Economics Bulletin

Volume 38, Issue 4

Effect of Banking Concentration on the Lending Channel: evidence from Colombia

Juan Camilo Galvis Ciro
Universidad Pontificia Bolivariana

Guillermo David Hincapié Vélez
Universidad Pontificia Bolivariana

Abstract

This article aims to analyze the effect of monetary policy on the growth rate of total gross loans for the Colombian economy under different scenarios of banking concentration. The effect of monetary policy on the growth rate of loans was made by the two-step system GMM dynamic panel estimator over the period of 2007-2017. The findings denote that the monetary policy has the capacity to affect the growth rate of loans. Furthermore, the central bank loses degrees of freedom to affect the growth rate of bank loans in a greater concentration scenario and banks size mitigates the monetary policy shock. The results of the paper offer new insights about the monetary policy management for developing countries. The principal conclusion is it is necessary a closer monitoring in concentration and structure of the banking system by monetary policymakers.

We thank an anonymous referee for helpful comments on an earlier version of this paper. Any remaining errors are the sole responsibility of the authors.

Citation: Juan Camilo Galvis Ciro and Guillermo David Hincapié Vélez, (2018) "Effect of Banking Concentration on the Lending Channel: evidence from Colombia", *Economics Bulletin*, Volume 38, Issue 4, pages 2254-2265

Contact: Juan Camilo Galvis Ciro - jcgalvisciro@gmail.com, Guillermo David Hincapié Vélez - guillermo.hincapie@upb.edu.co.

Submitted: February 15, 2018. **Published:** December 02, 2018.

1. Introduction

There are several channels through which the decisions of the central bank are transmitted. One of the main is the lending channel and relates to the effects of the monetary policy stance on the real sector through the credit supply (Bernanke and Blinder, 1992; Bernanke and Gertler, 1995). In the inflation targeting, the central bank depends critically on the financial system response to monetary decisions (Blinder et al., 2008). Therefore, understanding these is key to analyzing the inflation control and the achievement of macroeconomic stability (Kashyap and Stein, 2000; Gambacorta, 2005; Matousek and Sarantis, 2009).

The banking system structure of emerging economies has changed significantly in recent decades. In Latin America, several factors have affected banking concentration. The most important factors have been financial integration, economic opening, privatization and the entry into the market of international banks that have encourage the domestic banking system (Levy-Yeyati and Micco, 2007; Olivero, Li and Jeon, 2011; Khan, Ahmad and Gee, 2016). However, the financial markets of emerging economies still have several frictions and limitations. Often, the central banks do not have credibility and reputation in their policies and this makes difficult to transmit monetary decisions into the markets (de Mendonça, 2007; Montes, 2013). Consequently, for developing countries it is essential to analyze the direction in which the financial system responds to monetary policy rate changes (Simpasa, Nandwa and Nabassaga, 2015; Ramos-Tallada, 2015).

The literature of the credit channel is varied, although it is observed there is a renewed interest in using market concentration indexes to quantify the effects of bank concentration on the loans growth. A strand of the literature analyzes the existence and magnitude of the lending channel (see, Kishan and Opiela, 2000; Ehrmann et al., 2003; Ashcraft, 2006; Matousek and Sarantis, 2009). Another part of the literature focuses on the role of banking regulation environment, financial innovations and banking concentration on the transmission of monetary policy (Adams and Amel,2005; Olivero, Li and Jeon, 2011; Ozsuca and Akbostanci, 2012; Ghossoub and Reed, 2015; Ramos-Tallada, 2015; Khan, Ahmad and Gee, 2016). There are also studies that evaluate the financial crisis impact on the effectiveness of monetary policy in the credit market (Gambacorta and Marques-Ibanez, 2011; Fungáčová, Solanko and Weill, 2014; Heryán and Tzeremes, 2016).

The main objective of this study is to analyze the lending channel for an emerging economy, under different scenarios of banking concentration. In particular, we present empirical evidence to address this issue based on the Colombian experience. The analysis on Colombia deserves attention because is a small open economy that works under inflation targeting, has an investment degree in sovereign risk, shows a growing trend in the banking system concentration, and has an interesting scenario of credibility building up in its monetary policy (Ciro and de Mendonça, 2017).

This study contributes to the literature in several aspects. Firstly, it is the first study to analyze the lending channel for the Colombian economy in the period after the adoption of the inflation targeting. Secondly, it complements the studies of Adams and Amel (2005), Olivero,

Li and Jeon (2011), Fungáčová, Solanko and Weill (2014), Ghossoub and Reed (2015), and Khan, Ahmad and Gee (2016) and shows evidence that points out the relevance of banking concentration and the size of banks to evaluate the lending channel. Thirdly, the lending channel is examined in two phases of banking concentration that present a structural break in Colombia. Finally, the study indicates that bank concentration should be monitored by policymakers because it mitigates the ability of monetary policy to affect the lending.

The remainder of this paper is organized as follows: Section 2 presents the methodology for analyzing the effect of monetary policy on lending; Section 3 provides empirical evidence, by means of econometric analysis, of the monetary policy effect on bank lending; Section 4 divides the results according to the banking concentration scenarios; Section 5 concludes the paper.

2. Methodology and data

The central bank affects the financial intermediation returns because the policy rate influences funding and the opportunity cost of deposits. In short, a contractive monetary policy increases the cost of alternative sources of financing and impacts the liabilities of banks. Consequently, monetary policy rate is a variable that must be considered to analyze the bank loans portfolio (Bernanke and Blinder, 1988; Bernanke and Gertler, 1995; Gambacorta and Marques-Ibanez, 2011).

In order to check the existence of the lending channel, the growth rate of outstanding total gross loans is regressed on changes of the monetary policy rate and its interactions with individual bank characteristics. In addition, we include control variables associated with demand effects. Therefore, the basic model for the empirical analysis is the following:

$$\Delta L_{it} = \mu_i + \alpha_1 \Delta L_{it-} \ + \beta_1 MP_{t-1} + \sum_{j=1}^{3} \rho_j X_{i,t-1}{}^{j} MP_{t-1} + \sum_{k=1}^{3} \gamma_k Z_{k,t-1} + \varepsilon_{it} \qquad (1)$$

where $i = 1, \ldots, N$ represents the total number of banks and $t = 1, \ldots, T$ represents the monthly data. The variable L_{it} represents the nominal bank lending of bank i in period t, MP represents the changes in the interest rate controlled by the monetary authority, $X_{i,t}$ represents a matrix of supply variables associated with the banks-specific characteristics and Z_t represents a demand factors common to all banks. The residual term ε_{it} is assumed to follow an iid distribution with zero mean and constant variance and μ_i indicates bank-specific fixed effects. The model is a well-established model in the literature and has been used by Kashyap and Stein (1995), Altunbaş, Fazylov and Molyneux (2002), Ehrmann et al. (2003), Gambacorta (2005), Ashcraft (2006), Gambacorta and Marquez-Ibanez (2011), Ramos-Tallada (2015), Simpasa, Nandwa and Nabassaga (2015), Gómez-González et al. (2016), among others.

The banks-specific variables consider the heterogeneous response of banks to changes in funding costs. Thus, the bank-specific characteristics are size ($Size_{it}$), liquidity (liq_{it}) and capitalization (liq_{it}). It is also important to control the economic performance that can affect the growth rate of the loans. Consequently, based on the approach of Kashyap and Stein (1995), Gambacorta, (2005), Matousek and Sarantis (2009), and Ramos-Tallada (2015), we used

macroeconomic variables such as real GDP growth rate (ΔY_t), the industrial production index (IPI_t) and the exchange rate volatility (Δe_t) as representative variables of the loan demand.[1]

From the basic model, we used the following equation to calculate the impact of monetary policy on the growth rate of loans:

$$\frac{\partial \Delta L_{it}}{\partial MP_{t-1}} = \beta_1 + \rho_1 Size_{it} + \rho_2 liq_{it} + \rho_3 cap_{it} \qquad (2)$$

The data is an unbalanced panel with 2772 observations in monthly frequency, with 22 financial institutions ($i = 22$) from January 2007 to June 2017 ($t = 126$). Summary descriptive statistics for the variables used in the analysis are presented in Table 1. As usual in the lending channel analysis, we use a dynamic data panel framework (D-GMM). It is important to note that there is the possibility of simultaneity problem in the analysis since the macroeconomic variables may be influenced by lending supply, which, in turn, suggests endogeneity problem in the regressions. To avoid the possible problems of endogeneity, we used the GMM method, which allows obtaining consistent and unbiased estimates. According to Arellano and Bond (1991), endogeneity problems can be minimized under an adequate instruments selection. For this, the advice is to use the first difference of the data and lagged terms of the explanatory variables as instruments (D-GMM). In order to confirm the validity of the instruments in the models, the over-identification test (Sargan test) is used as suggested by Arellano (2003). In addition, serial correlation tests (AR(1) and AR(2)) were performed.

Table 1 – Summary descriptive statistics

Variable	Mean	SD	Min	Max
Bank-Specific				
ΔL_{it}	0.0112	0.0180	-0.1213	0.1375
$Size$	0.0353	0.0591	0.0001	0.2535
liq	0.0830	0.1090	0.0090	0.6711
cap	0.1477	0.0648	0.0847	0.8384
Monetary Policy				
MP	0.0000	0.0027	-0.0100	0.0050
Macroeconomic variables				
ΔY	0.0384	0.0176	0.0008	0.0776
IPI	99.5002	6.0449	84.3918	112.335
Δe	6.2283	103.65	-283.65280	280.93
Banking concentration				
ΔHHI	1.2767	16.9871	-62.7633	53.9467

Source of data: Financial Superintendence of Colombia and Central Bank of Colombia.

[1] See Table A.1 (Appendix) for sources of data and description of all variables used in the study.

3. Empirical Evidence

The empirical results of the baseline model are presented in table 2. All GMM regressions accept the null hypothesis of the Sargan test and thus the over-identification restrictions are valid. In addition, both serial autocorrelation tests (AR(1) and AR(2)) reject the hypothesis of autocorrelation.

Table 2 – Lending channel for Colombia

Estimator:	**D-GMM**				
Regressors:	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**
ΔL_{it-1}	-0.2465***	-0.2633***	-0.2536***	-0.2333	-0.2949***
	(0.0119)	(0.0149)	(0.0113)	(0.0169)	(0.0302)
MP_{t-1}	-2.5784***	-2.0307***	-2.9357**	-2.3719***	-1.6410***
	(0.3064)	(0.3081)	(0.2937)	(0.3051)	(0.3059)
$MP_{t-1} * liq_{it-1}$	8.5961***	5.7889***	9.6465***	8.9062***	5.6011***
	(1.5038)	(0.7218)	(1.2503)	(1.4320)	(1.6613)
$MP_{t-1} * Size_{it-1}$	6.7442	5.2262	9.6252	2.5057	0.0010
	(4.6902)	(3.5560)	(7.2143)	(6.2179)	(10.7177)
$MP_{t-1} * cap_{it-1}$	7.5889**	5.7299**	13.2195***	10.6538***	7.7641***
	(3.0418)	(2.3598)	(1.8104)	(2.7727)	(3.8632)
ΔY_{t-1}		0.7406***			0.5145***
		(0.1071)			(0.1323)
IPI_{t-1}			0.0016***		0.0010***
			(0.0001)		(0.0002)
Δe_{t-1}				-0.1451**	-0.2233***
				(0.0199)	(0.0371)
J-stat	19.78	18.00	17.07	19.12	16.49
Sargan test (p-value)	0.28	0.32	0.38	0.26	0.28
AR(1) p-value	0.14	0.22	0.09	0.62	0.12
AR(2) p-value	0.21	0.16	0.82	0.10	0.16
Number of Instruments	22	22	22	22	22
Observations	2562	2562	2562	2562	2562

Note: Marginal significance levels: (***) denotes 0.01, (**) denotes 0.05, and (*) denotes 0.1. Standard errors between parentheses. D-GMM – uses two-step of Arellano and Bond (1991) without time period effects. Tests AR(1) and AR(2) check that the average autocovariance in first order residuals is zero. The sample is an unbalanced panel of 22 financial institutions.

Overall, the coefficient of monetary policy rate presents a negative relationship with the growth rate of loans in all models and have statistical significance. The findings also show that the interaction of liquidity and solvency with the monetary policy rate is positive and significant. Thus, the most liquid and solvent banks can use their assets and isolate the adverse effects of monetary policy. These findings are in line with Kashyap and Stein (2000), Kishan and Opiela (2000), Ehrmann et al. (2003), Gambacorta (2005) and Matousek and Sarantis (2009).

The interaction between the size and the monetary policy rate is not significant. As suggested by Khan, Ahmed and Gee (2016), the size of assets becomes important to isolate monetary policy shocks only when associated with an increase in banking concentration. Other studies have also found that the size of banks alone does not serve to isolate monetary policy shocks (see, Ehrmann et al., 2003, Gambacorta, 2005, Gómez-González et al., 2016).

Based on the descriptive statistics (see Table 1), if liquidity and solvency and their average values are considered, the final effect a policy shock on the loans growth in the full model (model 5) is:

$$\frac{\partial \Delta L_{it}}{\partial MP_{t-1}} = -1.641 + 5.601 * 0.083 + 7.764 * 0.147 = -0.105 \qquad (3)$$

This indicates that once the average liquidity and solvency of the financial system are considered, thereby confirming the existence of the lending channel for Colombian economy. Specifically, for the 2007-2017 period, a variation of 1% of the monetary policy rate decreases by 10.5% the growth rate of bank loans.

The statistical significance and the signs of the coefficients of the variables associated with the demand for credits are as expected. It is observed that the coefficient on the economic growth is positive and significant. That is, in accordance with previous studies of Matousek and Sarantis (2009), Olivero, Li and Jeon (2011), Ramos-Tallada (2015) and Khan, Ahmed and Gee (2016), the greater dynamism of economic activity increases the growth rate of bank loans. Although, economic growth favors the increase in riskier loans (see, Kashyap and Stein, 1995).

The coefficient on industrial production is significant with positive sign. The behavior of industrial production is a measure of expectations and confidence in the economy. This suggests that greater confidence in the economy is followed by an increase in the bank loans demand to finance investments. Finally, the coefficient on exchange rate volatility is negative and significant. According to Simpasa, Nandwa and Nabassaga (2015) for the emerging economies the exchange rate volatility is associated with greater external uncertainty and macroeconomic instability, and, therefore, lower bank loans demand.

4. Two phases of banking concentration

The structural characteristics of the financial system are important to evaluate the monetary policy management. According to Adams and Amel (2005), Fungáčová, Solanko and Weill (2014), and Olivero, Li and Jeon (2011), a more concentrated banking system is associated with an increase in substitutive sources of financing by large banks. As a result, monetary policy loses degrees of freedom to affect the supply of credit.

There are several ways of defining and calculating concentration. A part of the literature indicates that there is an inverse relationship between concentration and competition of the banking sector (Adams and Amel, 2005). Another strand of literature analyzes the concentration with emphasis in the bank's pricing strategies (Olivero, Li and Jeon, 2011; Fungáčová, Solanko and Weill, 2014; Ghossoub and Reed, 2015; Khan, Ahmad and Gee, 2016).

We used the Hirschman-Herfindahl index (HHI), which is applied by government institutions as well as financial regulation agencies (Adams and Amel, 2005; Al-Muharrami, Matthews and Khabari, 2006). Among several indices, the HHI is intuitive, easy to calculate and has low data requirements, important characteristics for the limited data in Colombian economy. The HHI measures the structural characteristics of the market since it considers the number of competitors and their relative participation. The index is calculated by squaring the market share and then summing the squares of the *i-th* bank in the system. Hence,

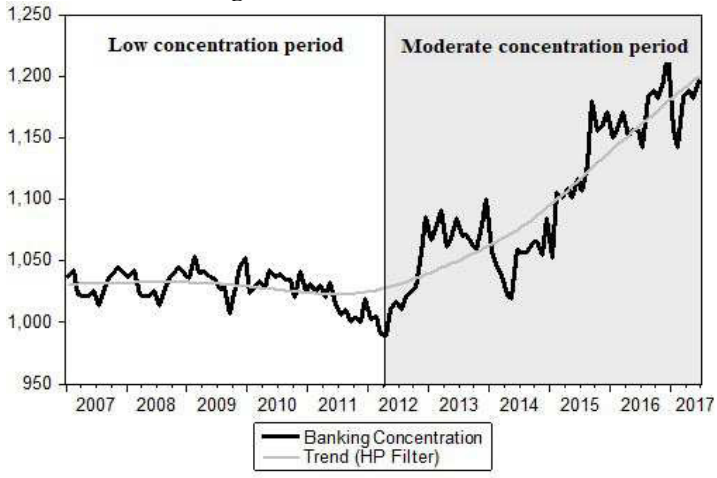
$$HHI = \sum_{i=1}^{N} \left(\frac{X_i}{X} * 100\right)^2 \qquad (4)$$

Where X_i is the loan portfolio of the *i-th* bank, $\frac{X_i}{X}$ is the loan share of the *i-th* bank in the market and N is the number of banks in the market. The scale of the index is between $0 < IHH < 10{,}000$ and the market structure is classified into three levels. If the index is $0 \leq HHI < 1000$ it indicates a low concentration level, $1000 \leq HHI < 1800$ a moderate level of concentration and $1800 \leq HHI$ indicates a high concentration level.

Taking into account the performance of the banking concentration in Colombia (see, Hirschman-Herfindah index in figure 1) it is possible to verify that there exists two distinct phases. We can identify a "low concentration period" (January of 2007 to January of 2012) that is a period in which the market structure remained stable after the financial uncertainty by subprime crisis; and a "moderate concentration period" (January of 2012 to June of 2017) which that corresponds to a growing trend in the concentration levels of loan portfolio in financial system.

Figure 1

Banking concentration in Colombia



Chow Breakpoint Test 2012M01 – Sample: 2007m01 2017m06

F-statistic	5.828	Prob. F(2,120)	0.003
Log likelihood ratio	11.495	Prob. Chi-Square(2)	0.003

Source of data: Financial Superintendence of Colombia.

Because there exists a change in the concentration over time it is possible to check if there is a difference in the impact of monetary policy on growth rate of loans for the two phases. Hence, using the same methodology adopted in the previous sections we re-estimate equation (1) for "low concentration period" and "moderate concentration period", respectively. The results are presented in table 3. The results allow us to observe that the monetary policy rate effect on the loan growth rate was greater in the "low concentration period" than in the "moderate concentration period". There are three important evidences. Firstly, in both periods it is possible to verify the lending channel, although with different magnitude. For the low concentration period a 1% increase in the monetary policy rate decreased the growth rate of bank loans in $\frac{\partial \Delta L_{it}}{\partial MP_{t-1}} = -1.415$ and for the moderate concentration period the effect was $\frac{\partial \Delta L_{it}}{\partial MP_{t-1}} = -0.684$. Therefore, we can conjecture that the monetary policy ability to affect bank loans depends critically on the banking concentration. Secondly, for the "moderate concentration period", the size of the banks was a significant variable in statistical terms and helped isolate the monetary policy effects on bank loans. Thirdly, the variables associated with the demand for loans had smaller effects in the "moderate concentration period" in relation to earlier. Conversely, the evidence also suggests a lower economic dynamic in the "moderate concentration period".

4.1. Marginal effect of banking concentration on the lending channel

In order to examine the role of banking concentration for the effectiveness of the policy, we also extended the basic model to include the *HHI* variable as a regressor, together with its interactions with the monetary policy indicator (*HHI* * *MP*). Therefore, like Adams and Amel (2005) approach, the model to be estimated is the following:

$$\Delta L_{it} = \mu_i + \alpha_1 \Delta L_{it-1} + \beta_1 MP_{t-1} + \beta_2 (\Delta HHI_{t-1} * MP_{t-1}) + \delta_1 \Delta HHI_{t-1} + \sum_{j=1}^{3} \rho_j X_{i,t-1}{}^{j} MP_{t-1} + \sum_{k=1}^{3} \gamma_k Z_{k,t-1} + \varepsilon_{it} \quad (5)$$

Based on this extended model, we use the following equation to verify the marginal effect of banking concentration on the lending channel:

$$\frac{\partial \Delta L_{it}}{\partial M_{t-1}} = \beta_1 + \beta_2 \Delta HHI_{t-1} + \rho_1 Size_{it} + \rho_2 liq_{it} + \rho_3 cap_{it} \quad (6)$$

With the same methodology adopted before, we estimate equation (5) and the results are displayed in table 4. The results show that the coefficient that measures the effect of monetary policy on the loans growth continues to be negative and significant. In particular, the coefficient associated with the interaction term between monetary policy and banking concentration shows statistical significance and is positive. This suggests that the higher concentration undermines the effectiveness of monetary policy over the growth rate of loans. After banking concentration is considered, the marginal effect of a policy shock on the growth of loans in the complete model is equal to $\frac{\partial \Delta L_{it}}{\partial MP_{t-1}} = -0.023$. Therefore, the findings suggest that the greater banking concentration importantly reduces the loans response to the changes of the policy rate. This evidence is in accordance with previous studies (see, Adams and Amel, 2005; Fungáčová, Solanko and Weill, 2014; Khan, Ahmad and Gee, 2016).

Table 3 – Lending channel for Colombia by concentration phases (D-GMM)

	Low concentration period (2007-2012)					Moderate concentration period (2012-2017)				
Regressors	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**
ΔL_{it-1}	-0.2840***	-0.2942***	-0.3369***	-0.3201***	-0.3525***	-0.1745***	-0.2658***	-0.3263***	-0.3038***	-0.3025***
	(0.0343)	(0.0403)	(0.0247)	(0.0316)	(0.0303)	(0.0185)	(0.0371)	(0.0509)	(0.0407)	(0.0456)
MP_{t-1}	-2.0803***	-1.8928***	-1.7306***	-1.8315***	-1.7947**	-1.1348***	-1.1092***	-1.0906***	-1.1403***	-0.9805***
	(0.7316)	(0.4169)	(0.6172)	(0.4325)	(0.8608)	(0.2791)	(0.1945)	(0.3582)	(0.2855)	(0.3061)
$MP_{t-1} * liq_{it-1}$	4.4289***	4.5807**	6.1568***	5.2076***	13.625***	11.424***	2.4124	10.616***	9.4505***	3.6834**
	(1.5020)	(1.9405)	(1.2767)	(1.0055)	(4.5047)	(2.0560)	(2.4761)	(1.4459)	(1.2441)	(1.8565)
$MP_{t-1} * Size_{it-1}$	11.003	12.252	10.8466	10.7096	3.9572	19.595**	10.0850	21.084**	21.007**	25.998*
	(7.8174)	(8.3816)	(11.074)	(9.7888)	(17.672)	(9.5854)	(14.1746)	(10.807)	(8.6839)	(15.288)
$MP_{t-1} * cap_{it-1}$	5.7646	2.0637	2.1709	3.0975	3.7935	5.0688	9.9933**	3.2469	3.3623	1.2040
	(8.5218)	(4.2664)	(3.9976)	(3.4160)	(3.6654)	(3.4871)	(3.6516)	(3.2329)	(2.0602)	(3.7362)
ΔY_{t-1}		0.4940***			0.2812***		0.1591***			0.2291**
		(0.1727)			(0.0823)		(0.0389)			(0.0534)
IPI_{t-1}			0.0015***		0.0018***			0.0006***		0.0005***
			(0.0004)		(0.0003)			(0.0001)		(0.0001)
Δe_{t-1}				-0.1473***	-0.1482***				-0.1330**	-0.1262***
				(0.0375)	(0.0157)				(0.0185)	(0.0196)
J-stat	18.71	13.91	14.87	15.69	11.80	18.36	21.24	19.45	19.97	18.16
Sargan test (p-value)	0.34	0.60	0.53	0.47	0.66	0.36	0.16	0.24	0.22	0.20
AR(1) p-value	0.41	0.65	0.16	0.08	0.58	0.32	0.39	0.10	0.09	0.16
AR(2) p-value	0.18	0.34	0.20	0.12	0.38	0.39	0.21	0.14	0.13	0.18
Number of Instruments	22	22	22	22	22	22	22	22	22	22
Observations	1165	1165	1165	1165	1165	1309	1309	1309	1309	1309

Note: Marginal significance levels: (***) denotes 0.01, (**) denotes 0.05, and (*) denotes 0.1. Standard errors between parentheses. D-GMM – uses two-step of Arellano and Bond (1991) without time period effects. Tests AR(1) and AR(2) check that the average autocovariance in first order residuals is zero.

Table 4 – Marginal effect of banking concentration on the lending channel for Colombia

Estimator:	D-GMM				
Regressors:	Model 1	Model 2	Model 3	Model 4	Model 5
ΔL_{it-1}	-0.2749***	-0.2646***	-0.2854***	-0.3068***	-0.2565***
	(0.0115)	(0.0257)	(0.0219)	(0.0312)	(0.0354)
MP_{t-1}	-1.7766***	-1.6476***	-2.1019***	-1.3949***	-1.4745***
	(0.6260)	(0.3874)	(0.5296)	(0.5021)	(0.5006)
$MP_{t-1} * \Delta HHI_{t-1}$	0.0038***	0.0034***	0.0018**	0.0044***	0.0049***
	(0.0009)	(0.0010)	(0.0008)	(0.0009)	(0.0014)
$MP_{t-1} * liq_{it-1}$	7.1751***	4.6222***	8.0155***	6.7595***	5.6036**
	(1.0200)	(1.2633)	(0.8642)	(1.1274)	(2.6391)
$MP_{t-1} * Size_{it-1}$	2.9395	2.8328	4.6155	6.8311	1.2142
	(6.4562)	(5.1300)	(6.4880)	(7.4188)	(9.0138)
$MP_{t-1} * cap_{it-1}$	5.1088***	4.7639***	3.5187***	5.6312**	7.1077***
	(1.5793)	(1.81891)	(1.1714)	(2.2791)	(2.3590)
ΔHHI_{t-1}	-0.0001***	-0.0001***	-9.38E-05*	-8.90E-05*	-0.0001**
	(3.84E-05)	(5.03E-05)	(5.50E-05)	(5.12E-05)	(7.34E-05)
ΔY_{t-1}		0.7361***			0.3910**
		(0.1027)			(0.1743)
IPI_{t-1}			0.0017***		0.0006***
			(0.0001)		(0.0002)
Δe_{t-1}				-0.2064***	-0.1593**
				(0.0345)	(0.0256)
J-stat	15.94	15.89	16.29	15.88	16.53
Sargan test (p-value)	0.31	0.33	0.29	0.32	0.27
AR(1) p-value	0.09	0.14	0.13	0.16	0.17
AR(2) p-value	0.13	0.13	0.11	0.24	0.10
Number of Instruments	22	22	22	22	22
Observations	2562	2562	2562	2562	2562

Note: Marginal significance levels: (***) denotes 0.01, (**) denotes 0.05, and (*) denotes 0.1. Standard errors between parentheses. D-GMM – uses two-step of Arellano and Bond (1991) without time period effects. Tests AR(1) and AR(2) check that the average autocovariance in first order residuals is zero. The sample is an unbalanced panel of 22 financial institutions.

5. Concluding remarks

Empirical evidence on the bank lending channel in emerging economies is scarce. The present paper contributes to addressing this issue and provides new evidence of the lending channel for the Colombian economy during the period 2007-2017 using bank-level data. The estimations allow to establish that the monetary policy has the capacity to affect the growth rate of loans in the case of Colombia. Overall, we find that increases in the policy rate decrease the growth rate of bank loans, although individual bank characteristics such as the liquidity and solvency mitigate the monetary policy shock.

The measure of the banking concentration used in this study allow one to see that in the period from 2007 to 2017 the concentration was unstable, and it is possible to identify two phases in the market structure. A first phase goes from 2007 to 2012 with a low and stable banking concentration. The second phase goes from 2012 to 2017 presents a sustainable growth in the concentration and thus it indicates less competition in the banking system in Colombia. Our results show the adverse implications that the greater banking concentration brings to the effectiveness of the monetary policy. Accordingly, the central bank loses degrees of freedom to affect the growth rate of bank loans in a greater concentration scenario and banks size mitigate the monetary policy shock. In brief, such as observed by Adams and Amel (2005), Olivero, Li and Jeon (2011), Fungáčová, Solanko and Weill (2014), the overall conclusion is it is necessary a closer monitoring in concentration and structure of the banking system by monetary policymakers.

6. References

Adams, R., Amel, D. (2005). The effects of local banking market structure on the banking-lending channel of monetary policy. Finance and Economics Discussion Series No. 2005-16, Board of Governors of the Federal Reserve System (U.S.). Washington.

Al-Muharrami, S., Matthews, K., Khabari, Y. (2006). "Market structure and competitive conditions in the Arab GCC banking system." *Journal of Banking & Finance*, 30(12), 3487-3501.

Altunbaş, Y., Fazylov, O., Molyneux, P. (2002). "Evidence on the bank lending channel in europe." *Journal of Banking & Finance*, 26(11), 2093-2110.

Arellano, M., Bond, S. (1991). "Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations". *The Review of Economic Studies*, 58(2), 277-297.

Arellano, M. (2003). *Panel data econometrics*. Oxford University Press. 231p.

Ashcraft, A.B. (2006). "New evidence on the lending channel." *Journal of Money, Credit and Banking*, 38(3), 751-775.

Bernanke, B. S., Blinder, A. (1988). "The Federal Funds Rate and the Channels of Monetary Transmission." *American Economic Review*, 82(4), 901-921.

Bernanke, B. S., Gertler, M. (1995). "Inside the black box: The credit channel of monetary policy." *The Journal of Economic Perspectives*, 9(4), 27-48.

Blinder, A., Ehrmann, M., Fratzcher, M., De Haan, J., Jansen, D. (2008). "Central Bank Communication and Monetary Policy." *Journal of Economic Literature*, 46(4), 910-945.

Ciro, J.C., de Mendonça, H.F. (2017). "Effect of Credibility and Reputation on Discretionary Fiscal Policy: Empirical evidence from Colombia." *Empirical Economics*, 53(4), 1529-1552.

De mendonça, H.F. (2007). "Towards credibility from Inflation targeting: the Brazilian experience." *Applied Economics*, 39(20), 2599–2615.

Ehrmann, M., Gambacorta, L., Martinez-Pages, J., Sevestre, P., Worms, A. (2003). Financial systems and the role of banks in monetary policy transmission in the euro area. In: Angeloni, I., Kashyap, A., Mojon, B. (Eds.): *Monetary Policy Transmission in the Euro Area.* Cambridge University Press, 235-269.

FungáčovÁ, Z., Solanko, L., Weill, L. (2014). “Does competition influence the bank lending channel in the euro area?.” *Journal of Banking & Finance*,49(C), 356-366.

Gambacorta, L., Marques-Ibanez, D. (2011). “The bank lending channel: lessons from the crisis.” *Economic Policy*, 26(66),137-182.

Gambacorta, L. (2005). “Inside the bank lending channel.” *European Economic Review*, 49 (7), 1737–1759.

Ghossoub, E., Reed, R. (2015). “The size distribution of the banking sector and the effects of monetary policy.” *European Economic Review*, 75(C), 156-176.

Gómez-González, J., Kutan, A., Ojeda-Joya, J., Ortiz, M. (2016). “The Bank Lending Channel of Monetary Policy: Does the Financial Structure of Banks Matter.” *Borradores de Economía*, 953, 1-22.

Heryán, T., Tzeremes, P. (2016). “The bank lending channel of monetary policy in EU countries during the global financial crisis.” *Economic Modelling*, 67(December), 10-22.

Kashyap, A.K., Stein, J.C. (1995). “The impact of monetary policy on bank balance sheets.” *Carnegie-Rochester Conference Series on Public Policy*, 42, 151–195.

Kashyap, A.K., Stein, J.C. (2000). “What do a million observations on banks say about the transmission of monetary policy.” *American Economic Review*, 90 (3), 407–428.

Khan, H., Ahmad, R., Gee, C. (2016). “Bank competition and monetary policy transmission through the Bank Lending Channel: Evidence from ASEAN.” *International Review of Economics and Finance*, 44(C), 19-39.

Kishan, R.P., Opiela, T.P. (2000). “Bank size, bank capital, and the bank lending channel.” *Journal of Money, Credit and Banking*, 32(1), 121–141.

Levy-Yeyati, E., Micco, A. (2007). “Concentration and foreign bank penetration in Latin American banking sectors: Impact on competition and risk.” *Journal of Banking and Finance*, 31(6), 1633-1647.

Matousek, R., Sarantis, N. (2009). “The bank lending channel and monetary transmission in central and eastern European countries.” *Journal of Comparative Economics*, 37 (2), 321–334.

Montes, G. (2013). “Credibility and monetary transmission channels under inflation targeting: An econometric analysis from a developing country.” *Economic Modelling*, 30(C), 670-684.

Olivero, M. P., Li, Y., Jeon, B. N. (2011). “Competition in banking and the lending channel: Evidence from bank-level data in Asia and Latin America.” *Journal of Banking & Finance*, 35(3), 560-571.

Ozsuca, E., Akbostanci, E. (2012). An Empirical Analysis of the Bank Lending Channel in turkey. ERC Working Papers No. 1205, Economic Research Center, Middle East Technical University. Ankara-Turkey.

Ramos-Tallada, J. (2015). “Bank risks, monetary shocks and the credit channel in Brazil: Identification and evidence from panel data.” *Journal of International Money and Finance*, 55(C), 135-161.

Simpasa, A., Nandwa, B., Nabassaga, T. (2015). “Bank lending channel in Zambia: empirical evidence from bank level data.” *Journal of Economic Studies*, 42(6), 1159-1174.

Appendix

Table A.1

Sources of data and description of the variables

	Type	***Variable***	***Definition***	***Source***
Dependent Variable	i	L_{it}	% growth of outstanding total gross loans.	Financial Superintendence of Colombia https://www.superfinanciera.gov.co/jsp/60950
Monetary Policy	c	*MP*	Variation of observed monetary policy rate.	Central Bank of Colombia http://www.banrep.gov.co/es/tasas-interes
Factors affecting the sensitivity of lending to a monetary shock	i	*Liq*	Ratio of liquid assets (cash, interbank lending and securities) to total assets.	Financial Superintendence of Colombia https://www.superfinanciera.gov.co/jsp/60951
	i	*cap*	Ratio of capital and reserves to total assets.	Financial Superintendence of Colombia https://www.superfinanciera.gov.co/jsp/60949
	i	*Size*	Ratio of bank assets to total system assets.	Financial Superintendence of Colombia https://www.superfinanciera.gov.co/jsp/60949
Control Variables	c	ΔY	Annual growth rate of real GDP (accumulated in the last 4 quarters).	Central Bank of Colombia http://www.banrep.gov.co/es/imaco
	c	*IPI*	Monthly variation in industrial production (IPI index).	Central Bank of Colombia http://www.banrep.gov.co/es/produccion
	c	Δe	Exchange rate variation.	Central Bank of Colombia http://www.banrep.gov.co/es/trm
Banking concentration	c	*HHI*	Hirschman-Herfindahl index.	Devised by authors based on equation (4) and data from Financial Superintendence of Colombia https://www.superfinanciera.gov.co/jsp/60950

Note: c or i stand respectively for "common to all banks" or "bank-specific variable".