The Determinants of Bank Interest Rate Margins in the Colombian Housing Credit Market

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Abstract

This paper analyses the determinants of banking mortgage loan interest rate margins in the Colombian mortgage credit market focusing on the effects of market concentration and using a panel-econometric approach for the period Jan-2003 to Dic-2014. Results imply that interest rate margins are mainly explained by the volatility of long-run interest market rates and negatively associated to the level of market concentration. These findings are consistent with a modified version of the efficient-structure hypothesis which suggests that differences in efficiency create unequal market shares and allow firms to set lower prices. Further evidence is presented by the existence of a long-term relationship between mortgage interest rates and market concentration during the sample period.

Keywords: Interest rate marings (Márgenes de intermediación); Market structure (Estructura de mercado); Housing finance (Financiación de vivienda).

JEL classification: G21; G40; C23

I. Introduction

Housing is a very valuable good for policy-makers since it has important consequences for both social and economic outcomes as long as it represents a significant part of household expenses, a large sector of the economy and a component of social stability (Hoek-Smith, 2009). Consequently, efforts to develop a transparent and efficient supply of housing finance entail relevant returns to achieve a wide range of economic goals (Buckley, Chiquier and Lea, 2009). Competitive banking markets have been identified by the literature as a factor that increases the welfare of households by reducing loan interest rates and, more generally, the social cost of financial intermediation (Van Leuvensteijn, Kok Sørensen, Bikker and van Rixtel, 2013).

The issue of the competence has been widely related to market structure and concentration, although these variables may be related in multiple ways (Berger, Demirgüç-Kunt, Levine and Haubrich, 2004). Economic literature has theorized the relationship between market concentration and industry profitability with two different hypotheses (Berger and Hannan, 1989). On one hand, the *structure-performance hypothesis* suggests that there exist a positive relation between market concentration and profitability due to the ability of firms to set prices. On the other hand, the *efficient-structure hypothesis* maintains that high levels of concentration are related with greater efficiency since firms with high levels of efficiency tend to exhibit higher market shares.

Berger and Hannan (1989) assert that both hypotheses imply the same positive statistical relationship between market concentration and industry profitability. The differences are then explained by the structural models related to each theory:

> […] The structure-performance hypothesis takes concentration as exogenous and maintains that high concentration allows for noncompetitive behavior that results in less favorable prices to consumers and higher profits to firms. The usual form of the efficient-structure hypothesis, however, takes firm-specific efficiencies as exogenous and maintains that these efficiencies result in both more concentrated markets and higher profits (Berger and Hannan, 1989, p. 291).

Notwithstanding, the relationship between concentration and profitability is not clearly determined under the efficient-structure hypothesis. Namely, if efficiency gains are sufficiently high, firms could set more favorable prices to consumers which are expected to drive down the industry profit margins. As Corvoisier and Gropp (2002) note, in this case firms would price their services more (rather than less) competitively and, as a result, it is possible to expect a negative statistical

relationship between concentration measures and profitability. The latter case will be treated here as a modified version of the efficient-structure hypothesis.

This paper discusses the determinants of banking loan interest rate margins in the Colombian mortgage credit market. Specifically, this study discusses the effects of market concentration on mortgage loan interest rate margins over the period Jan-2003 to Dic-2014. Testing this relationship is particularly relevant in Colombia for several reasons. Firstly, low levels of income and saving imply serious restrictions for the population to effectively demand housing credit (Gaviria and Tovar, 2011). Hence, a deeper understanding of the determinants of mortgage loan interest rate margins is desirable in order to design policies to reduce the cost of financial intermediation and improve the existing ones. Secondly, since the Government has developed programs of interest rate subsidies to reduce housing deficits and achieve counter-cyclical macroeconomic goals, an environment of market competition is desirable to increase the effect of this type of policies.

Following the theoretical models of Ho and Saunders (1981), Maudos and Fernández de Guevara (2004) and Van Leuvensteijn et al. (2013), the empirical strategies employed account for both banking and market level factors as determinants of the mortgage interest rate margins. Results are consistent with the modified version of the efficient-structure hypothesis. Specifically, after controlling for different kind of costs and risk measures, increases in market concentration are associated with significantly lower interest rate margins. The study also suggests that public policy must be aimed at achieving environments of macroeconomic and financial stability as the main strategy to drive down the cost of intermediation.

Moreover, this article also explores the long-run relationship between mortgage loan interest rates and long-term Government bond returns. While the estimation of this relationship has already been investigated by some studies (Galindo and Hofstetter, 2008; Vargas, Hamman and González, 2010), the effect of market concentration has not been considered explicitly.

The article is organized as follows. Section II briefly discusses the literature on bank competition and interest rate margins. Section III describes the evolution of the Colombian mortgage credit market during the last decade. The empirical strategy is introduced in Section IV. Section V presents the estimation results. Finally, Section VI concludes.

II. Interest Rate Margins and Market Concentration

Economic literature has identified different factors determining interest rate margins besides pure operating costs. The model of Ho and Sunders (1981) has become a benchmark for this type of analysis. In this model, banks are viewed as intermediaries that demand deposits and supplies loans[1]. Since these flows of resources arrive at different moments of time, banks face cost due to the uncertainty generated by possible mismatches between loan demands and deposit supplies.

Uncertainty then provides the first set of determinants and at least two relevant elements may be mentioned at this point. Firstly, as long as it is assumed that banks are risk-averse, greater levels of risk-aversion will imply higher interest rate margins because expected loses would be valued at a higher level. Secondly, if the bank holds an unmatched portfolio by the end of the decision period in which interest rate were determined, changes of money market interest rates could imply interest-rate risks. For instance, suppose a certain amount deposits were made during the initial decision period but those resources were insufficient to meet loans demand. Then the bank must fund the loans with borrowings of the money markets that have to be restored in the next decision period. The in which the short-term interest rate rises implies a reinvestment risk that should be charged on higher interest rate margins.

Another important determinant of interest rate margins consists in the market structure in which banks operate. The effect of market concentration on pricing behavior has been investigated with two hypotheses by most of the literature. These theories try to explain the "commonly observed positive correlation between market concentration and profitability" (Berger and Hannan, 1989). The structure-performance hypothesis argues that this relationship is explained by a non-competitive behavior that firms are able to maintain in the market due to great levels of concentration. An alternative interpretation, the efficient-structure hypothesis, suggests that higher than average levels of efficiency of some firms raise their market shares and, as a result, concentration increases. Since efficiency allows more favorable profitably, market concentration and interest rate margins should be positively related.

Note that both the structure-performance and the efficient-structure hypotheses seem to explain a world in which concentration necessary implies less market competition. Whether firms have ability to collude or their comparative advantage in terms of efficiency allows them to obtain higher

[1] Formal versions of this model and similar approaches are presented by McShane and Sharpe (1988), Angbanzo (1997), Corvoisier and Gropp (2002) and Maudos and Fernández de Guevara (2004).

profitability, prices are set *as if* they were the result of market structures with lower or at least the same levels of competition. Namely, in the structure-performance hypothesis firms can openly increase the prices relative to a given cost and in the efficient-structure hypothesis the efficiency gains reduces the cost relative to a given price in order to increase the profitability. Nevertheless, as Van Leuvensteijn et al. (2013) assert, concentration and competition may be related in a different way:

> Where the traditional interpretation is that concentration erodes competition, concentration and competition may instead increase simultaneously where competition forces consolidation. For example, in a market where inefficient banking firms are taken over by efficient peers, strengthened competition may go hand in hand with an increased concentration ratio (p. 1360).

Indeed, if higher concentration reflects a general increase in the efficiency of the industry, it is possible to expect that products would be priced more competitively (Corvoisier and Gropp, 2002). Then, a negative relation between interest rate margins and concentration in markets may be observed in markets where firms operate under imperfect competition structures. This possibility will be treated here as a modified version of the efficient-structure hypothesis.

While an important part of the empirical evidence reports a positive relation between market concentration and interest rate margins, some studies find mixed results on this relationship. For instance, Carbó and Rodríguez (2007) find that market concentration is not significantly related to interest rate margins for European banks and assert that this result is in line "[…] with recent evidence indicating that margins and concentration are not necessarily positively related and that interest margins may be even lower in more concentrated markets". Furthermore, Nassar, Martínez and Pineda (2014) show that market concentration is negative and significantly associated with net interest margins in the case of Honduras. The authors maintain that a possible rationale for this result is that more efficient banks operate at lower costs and gather greater market shares.

Finally, Ho and Saunders (1981) consider other factors that affect bank margins due to regulatory and institutional issues: i) implicit interest payments on deposits with other services because of regulatory restrictions on explicit payments; ii) the opportunity cost of holding required reserves; iii) the default risk of loans that generates a premium according to the expected loss. Hence, the pure interest rate margin would be enlarged by a mark-up

for implicit interest payments, the opportunity cost of keeping unproductive reserves and default premiums.

III. Housing Finance in Colombia

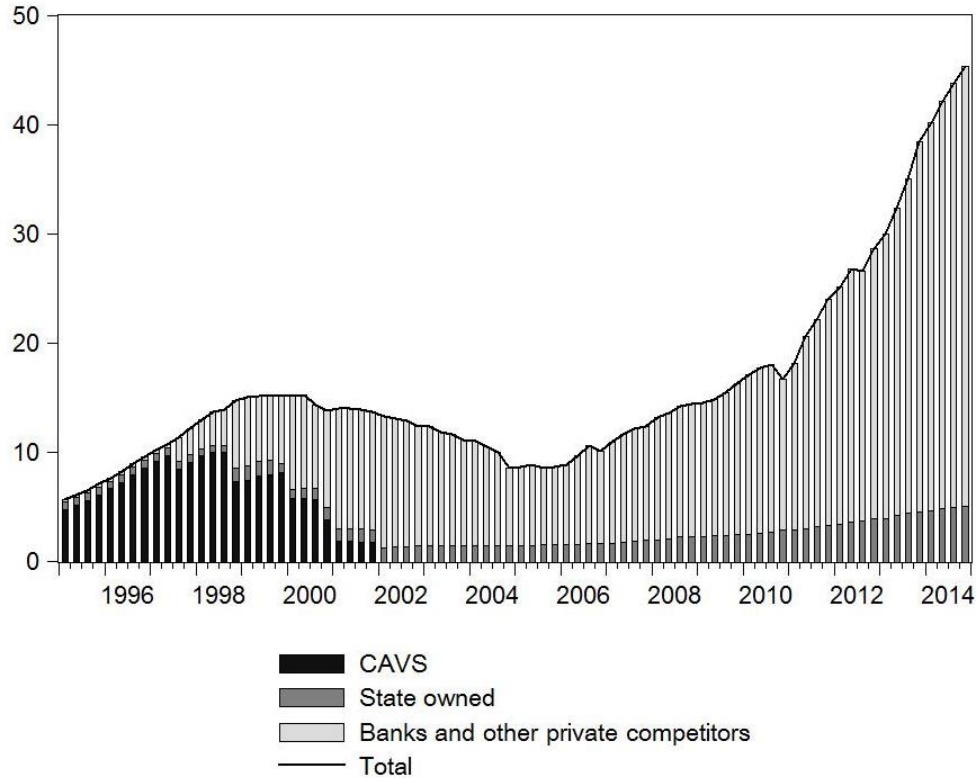
During the last century, the Colombian housing finance system has operated in an environment of market intervention and substantial levels of banking regulation. Before 1970 housing finance was provided by state banks with significant restrains of supply and efficiency (Cuéllar, 2006). In 1972 the Government established a new model in order to drive economic resources from private savings to the construction industry. This system was based in special banks known as Corporations for Savings and Housing –*Corporaciones de Ahorro y Vivienda* (CAVs) – which operated exclusively by funding projects of urban development and mortgage loans with cash deposits. Initially, only these financial institutions were allowed to remunerate deposits to grant mortgage loans indexed to the inflation rate.

After a process of financial liberalization during early 1990s, the privilege on remuneration of deposits was eliminated and, as a result, the competitiveness of CAVs to attract savings diminished. To manage this setback, mortgage loans were indexed to deposit interest rates in 1993 and, after a dramatic increase of the fixed-deposit interest rate due a set of unfavorable economic conditions in 1998, the system was severely damaged by debtor defaults and painful adjustments to the value of debts.

In the case of housing finance, the aftermath of the crisis implied a new regulatory framework in which the figure of CAVs as institutions focused in housing finance was eliminated and any financial institution was able to provide mortgage credit under certain conditions.[2] The legislation established a period of three years for CAVs to be transformed into commercial banks. As a result, this measure generated merges in the housing finance system; the number or participants in the market of mortgage loans went from 9 in 1996 to 6 in 2006 with 3 merges and 3 acquisitions by other former commercial banks. Hence, the recovery of outstanding housing loans that took place in 2005 (Fig 1.) occurred in an environment of fewer competitors and stronger regulation.

[2] This regulatory framework adopted a set of policies in order to deal with the economic crisis and reduce the systematic risk of the housing finance system. Although some measures were transitory, a set of them remains active today. These measures include : i) constrains on loan-to-value (LTV) ratios of 80% for social housing and 70% for non-social housing loans; ii) limits on interest rates; iii) constrains on debt-to-income ratio of 30%.

Fig. 1. Outstanding mortgage loans by type of creditor

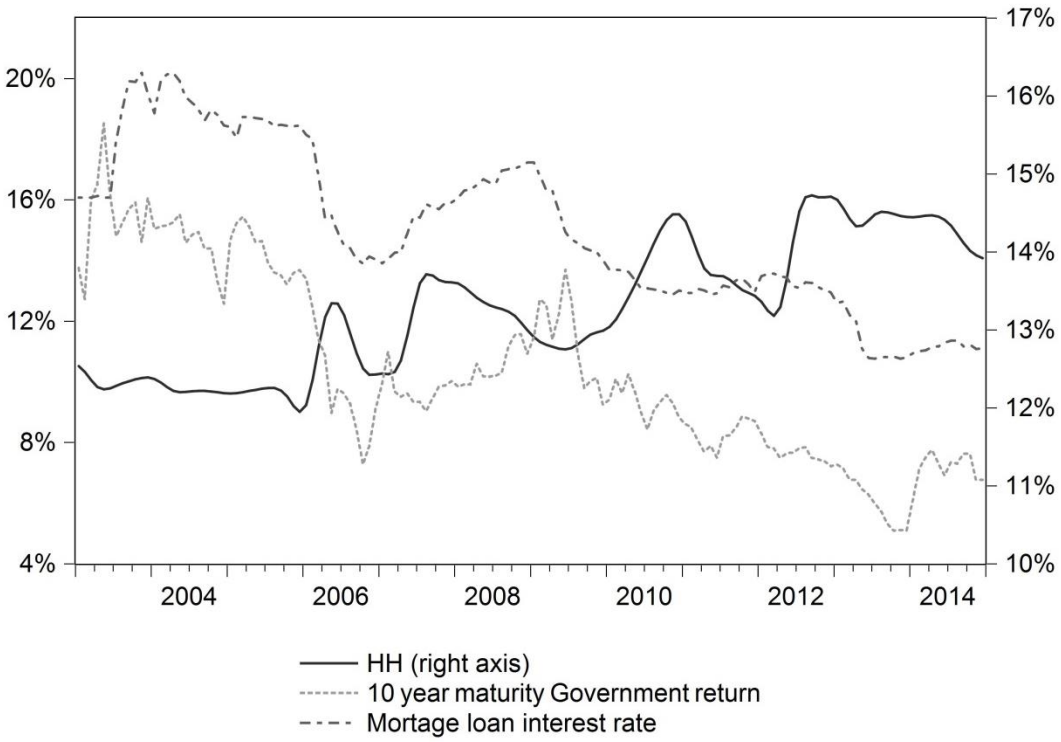


Source: Financial Superintendence of Colombia and Titularizadora Colombiana.
Notes: The figure depicts quarterly data on outstanding mortgage lending which include regular mortgage loans and securitizations measured in million Colombian pesos. Debtors are divided in CAVs, commercial banks and public institutions (only *Banco Central Hipotecario* and *Fondo Nacional del Ahorro* are considered here).

After these institutional changes, the level of concentration of the mortgage credit market measured as the Herfindahl-Hirschman (HH) index of outstanding loans increased progressively (Fig. 2). Nevertheless, concentration remained moderated during the whole sample according to the international guidelines of the HH index[3]. Conversely, loans have been priced at lower interest rates on average, a behavior that is consistent with the reduction of long-term market interest rates reflected in the return of ten year maturity Government bonds (Fig. 2).

[3] The HH index ranges between 0 and 10.000. International standard guidelines consider less than 1.000 as a competitive market and between this level and 1.800 as a concentrated market (Al-Muharrami, 2009). In this case, the normalized index ranges between 10,6% to 14,7% which lies below the threshold of 18% that implies moderate market concentration.

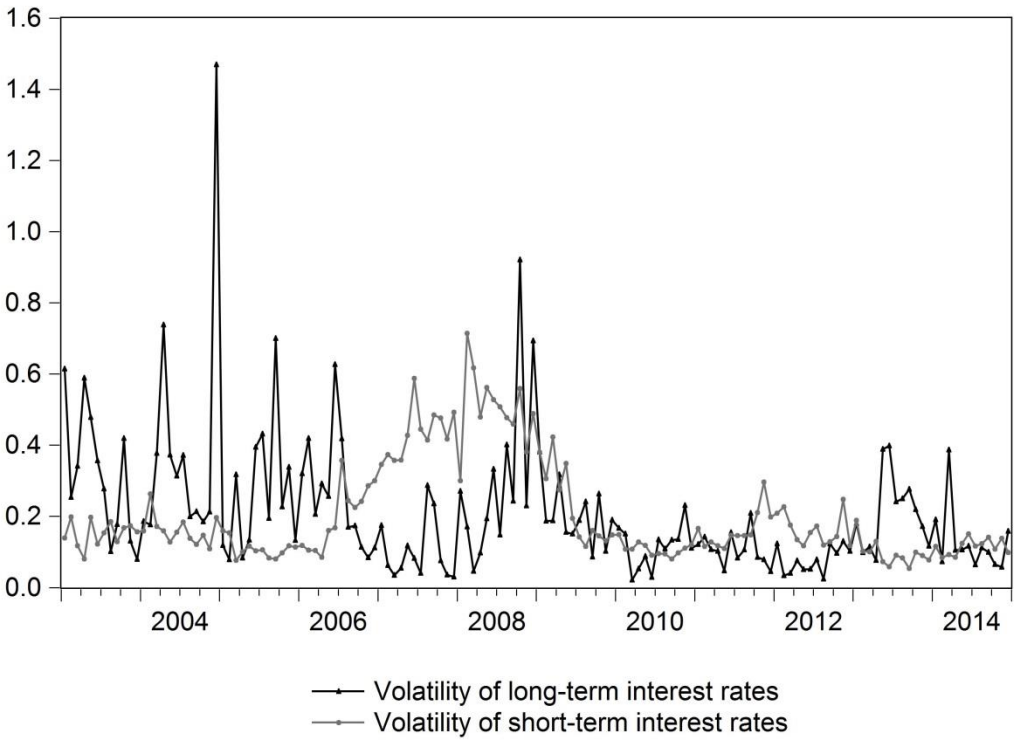
Fig. 2. Evolution of mortgage loans interest rates, long-term maturity Government bonds' return and mortgage credit market concentration in Colombia



*Source***:** Financial Superintendence of Colombia and Central Bank of Colombia.
Notes: The figure presents monthly data on i) mortgage loan interest rates of non-public financial institutions as a weighted average; ii) the return of the 10 year maturity Government bond as a proxy of long-term market interest rates; and iii) market concentration measured as the HH index of outstanding loans including securitizations.

It is also worth noting that the sample period (2003-2014) encompasses phases of financial stress and calm. Fig. 3 shows the volatility of both short and long-term interest rates during the sample period. 2004 and 2008 are periods of high financial stress in the long-term money markets. This volatility, as mentioned above, creates important pressures on interest rate margins because of the reinvestment risk.

Fig. 3. Volatility of long and short-term interest rates



Source: Central Bank of Colombia.
Notes: The figure shows the volatility of market interest rates measured as the monthly standard-deviation of 90 days fixed-term deposits interest rate and the ten year maturity Government bonds' return for short and long terms, respectively.

Regarding empirical literature on the Colombian mortgage credit market and its degree of competition, Galindo and Hofstetter (2008) investigate the determinants of the level of mortgage interest rates highlighting public debt interest rates and credit risk as the main explaining factors, but find no significant effect of market concentration on these variables. Conversely, Galindo and Jaramillo (2011) find that interest rate ceilings work as collusion devices for market participants[4]. According to these authors, this behavior is persistent over time and increases with higher levels of market concentration.

[4]It must be noted, as Galindo y Jaramillo (2011) recognize, that mortgage credit has the lowest price ceilings in the Colombian credit market.

IV. Empirical Strategy

This paper investigates the impact of market concentration on interest rate margins using two different econometric models. The first model follows the theory of Ho and Saunders (1981) to estimate a panel regression for mortgage loan interest rate margins. A simple regression that involves the determinants of pure interest rate margins may be written as:

$$\tau_{i,t} = \theta_1 OC_{i,t} + \theta_2 K/A_{i,t} + \theta_3 {\sigma^{ST}}_{i,t} + \theta_4 {\sigma^{LT}}_{i,t} + \theta_5 HH_t + \theta_6 Size_{i,t} + \varepsilon_{i,t} \quad (1)$$

where i and t represents each bank and month; τ denotes the mortgage loan interest rate margin expressed the difference between the loan interest rate and the ten year maturity Government bond return as a long-term money market interest rate; OC reflects the operating and management cost as the relation between operating expenses and total productive assets; K/A represents the degree of risk-aversion of each bank measured as the equity to assets ratio (Ho and Saunders, 1981); σ^{ST} and σ^{LT} denote the volatily of short and long-term money market interest rates expressed as the standard deviation of 3-months fixed-term deposits interest rate and the ten year maturity Government bonds' return (Saunders and Schumacher, 2000), respectively; HH reflects the market concentration measured as the Herfindahl-Hirschman index of mortgage outstanding loans; $Size$ represents the volume of operation measured by the amount of outstanding loans of each bank in logarithms; ε is an error term.

An alternative version of this model incorporates the regulatory factors identified by Ho and Saunders (1981) and mentioned above. This regression may be expressed as follows:

$$\tau_{i,t} = \theta_1 OC_{i,t} + \theta_2 K/A_{i,t} + \theta_3 {\sigma^{ST}}_{i,t} + \theta_4 {\sigma^{LT}}_{i,t} + \theta_5 HH_t + \theta_6 IIP_{i,t} + \theta_7 RR_{i,t} + \theta_8 DR_{i,t} + \theta_9 Size_{i,t}\mu_{i,t} \quad (2)$$

where IIP denotes the implicit interest payments to deposits measured as the difference between non-interest expense and non-operating income to average assets; RR represents the reserve requirements expressed as the ratio of non-earning assets to total average assets; DR reflects the default risk measured as the delinquency rate of mortgage loans (Saunders and Schumacher, 2000). Both models are estimated with monthly data of 8 Colombian banks that offered mortgage loans for non-social housing during the period Jan-2003 to

Dic-2014[5]. Bank specific effects are added (as suggested by the Hausman and Lagrange multiplier tests). Moreover, in order to correct problems of cross-sectional correlation and heteroskedasticity, residuals are adjusted for cross-correlation effects and models (1) and (2) are estimated using an OLS-based panel corrected standard error procedure.

The second model explores the long-run relationship between mortgage loan interest rates, long-term Government bond returns and market concentration. Although some studies investigate the relationship between mortgage loan interest rates and Government bonds without considering the effect of concentration (Galindo and Hofstetter, 2008; Vargas, Hamman and González, 2010), a cointegration analysis is more appropriate to better understand the effect of banking concentration on interest rates once long-term money market interest rates are considered (Van Leuvensteijn et al., 2013). The regression has the following form:

$$i_t^m = \rho_0 + \rho_1 TES_t^{10} + \rho_2 HH_t + \vartheta_t \qquad (3)$$

where i_t^m denotes the loan interest rate of mortgage loans at time t, TES represents the long-term Government bonds' return; HH reflects the market concentration of outstanding mortgage loans also measured with the Herfindahl-Hirschman index. All variables must be non-stationary and cointegrated in order to estimate equation (3). A dynamic ordinary least squares (DOLS) approach is employed since is an appropriate method to generate robust single equations and corrects a set of problems related to dynamic source bias as well as endogeneity (Stock and Watson, 1993). The model is estimated with monthly data of non-social housing loans for the same period of time.

V. Estimation Results

As discussed in the previous section, the first empirical approach aims to take identify the determinants of interest rate margins with a panel of data. Table 1 contains the estimation results of models (1) and (2). In both regressions all variables have the expected signs and are statistically significant to explain the mortgage loan interest rate margin. Note that the volatility of long-term interest rates is by far the most important determinant of interest rate margins, even when regulatory factors are included. Market concentration is also a significant variable in both models and its

[5] This period of time was chosen due to the availability of data on Government bonds returns.

coefficient is negative suggesting that, on average, a 1% increase in the HH index is related with a reduction of bank margins of 0,3% to 0,5%.

Table 1. Estimation results, cross-sectional regressions

	(1)	(2)
$OC_{i,t}$	0.108^{*} [0.061]	0.273^{***} [0.063]
$K/A_{i,t}$	0.157^{***} [0.034]	0.098^{**} [0.034]
$\sigma^{ST}{}_{i,t}$	-0.008^{**} [0.004]	-0.010^{***} [0.004]
$\sigma^{LT}{}_{i,t}$	0.939^{***} [0.275]	0.642^{**} [0.270]
HH_t	-0.530^{***} [0.406]	-0.358^{***} [0.107]
$Size_{i,t}$	0.007^{***} [0.001]	0.005^{***} [0.000]
$IIP_{i,t}$		0.031^{**} [0.011]
$RR_{i,t}$		0.239^{***} [0.035]
$DR_{i,t}$		0.077^{***} [0.017]
Observations	806	806
Hausman test	0.848	0.745

Notes: Models (1) and (2) were estimated with monthly data of 6 banks for the period June 2003 – December 2014. The dependent variable: mortgage loan interest rate margins. Standard errors in parentheses are clustered in order to adjust for cross-correlated effects. *, **, *** denotes significance at 5% and 1% levels, respectively.

While these results provide supportive evidence of the modified efficient-structure hypothesis, the long-run effect of market concentration on interest rates is explored with the second empirical approach. The estimation results of model (3) are reported in Table 2[6]. The null hypothesis of the Eagle-Granger and the Phillips-Ourlais tests (under which series are not cointegrated) is rejected at the 5% and 10% level, respectively. Results show that increases in market concentration (that is, within the modified efficient-structure hypothesis, stronger competition) significantly reduces interest rates in the non-social housing mortgage loan market once the effect of long-term Government bonds' return is incorporated.

[6] The *p*-value of the Augmented Dickey-Fuller and the Phillips-Perron unit root tests for the three variables of this model were significant at the 1% levels. See Appendix I for further details.

Finally, the long-term relationship between mortgage interest rates and long-term Government bonds' return is identified in order to update the estimations of Galindo and Hofstetter (2008) and Vargas, Hamman and González (2010). This regression, noted as model (4) in Table 2, is also estimated with the DOLS method. Once more, there exists empirical evidence of a cointegration relationship at the 5%. Results suggest that on average a 1% increase in the return of 10 years maturity Government bonds increase mortgage interest rates by about 0,97%. The magnitude of this effect is similar to the one estimated by Vargas, Hamman and González (2010), indicating a one-to-one relationship in the long-run.

Table 2. Estimation results, cointegrating regressions

	(3)	(4)
TES_t^{10}	0.905^{***} [0.038]	0.969^{***} [0.017]
HH_t	-0.323^{**} [0.159]	
Observations	144	144
Eagle-Granger test	0.014	0.035
Phillips-Ourlais	0.081	0.020

Notes: Models (3) and (4) were estimated with monthly data for the period June 2003 – December 2014 with the DOLS method. *, **, *** denotes significance at 5% and 1% levels, respectively.

VI. Final Remarks

This paper explores the determinants of banking interest rates margins of Colombian mortgage loans using monthly data for the period June 2003-December 2014. Controlling for both bank-specific and market factors, the results from a panel-econometric approach show that interest rate margins are mainly explained by the volatility of long-run interest market rates and negatively associated to the level of market concentration. As long as this relationship between bank concentration and interest rate margins for mortgages is statistically significant, results are consistent with the modified version of the efficient-structure hypothesis which states that concentration is the result of higher levels of efficiency that allow firms to set lower prices. Furthermore, the existence of a long-run relationship between mortgage interest rates and market concentration provides additional evidence for the modified efficient-structure hypothesis.

The results of this analysis may be useful to design economic policies that reduce the cost of financial intermediation for housing finance in Colombia. Since a significant part of the evolution

of mortgage loan interest rate margins, policies should be oriented towards environments of financial and macroeconomic stability (Maudos and Fernández de Guevara, 2004).

Appendix 1

	$\tau_{i,t}$	$OC_{i,t}$	$K/A_{i,t}$	$\sigma^{ST}{}_{i,t}$	$\sigma^{LT}{}_{i,t}$	HH_t	$Size_{i,t}$	$IIP_{i,t}$	$RR_{i,t}$	$DR_{i,t}$
$\tau_{i,t}$	1									
$OC_{i,t}$	0,10	1								
$K/A_{i,t}$	-0,12	-0,39	1							
$\sigma^{ST}{}_{i,t}$	0,07	0,45	-0,17	1						
$\sigma^{LT}{}_{i,t}$	0,02	0,33	-0,14	0,07	1					
HH_t	-0,15	-0,61	0,31	-0,19	-0,30	1				
$Size_{i,t}$	-0,30	-0,40	0,24	-0,29	-0,12	0,51	1			
$IIP_{i,t}$	0,16	0,42	-0,34	0,07	0,28	-0,55	-0,29	1		
$RR_{i,t}$	0,16	0,36	-0,03	0,09	0,35	-0,70	-0,45	0,52	1	
$DR_{i,t}$	0,05	0,58	-0,29	-0,03	0,33	-0,66	-0,36	0,70	0,60	1

Table A.1. Correlation matrix of the variables in models (1) and (2)

Notes: The table presents the correlation coefficients for variables employed in models (1) and (2) for the period June 2003 – December 2014 and the 8 banks of the sample.

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