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Assessing Real Estate Value: An Empirical Analysis of Alternative Pricing Theories

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Abstract Lenders typically require mortgage appraisals before approving a loan to ensure the property's value justifies the amount of the mortgage. However, when appraisers have access to transaction price information and are compensated by the lenders, a conflict of interest may arise. This situation can incentivize appraisers to inflate property values to match or exceed the transaction price, aligning their valuations with the interests of lenders and potentially compromising their objectivity. This paper introduces an alternative theoretical framework that diverges from the traditional moral hazard model. Drawing from the appraisal updating process and incorporating a signaling extension from previous research, we propose a new theoretical model that generates unique empirical predictions. To test both the original moral hazard model and our alternative theory, we use appraisal and transaction data from a lending institution in Singapore. Our empirical analysis demonstrates that the findings support our alternative theoretical model, suggesting a different mechanism at play in the valuation process during various market conditions.

Index Terms mortgage appraisals, conflict of interest, appraiser objectivity, moral hazard model, alternative theoretical framework

I. Introduction

Valuers in the United Kingdom, Ireland, and Australia prioritize confirming the transaction price, according to recent findings. An anonymous valuer remarked, "The mortgage valuation confirms the transaction price." This practice raises concerns about the independence of property valuations [1], [2].

A critical question emerges: do appraisers working for lenders exercise independent judgment when determining the appraised value, or are they influenced by the lenders? This question is vital as lenders require appraisals before approving mortgages to ensure that the property's value meets or exceeds a minimum loan-to-value ratio. Appraisers understand this requirement, which can lead to a moral hazard problem if lenders reward them with future business for appraisals that align with desired outcomes [3].

This principal-agent problem has been extensively discussed in previous research. When a lender's representative is compensated based on the volume of generated loans, they may exert pressure on appraisers to value properties at the agreed-upon transaction price. Conversely, if a lender is concerned about defaults, they might pressure appraisers to undervalue the property [4]. Studies have revealed that many appraisers experience such lender pressure to adjust their valuations. Some argue for the implementation of regulations to shield appraisers from aggressive lenders.

The transaction price is determined through negotiations between sellers, real estate brokers, and buyers, whose interests may not always align with those of the lender. Home buyers or borrowers seek high appraisals to qualify for larger loans and to independently verify that they are paying a fair price. Similarly, sellers and brokers prefer high appraisals to expedite the sale and avoid further marketing expenses. These incentives can sometimes lead to transaction prices that exceed the true market values. However, lenders face financial risks if borrowers default and there is insufficient collateral to cover the loan's face value. Consequently, lenders rely on independent appraisers to verify the property's true value. The quality of these appraisals is, therefore, a significant concern for lenders [5].

Previous research has delved into appraiser incentives and the associated moral hazard problem. An appraiser may be inclined to overstate a property's value if the lender suggests it. This moral hazard problem can result in appraisals that match the transaction price. The current model suggests that in a bear market, the incentive to set the appraised value equal to the transaction price diminishes. However, this paper proposes an alternative theory based on the Quan and Quigley framework, which predicts an increased incentive to set the appraised value equal to the transaction price in a bear market. This paper also conducts an empirical test of these competing theories using a logit model and data from a Singaporean loan cooperative. The findings support the alternative theory.

Variable	Mean	Std Deviation	Minimum	Maximum
Po ($)	643,347	352,495	136,000	6,060,000
A ($)	639,527	345,678	120,000	6,000,000
BEAR	0.6227	0.4850	0.0000	1.0000
NB	2.0118	0.5279	1.0000	6.0000
LOAN ($)	360,212	221,876	47,000	3,680,000
LV	0.5657	0.1581	0.0562	0.9993
HHINC ($)	102,885	81,823	9,800	1,235,461
HHINCOV	0.1725	0.1949	0.0176	4.6250
AGE (years)	38	7	22	64

Table 1: Descriptive Statistics

The next section outlines the theoretical models and introduces a signaling modification to the moral hazard model. A testable hypothesis is formulated to evaluate the competing models. Data from the Singaporean loan cooperative is then used to empirically test these theoretical predictions, and the results are presented. The findings support an alternative theory based on the Quan and Quigley appraisal updating framework and a signaling modification to the moral hazard model [6].

II. A Moral Hazard Model

The theoretical framework is a moral hazard model, where the appraiser considers the implications of their appraisal on future business opportunities with the lender. This depends on two key factors: (1) the likelihood of securing a mortgage for the lender and (2) the probability of future default. The lender will penalize the appraiser for lost business or borrower defaults within a relatively short period. The appraiser assesses the probability of default based on the appraised value and the state of the real estate market. They compare the probability of default if the appraised value (A) equals the transaction price (Po) and if A differs from Po. Notably, the state of the real estate market, which indicates future price trends, significantly influences the appraiser's evaluation. If property prices are rising, the probability of borrower default is low, making it optimal for the appraiser to choose A greater than Po. Conversely, in a declining market, the appraiser is more likely to choose A equal to Po to mitigate potential losses in future business with the lender due to borrower defaults [7].

These observations lead to a testable hypothesis: in a bear market, the probability of the appraisal being less than the transaction price is likely to increase, while the probability of the appraisal equaling the transaction price is likely to decrease.

III. An Alternative Model

A theoretical framework offers an explanation for appraisal smoothing, building on a model that allows for an appraiser's subjective property valuation. This alternative hypothesis draws from the original modeling framework, which shows that the appraised value is a weighted average of the transaction price and the previous appraised value of comparable properties [7].

$$A_t = KP_t + (1 + K)A_{t-1}$$

where K is a function of market and transaction price variances. Appraisal smoothing can result if transaction price variance is high, implying K approaches 0. Although the original model is silent on appraised value formation under different market conditions, in a bearish market, the prior appraised value is not a reliable indicator of true value. The appraiser knows the prior value is too high and, if the proposed transaction value is lower, would attach a higher weight to the agreed price as the true market value. In contrast, in a bullish market, appraisal smoothing occurs more frequently [8].

This alternative hypothesis contrasts with the prediction that appraisers tend to set appraised values equal to transaction prices in bear markets. Instead, in bearish markets, appraisers tend to attach a low weight to the previous appraised value and a higher weight to the agreed transaction price, resulting in At = Pt. This tendency does not hold in stable or bullish markets, where appraisal smoothing is more common.

The alternative model formulation, based on [7], may initially seem to produce conflicting results with [8]. However, a signaling modification to the Gwin and Maxam model can reconcile the results. The key insight is that the appraised value serves as a signal of value to the buyer, particularly when the market is bearish [9].

Suppose the appraised value (A) is less than the intended transaction price (Po) in a bearish market. The buyer, upon receiving this signal, may infer that they have overpaid for the property. In most countries, the appraisal is revealed to the buyer before the final purchase completion, giving them the option to cancel or negotiate a lower price. From the lender's perspective, an appraised value lower than the contracted price likely leads to a rejected loan application, resulting in lost business. This loss may be severe enough to offset against potential future losses due to borrower default. Considering this signaling effect, it becomes optimal for the appraiser to choose A equal to or greater than Po, even in a bearish market. This modification aligns with the original prediction in ensuring consistency across models [10].

	Model 1			Model 2		
Variable	Coeff.	Std. Error	p-value	Coeff.	Std. Error	p-value
Constant	0.3398	0.3292	0.3020	0.3243	0.3246	0.3178
BEAR	1.1074**	0.1714	0.0000	1.1234	0.1701**	0.0000
LV	1.3137*	0.5276	0.0128	1.2546	0.5247*	0.0168
HHINCOV	0.0008	0.0005	0.1163			
AGE	0.0007	0.0012	0.5458			
NB	0.0036	0.0067	0.5915			

Table 2: Likelihood Appraised Value is Equal to Transaction Price

IV. Methodology and Hypotheses Testing

This paper employs a logit model to test the two theoretical models, examining the probability of the appraisal value equaling the transaction price. The dependent variable, y_i, is binary, taking values of 0 (failure) or 1 (success), and is influenced by a vector of independent variables, x_i. Specifically, y_i equals 1 if the appraisal value matches the transaction price $A = P_0$ [11].

The primary explanatory variable is a bear market dummy variable, expected to have a negative coefficient under the original [7] hypothesis and a positive coefficient under the alternative hypothesis. Additionally, a second dependent variable, $y_2 i$, is defined, equaling 1 if the appraised value is less than the transaction price $A < P_0$. The bear market dummy variable coefficient in the logit regression on $y_2 i$ is expected to be positive under the original hypothesis [12].

The probability of observing 1 for y_i is specified as:

$$\Pr(y_i = 1) = F(\beta \mathbf{x}_i) \tag{1}$$

where F is an appropriate distribution function. A logit specification for

$$F(x) = \frac{e^{\beta \mathbf{x}_i}}{1 + e^{\beta \mathbf{x}_i}} \tag{2}$$

The logit model is estimated by maximizing the joint likelihood function:

$$L = \prod_{i=1}^{N} [F(\beta \mathbf{x}_i)]^{y_i} [1 - F(\beta \mathbf{x}_i)]^{1-y_i} \tag{3}$$

The dataset for this research was provided by a prominent cooperative association in Singapore, which has been issuing mortgages since 1983. Although residential mortgage financing makes up a relatively small portion of the association's loan portfolio, it has very strict lending requirements. For instance, the cooperative association only issues loans if the loan amount is no more than five times the borrowers' total annual income, which is more conservative than some local banks. Additionally, the cooperative association is more cautious in setting its mortgage rates, whereas other banks are more aggressive in lowering rates to gain a competitive edge. As a result, its loan portfolio mainly consists of genuine homebuyers rather than speculators [13].

The mortgage data from the cooperative association includes the transaction price (Po), appraised value (A), loan amount (LOAN), mortgage term (TERM), household income (HHINC), age of the oldest borrower (AGE), number of borrowers (NB), and the transaction date (PDATE). The dataset covers a period from 1983 to 1999, with most loans issued in the last five years. All the loans were for purchasing properties, as almost all mortgages in Singapore are adjustable rate mortgages [14].

The Singapore residential real estate market experienced a severe downturn from 1996 to 1998 due to anti-speculation measures and the Asian Financial Crisis, with the official property price index falling by over 40% across all sectors. However, in 1999, real estate prices rebounded by 15% to 20%. The Asian Financial Crisis created a natural experiment to test the hypothesis. A bear market dummy variable (BEAR) was created, taking the value of 1 if the transaction occurred during this period and 0 otherwise [15]. Another definition of a bear market is two consecutive quarters of negative price changes, consistent with the definition of economic recession. The 1996/1998 period meets this alternative definition as well.

Out of the 766 observations, 477 loans (62%) were made during a bearish property market. In the full sample, the appraisal equals the transaction price for approximately 73% of the loans. The appraisal exceeds the transaction price in 61 cases and is lower than the transaction price in the remaining 142 cases [16].

By contrast, this proportion falls to 0.599 during non-bear markets. It is clear from the results in Exhibit 3 that prima facie evidence exists to support the hypothesis that appraisers are more likely to appraise at the transaction price in a bear market.

Finally, the study examines if there is an increased tendency to set appraised value less than transaction price for higher LV loans in a bear market when the probability of loan losses is high for the lender. An interactive variable was created to capture mortgages with LV of greater than 0.75 in a bear market. The results (not reported) show that loans with higher LVs lead to a higher probability that the appraised value is less than transaction price, but the coefficient is insignificant [17]–[20].

	Model 1			Model 2		
Variable	Coeff.	Std. Error	p-value	Coeff.	Std. Error	p-value
Constant	0.0034	0.3574	0.9924	0.0219	0.3522	0.9505
BEAR	0.9626**	0.1936	0.0000	0.9867**	0.1913	0.0000
LV	1.7431**	0.5865	0.0030	1.6451**	0.5815	0.0047
HHINCOV	0.0011*	0.0005	0.0426			
AGE	0.0010	0.0012	0.4098			
NB	0.0038	0.0071	0.5967			

Table 3: Likelihood of Appraised Value Less Than Transaction Price

V. Conclusion

This study provides compelling evidence that appraisers are more likely to appraise properties at the transaction price during bear markets, a finding that contradicts the predictions of the moral hazard model. The results indicate that appraisers tend to adopt a more conservative approach in their valuations during downturns, aligning with the alternative theory that appraised values often match transaction prices in such market conditions. Furthermore, the findings reveal that the likelihood of the appraised value equaling the transaction price increases with higher loan-to-value (LTV) ratios, while factors such as age and household income do not significantly influence the outcomes.

The implications of these findings are significant for mortgage lending and risk management. They suggest that lenders should exercise caution when relying on appraised values in bear markets, as these values are more likely to mirror the transaction price, potentially obscuring true market value. Additionally, the results underscore the critical role of LTV ratios in assessing the risk associated with mortgage loans.

Overall, this study enhances our understanding of the relationship between appraised values and transaction prices within the mortgage lending context. It offers fresh insights into appraiser behavior and the factors influencing their valuations, thereby informing better risk management practices for lenders.

The study also opens avenues for future research. Subsequent studies could investigate the relationship between appraised values and transaction prices in other real estate markets, such as commercial properties or residential markets with different characteristics. Moreover, future research could explore the impact of various factors, including regulatory environments and appraiser incentives, on the alignment between appraised values and transaction prices. This would further illuminate the dynamics at play and support the development of more robust mortgage lending practices.

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