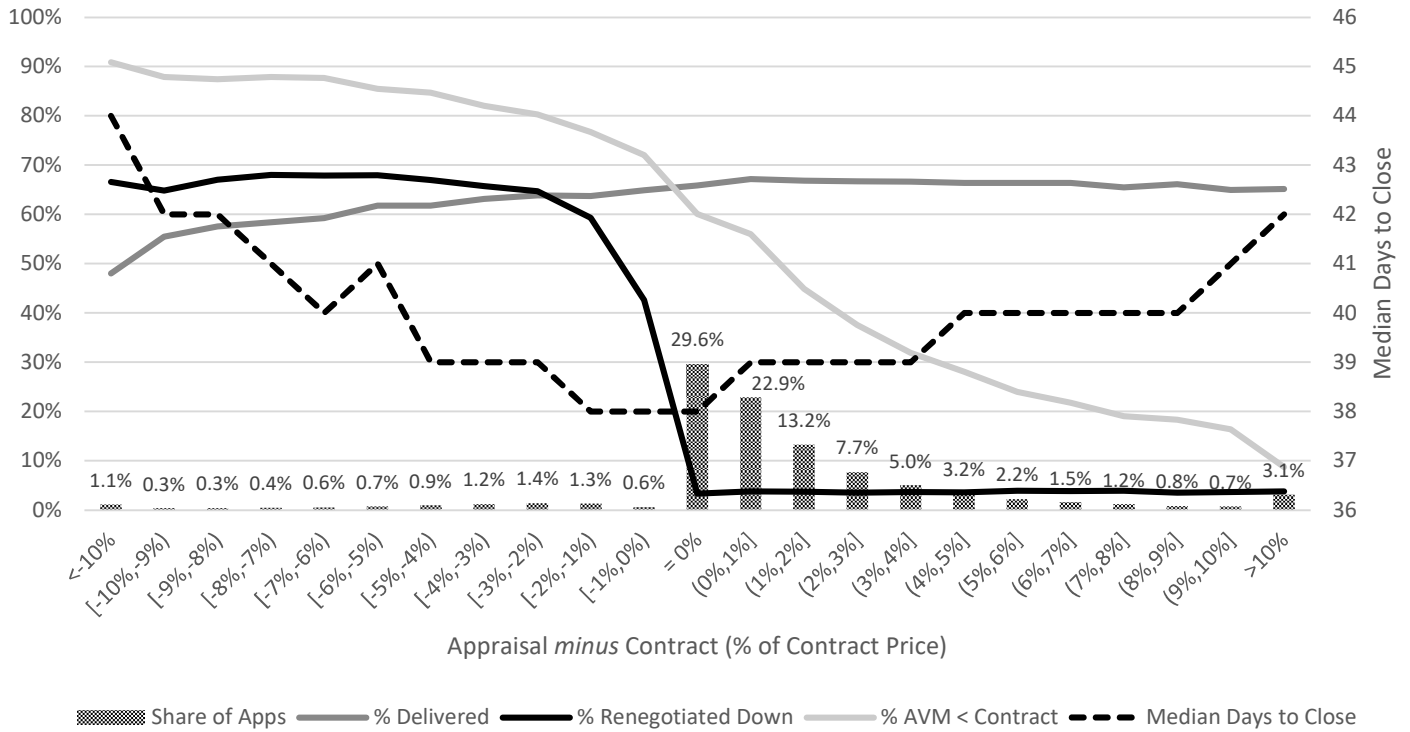**Figure A1A**: Figure 1A for 2013 applications

Figure A1B: Figure 1A for 2014 applications
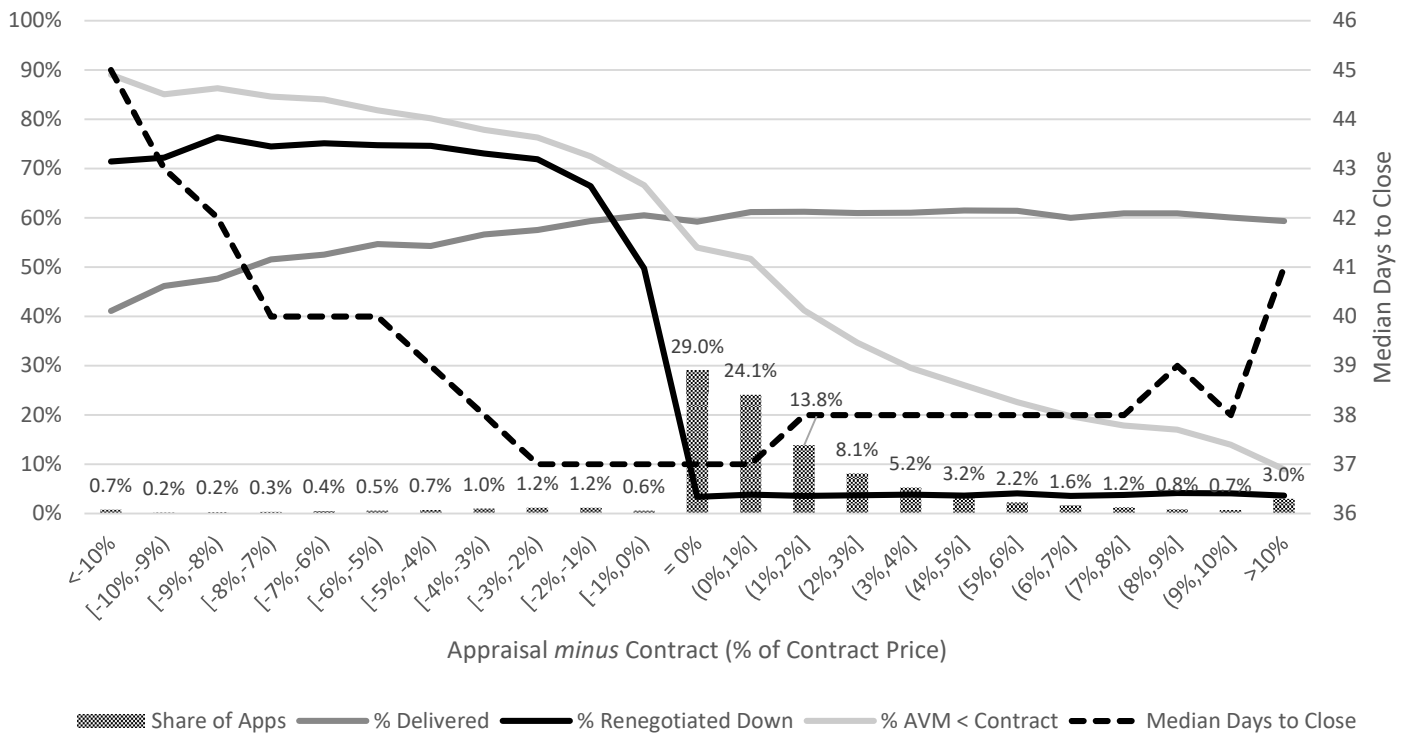
Figure A1C: Figure 1A for 2015 applications

Share of Apps values shown: 0.8% 0.2% 0.3% 0.4% 0.5% 0.6% 0.9% 1.1% 1.4% 1.4% 0.6% 28.8% 24.0% 13.7% 7.8% 5.1% 3.2% 2.1% 1.5% 1.2% 0.8% 0.7% 2.9%

X-axis: Appraisal *minus* Contract (% of Contract Price)

Right axis: Median Days to Close

Legend: Share of Apps — % Delivered — % Renegotiated Down — % AVM < Contract — — Median Days to Close
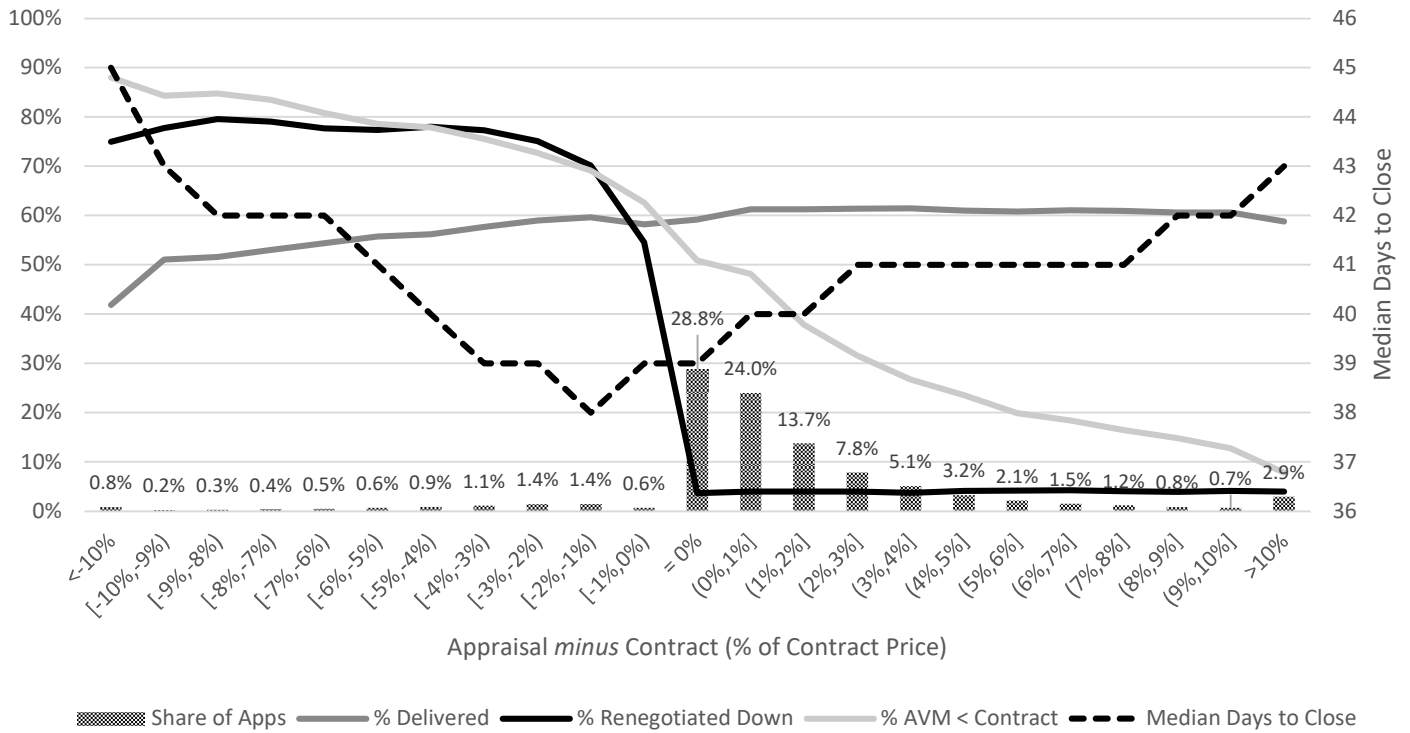
Figure A1D: Figure 1A for 2016 applications

Appraisal *minus* Contract (% of Contract Price)

Share of Apps ▨▨▨▨ % Delivered —— % Renegotiated Down —— % AVM < Contract —— Median Days to Close ═ ═ ═
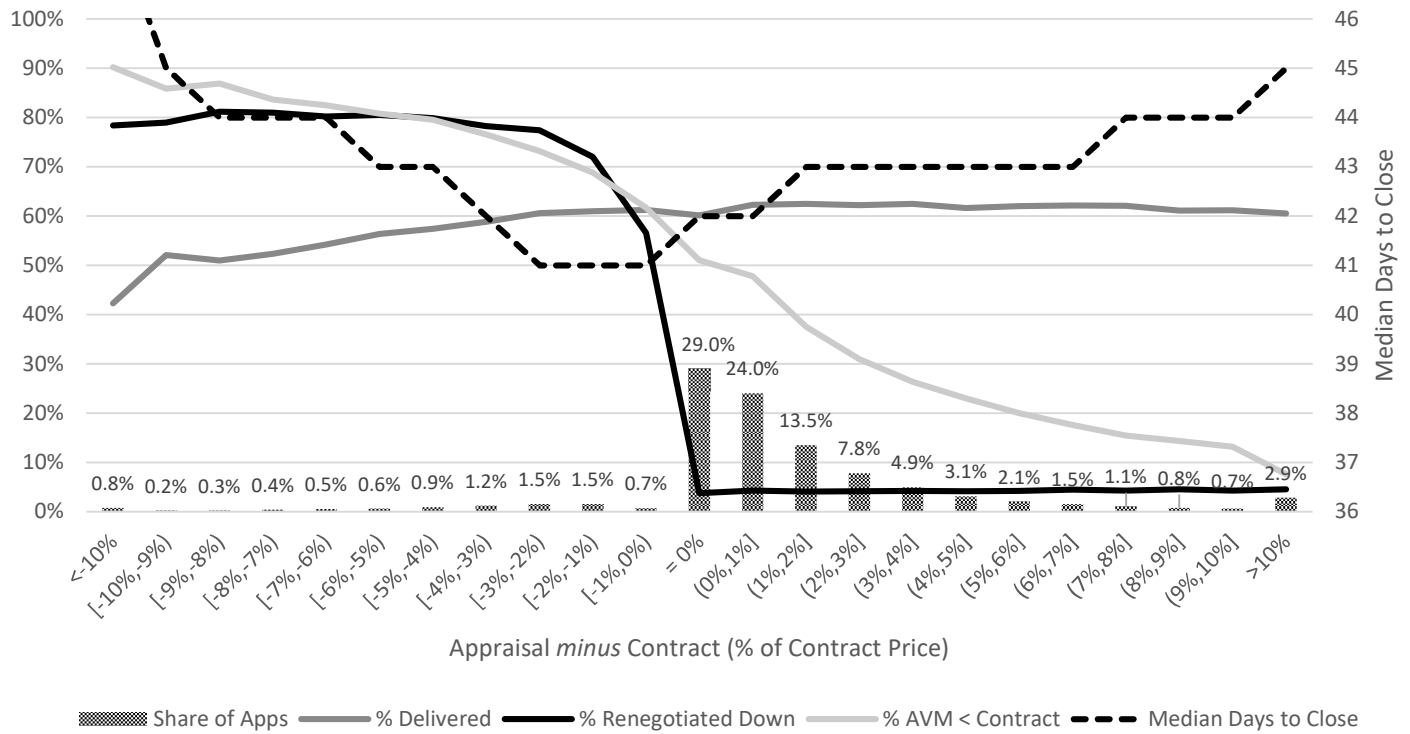
Figure A1E: Figure 1A for 2017 applications

Appraisal *minus* Contract (% of Contract Price)

Share of Apps ▨▨▨▨ % Delivered —— % Renegotiated Down —— % AVM < Contract —— Median Days to Close ═ ═ ═
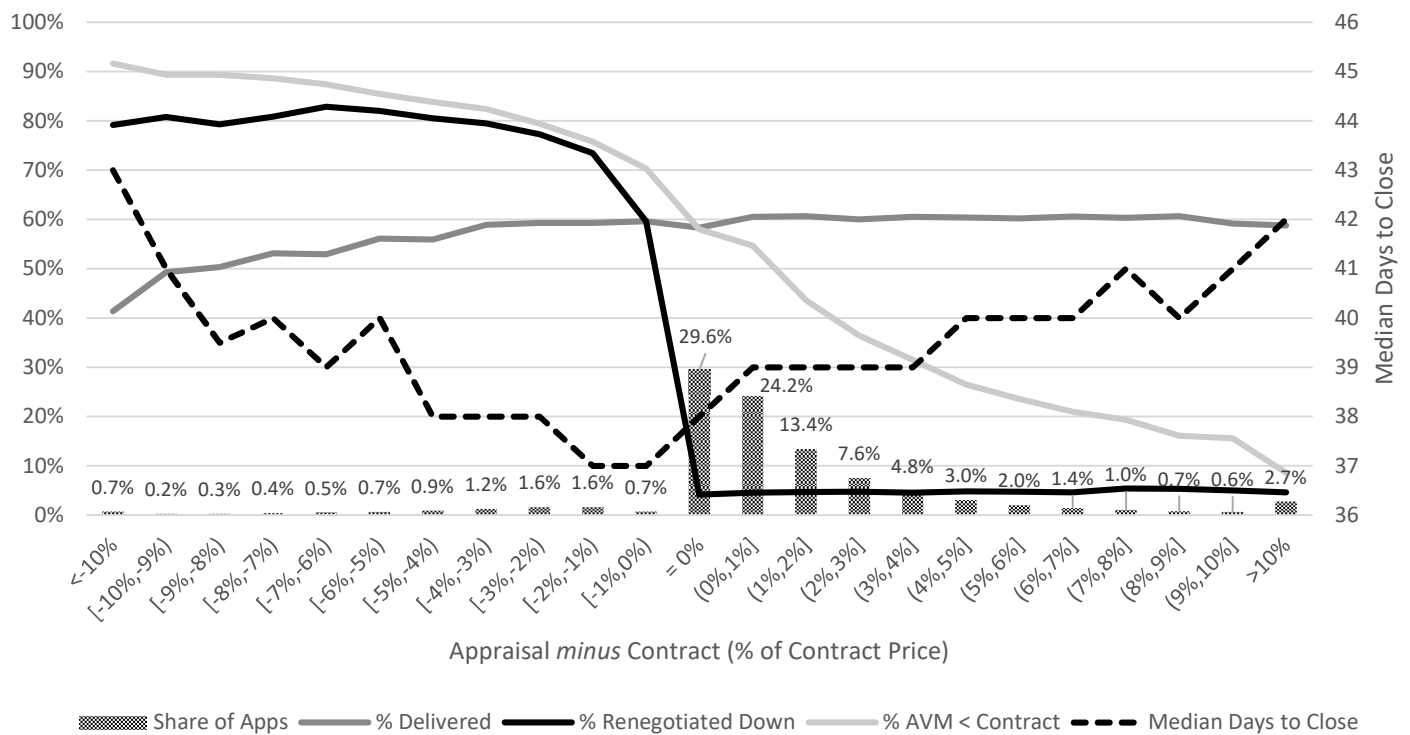
Figure A1F: Figure 1A for 2018 applications

Appraisal *minus* Contract (% of Contract Price)

Legend: Share of Apps — % Delivered — % Renegotiated Down — % AVM < Contract — — — Median Days to Close
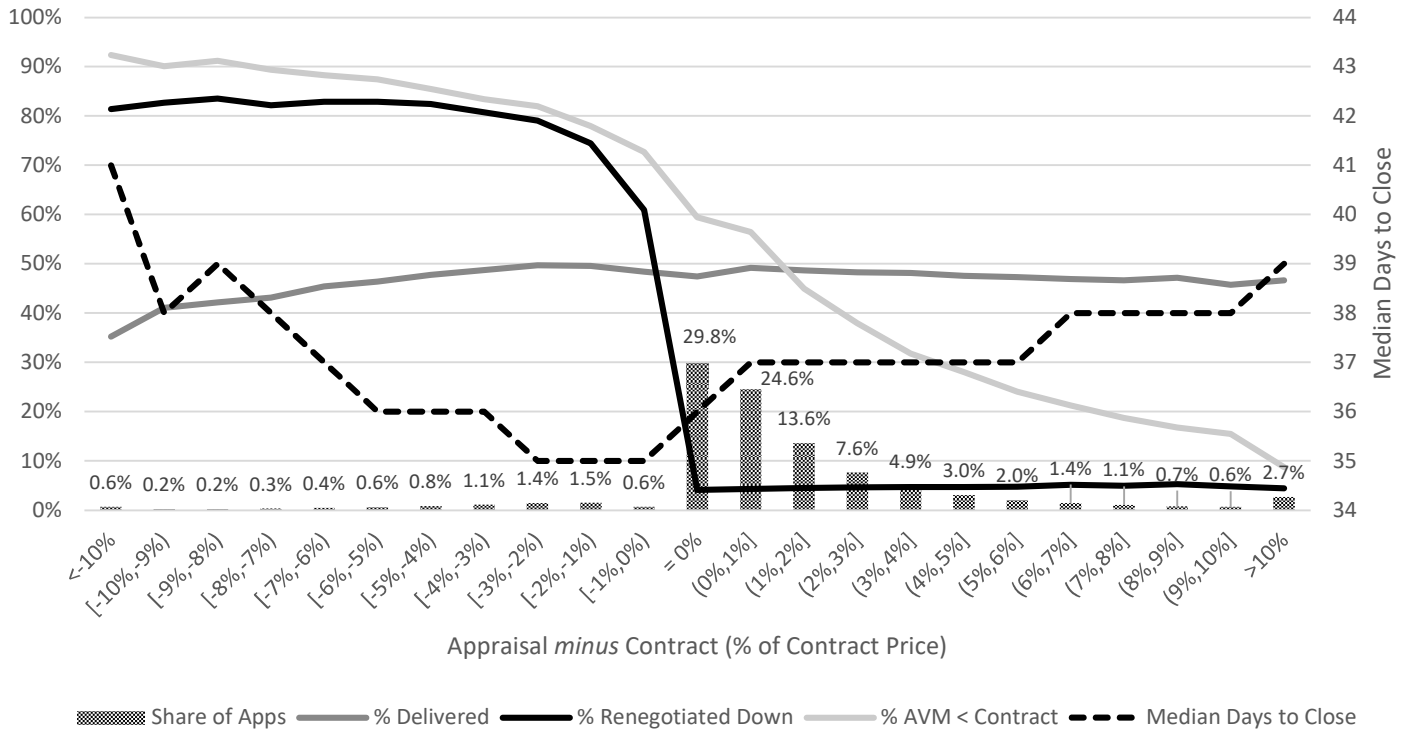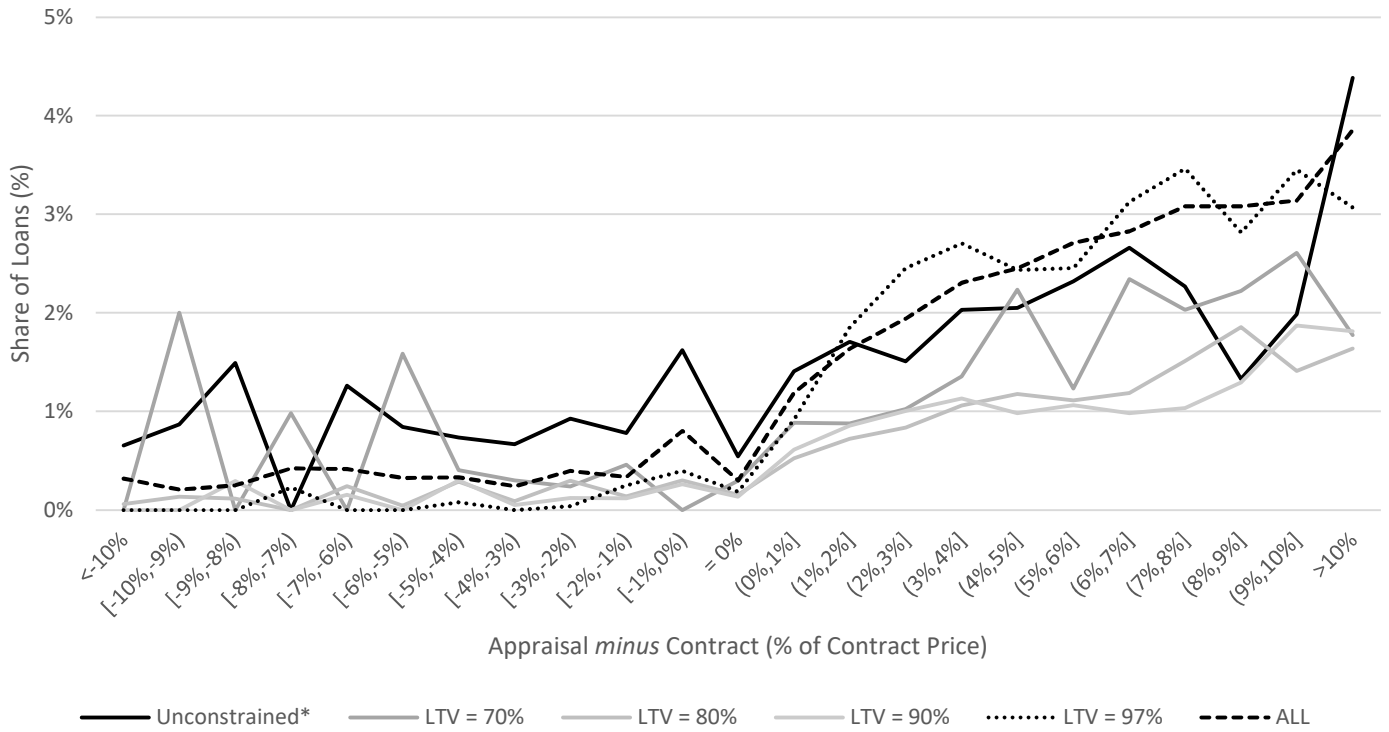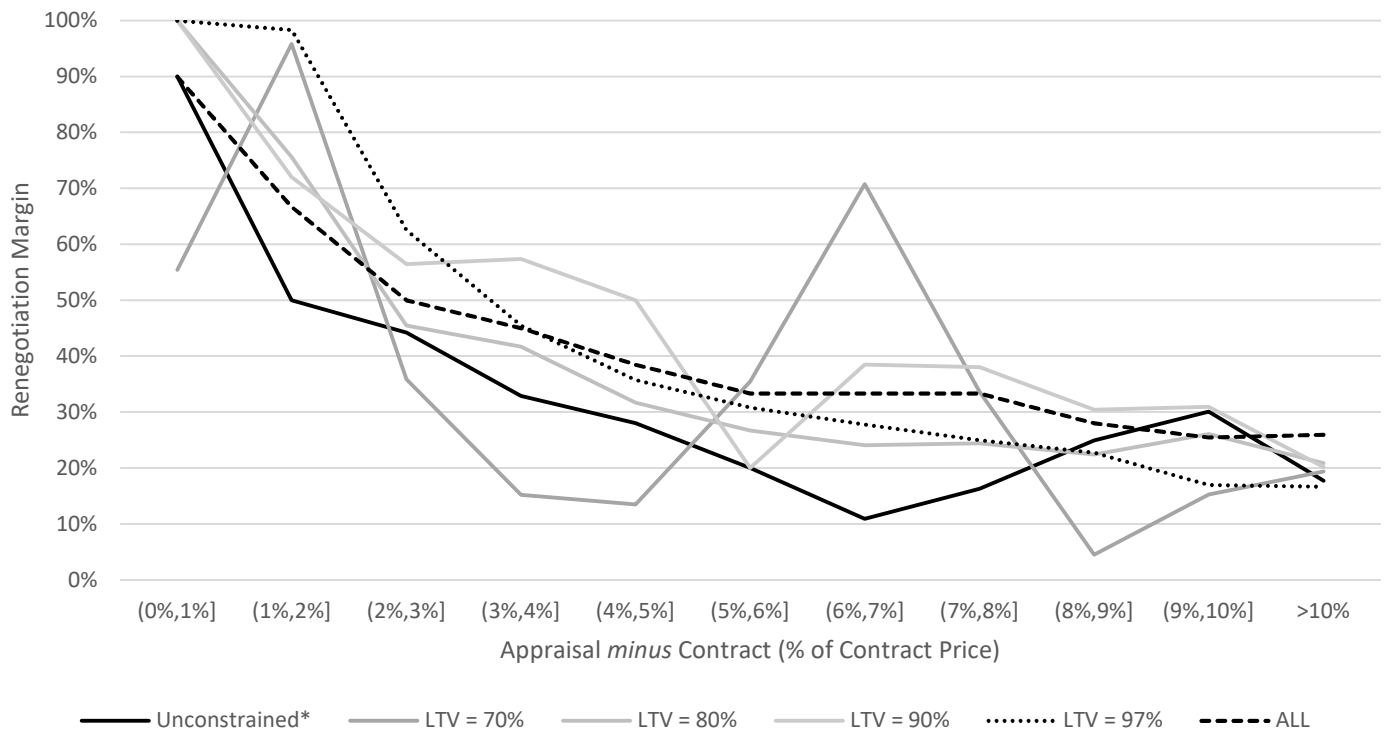
Figure A2: Upward renegotiation rates by LTV category and appraised value minus contract

* "Unconstrained" borrowers defined as those with a post-appraisal LTV below 60% and FICO of 740 or higher.

Figure A3: Median percent of difference between appraised value and contract yielded by buyers in cases where upward renegotiation occurs

* "Unconstrained" borrowers defined as those with a post-appraisal LTV below 60% and FICO of 740 or higher.

Table A1: Modeling downward renegotiation for the unconstrained borrower group[1]

	Model 1		Model 2		Model 3		Model 4^	
	Coef.	(Std. Err.)	Coef.	(Std. Err.)	Coef.	(Std. Err.)	Coef.	(Std. Err.)
Intercept	0.052***	(0.001)	0.01	(0.048)	0.017	(0.048)	0.014	(0.047)
Appraisal *minus* Contract								
<-10%	0.33***	(0.011)	0.334***	(0.011)	0.336***	(0.011)	0.432***	(0.014)
[-10%,-9%)	0.413***	(0.018)	0.412***	(0.018)	0.412***	(0.018)	0.501***	(0.019)
[-9%,-8%)	0.433***	(0.017)	0.437***	(0.017)	0.439***	(0.017)	0.524***	(0.018)
[-8%,-7%)	0.428***	(0.014)	0.432***	(0.014)	0.433***	(0.014)	0.524***	(0.015)
[-7%,-6%)	0.405***	(0.012)	0.406***	(0.011)	0.406***	(0.011)	0.495***	(0.014)
[-6%,-5%)	0.413***	(0.001)	0.414***	(0.010)	0.415***	(0.010)	0.505***	(0.013)
[-5%,-4%)	0.427***	(0.009)	0.425***	(0.009)	0.426***	(0.009)	0.510***	(0.011)
[-4%,-3%)	0.416***	(0.008)	0.416***	(0.008)	0.417***	(0.008)	0.501***	(0.010)
[-3%,-2%)	0.436***	(0.007)	0.433***	(0.007)	0.433***	(0.007)	0.514***	(0.010)
[-2%,-1%)	0.392***	(0.006)	0.388***	(0.006)	0.388***	(0.006)	0.471***	(0.010)
[-1%,0%)	0.287***	(0.009)	0.283***	(0.009)	0.283***	(0.009)	0.363***	(0.012)
= 0%	0	.	0	.	0	.	0	.
(0%,1%]	-0.002	(0.002)	-0.007***	(0.002)	-0.007**	(0.002)	-0.006**	(0.002)
(1%,2%]	-0.003	(0.003)	-0.008**	(0.003)	-0.008**	(0.003)	-0.007**	(0.003)
(2%,3%]	-0.003	(0.003)	-0.008*	(0.003)	-0.007*	(0.003)	-0.007*	(0.003)
(3%,4%]	-0.004	(0.004)	-0.009*	(0.004)	-0.009*	(0.004)	-0.008*	(0.004)

(4%,5%]	0.0003	(0.005)	-0.005	(0.005)	-0.004	(0.005)	-0.003	(0.005)
(5%,6%]	-0.004	(0.007)	-0.010	(0.007)	-0.009	(0.007)	-0.009	(0.007)
(6%,7%]	0.005	(0.008)	0.0005	(0.008)	0.001	(0.008)	0.001	(0.008)
(7%,8%]	-0.005	(0.009)	-0.011	(0.009)	-0.010	(0.009)	-0.009	(0.009)
(8%,9%]	0.009	(0.012)	0.008	(0.012)	0.009	(0.012)	0.009	(0.012)
(9%,10%]	0.006	(0.013)	0.002	(0.013)	0.003	(0.013)	0.003	(0.013)
>10%	0.001	(0.009)	-0.005	(0.009)	-0.002	(0.009)	-0.002	(0.009)
Reserves <= 2 Mths					-0.009***	(0.003)	-0.011***	(0.003)
Reserves (2,12) Mths					-0.01***	(0.002)	-0.009***	(0.002)
Reserves >= 12 Mths					0	.	0	.
<= 2 Mths*Low Appraisal							0.024*	(0.011)
(2,12)Mth*Low Appraisal							-0.005	(0.008)
>=12Mth* Low Appraisal							0	.
0 Wks. on Market					-0.024***	(0.004)	-0.013***	(0.004)
1 Wks. on Market					0.002	(0.002)	0.003	(0.002)
2 Wks. on Market					0.0018	(0.003)	0.004	(0.003)
3 Wks. on Market					-0.0012	(0.003)	-0.001	(0.003)
4 Wks. on Market					0.004	(0.003)	0.003	(0.003)
5 Wks. on Market					0.002	(0.003)	0.002	(0.004)
6+ Wks. on Market					0	.	0	.

Table A1: Modeling downward renegotiation for unconstrained borrower group[1] (cont.)

	Model 1		Model 2		Model 3		Model 4^	
Dependent variable is indicator of sale price < contract price								
	Coef.	(Std. Err.)	Coef.	(Std. Err.)	Coef.	(Std. Err.)	Coef.	(Std. Err.)
0 wks * Low Appraisal							-0.138***	(0.014)
1 wk * Low Appraisal							-0.012	(0.008)
2 wks* Low Appraisal							-0.021*	(0.009)
3 wks * Low Appraisal							-0.002	(0.010)
4 wks* Low Appraisal							0.011	(0.012)
5 wks * Low Appraisal							-0.001	(0.013)
6+ wks * Low Appraisal							0	.
MSA by Quarter Mean Low Appraisal Share					-0.001***	(0.0004)	-0.0004	(0.0004)
MSA by Qtr Low App. Share * Low Appraisal							-0.007***	(0.0005)
LTV at 1st Und. FEs	0		0		0		0	
App. Year & Quarter FEs	0		24		24		24	
MSA FEs	0		453		453		453	
R-Squared	0.1589		0.1692		0.1699		0.1720	
N Obs.	102,690		102,690		102,690		102,690	
Mean Sale Price < Contract Price				0.080				

[1] Unconstrained borrower group consists of borrowers with an post-appraisal LTV under 60% and a FICO score in the [740,850] range. Given this restriction and the categorical values employed for the LTV and FICO score range fixed effects, these drop out of the models.

^ Model 4 also includes the interaction of LTV at 1st und. and the low appraisal indicator. * denotes statistically significant at 10% level, ** at 5% level, *** at 1% level.