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This article investigates the short-term and long-term effects of bank market power on the availability of credit for companies, and on firm investment. Our results suggest that an increase in bank market power reduces firms' credit availability and investment in the short-term, but firm investment recovers in the long-term. The economic significance of these relationships is found to be larger for SMEs than for other (larger) firms.

Keywords: Bank loans, bank market power, Euler equation, firm investment rate, risk premium.

Subject classification codes: G21; G31; D40

1. Introduction and motivation

A number of contributions have suggested that bank market power could reduce lending availability for small and medium enterprises (SMEs hereafter) (Carbó et al. 2009, Ryan et al., 2014), reducing company size (Cetorelli 2004; Cetorelli and Strahan, 2006), and the creation of new firms (Black and Strahan, 2002; Bonaccorsi di Patti and Dell'Ariccia, 2004; Bonaccorsi di Patti and Gobbi, 2007). However, few studies have paid attention to how these relationships may change over time. One exception is Degryse et al. (2011) who suggest the existence of long-term effects of bank concentration, finding evidence of discontinuation in the relationship between banks and firms after the mergers. Other studies have concluded that bank concentration creates informational rents (Ogura, 2010, 2012; Petersen and Rajan, 1995) which allow banks to invest specific resources in relationship with borrowers that may also have long-term effects (Degryse and Ongena, 2007; Elsas, 2005; Presbitero and Zazzaro, 2011). Perhaps, the conflicting results suggesting a negative relationship between bank market power and firm financial restrictions (and investment) in some cases, and a positive relationship in other cases, can be somehow reconciled analysing both a short-term and a long-term perspective.

In this article, we investigate the relationship between bank market power and firms' credit availability and investment both in the short-run and the long-run in Spain. To perform our empirical analysis, we rely on a unique and representative sample combining firm and bank information from *Bureau van Dijk's* SABI database and the three Spanish banking associations –AEB, CECA, and UNACC- consisting of 578,188 observations (61,174 Spanish firms) for the period 1998-2009. We employ the Lerner index as a measure of bank market power. We also use Granger predictability to explore the direction of the relationship between bank market power and firm investment. As a way of preview, the main findings are the following: (i) bank market power exerts a negative influence on credit availability and the firm investment rate in the short run; (ii) The negative relationship holds in the short term but investment rate grows again in the long term. The results are robust when we employ alternative investment variables such as asset growth or investment over assets, and when the Lerner index is replaced by measures of bank loan concentration; (iii) the Granger predictability test shows that bank market power predicts firm investment, but not the opposite.

The remainder of the paper is structured as follows. Section 2 provides the background for the theoretical and empirical literature on different firm investment methodologies and approaches to bank market structure. Section 3 presents the methodology. Section 4 describes the data. Section 5 offers the main results. Section 6 concludes.

2. Background literature

Previous studies have highlighted the importance of the availability of bank credit for SMEs (Berger and Udell, 1998, 2002, 2006), and the impact of bank credit constraints on the access to other financial resources, such as trade credit (Fisman and Love, 2003; Fisman and Raturi, 2004; Petersen and Rajan, 1997). Overall, difficulties in the access to external finance have been shown to hamper firm growth and induce an increase in company liquidations (Canales and Nanda, 2012).

However, there are conflicting results in previous studies on the relationship between bank market power, firm financing constraints and, ultimately, investment. Some studies advocate that bank competition can have positive effects on firm financing (Berger, 1995; Berger and Udell, 2002; Berger and Black, 2011; Boot and Thakor, 2000; Carbó et al., 2009; Cetorelli and Gambera, 2001; Cetorelli, 2004; Elsas, 2005; Ogura, 2010, 2012; Sapienza, 2002; Scott and Dunkelberg, 2003, 2010; Zarutskie, 2006)[1]. In this vein, there has been empirical evidence suggesting that bank concentration reduces firm access external finance, particularly in countries with poor institutional development or significant restrictions to financial activities (Beck et al., 2004). These effects have been found to be particularly acute in the the case of SMEs (see Craig and Hardee, 2007).. Agostino and Trivieri (2008, 2010) show, for Italian firms, the negative effect of local bank market power on firms' access to bank finance. Scott and Dunkelberg (2010) find that increases in bank competition improve both bank and non-bank financing availability. Canales and Nanda (2012) analyse the effects of bank deregulation and

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[1] Berger et al. (2004) offer an extensive overview of the effects of bank concentration on firm financing, particularly for the case of SME financing, and offer a future research agenda as well.

competition on the amount and price of loans offered to firms. They show that decentralized banks tend to lend more to firms, particularly SMEs, thereby increasing entrepreneurial activity. Financial institutions offer more attractive terms to firms in competitive environmental markets, and they are in a better position to select the healthiest firms and restrict credit in areas where they have the necessary market power. Similarly, Ryan et al. (2014) find that increased bank market power results in increased financial constraints for the SMEs that are more dependent on bank financing. This result strongly supports the market power hypothesis.

There are studies suggesting that bank market power may be perceived by financial institutions as a necessary tool to extract information from borrowers (Ogura, 2010; Petersen and Rajan, 1994, 1995; Rajan, 1992). The seminal work of Petersen and Rajan (1995, 2002) concludes that banks can extract informational rents of their relationship with customer and lend to increasingly distant firms without compromising their ability to underwrite or monitor those loans. Various studies have shown ways in which information technology could be employed as a lending tool for the smallest firms, including fixed-asset lending, asset-based lending, or even credit scoring.[2] Dell'Ariccia (2000) shows that the effect of banking competition on screening gives rise to certain ambiguities resulting in a prisoners' dilemma in which banks must decide between relationship and transactional lending. Boot and Thakor (2000) show that bank competition reduces the profitability of transactional lending in relation to relationship lending. Thus, the authors find that the profit that each bank gains by investing in

[2] Recent empirical papers have shown that the comparative advantage of large banks in hard information technologies do not appear to be monotonically increasing with firm size (see Berger et al., 2005a, b; Berger and Black 2011; Frame et al., 2001).

knowledge decreases as income increases, so the income per unit of relationship lending decreases. Degryse and Ongena (2001) find that profitability is higher if firms maintain only one bank relationship, whilst firms having relationships with more than one bank are generally smaller and younger than companies which do not.[3] Carbó *et al.* (2012) show that firms with more intense relationships throughout their lifespan and a lower number of banks enjoy greater credit availability and are less likely to be credit constrained. In the same line, Kano et al. (2011) suggest that the bank-borrower relationship depends on three factors, identified by the economic literature as: verifiability of information, bank size and complexity, and bank competition. Based on a database of Japanese firms, the authors find evidence that longer relationships benefit borrowers and smaller banks in terms of reduced loan interest rates and credit availability, although they find that bank competition has little effect on the benefits derived from relationship lending.

As for the intensity of the relationship, some studies document the existence of a U-shaped relationship between market concentration and bank-firm relationships (Degryse and Ongena, 2007; Ogura, 2010, 2012; Ongena et al., 2012; Presbitero and Zazzaro, 2011). Using loan information of five major German banks, Elsas (2005) shows the existence of a U-shaped relationship between banking concentration in a local credit market and the likelihood of a relational bank-firm tie. Degryse and Ongena (2007) also find a U-shaped relationship between market concentration and the likelihood of bank branches providing bank credit. This result confirms that the non-monotonic effect of market concentration is robust to controls on the presence of local credit markets for

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[3] See also Goddard and Wilson (2009); Goddard et al., (2007, 2011) for a complete overview of New Industrial Organization approaches as profit hypotheses, as well as different methodological aspects.

banks with multiple contacts. Presbitero and Zazzaro (2011) extend their analysis by suggesting that this non-monotonicity can be explained by examining the organisational level of local credit markets. Ongena et al. (2012) explore the determinants of creditors' concentration by using an extensive bank-firm database for German firms. They show that bank borrowing is often concentrated in a *Hausbank*, which plays an important role in determining creditor concentration. Similarly, Ogura (2012) predicts that bank market power, measured as the price-cost margin, improves credit availability, in particular for younger firms, although in the second step of his analysis, the results reveal that the adjusted price-cost margin is negatively correlated to the share of nationwide larger banks; he also provides evidence for the positive impact of the price-cost margin, as a measure of bank market power, on credit availability for new firms, as well as indirect evidence that higher bank market power is likely to be generated by relationship banking. Ogura (2012) also shows that the price-cost margin is inversely U-shaped, consistent with the argument presented by the theoretical model of Dinc (2000).

Black and Strahan (2002) examine the effects of bank market concentration on the constitution of new firms, and find a strong negative relationship between bank market concentration and new business formation. Bonaccorsi di Patti and Dell'Ariccia (2004) find the existence of a bell-shaped relationship between bank market concentration and company creation. Moreover, these authors also find evidence that bank competition might prove less favourable to the creation of new firms in the industrial sector, where informational asymmetries are more important. Zarutskie (2006) examines the impact of bank competition on bank credit and firm investment, concluding that in competitive bank environments younger firms invest less, suggesting that competition increases firm financing constraints, diminishing the effects in the long run. This result is in line with Rice and Strahan (2010), who find that firms in a more competitive environment are more likely to borrow from banks at a lower cost. Other papers also relate bank market concentration and business size. Cetorelli (2004) finds that improving market competition leads to the removal of financial barriers to new firms, as well as possibly helping to increase company size in terms of added value or employment. Closely related with the present study, Bonaccorsi di Patti and Gobbi (2007) find that firms borrowing from banks involved in a process of M&A have a higher investment rate after the merger, whilst Degryse et al. (2011) criticise Bonaccorsi di Patti and Gobbi(2007) for failing to find a larger mergers effect for firms less dependent on banks.

Based on the theoretical foundations presented above, we propose the following two hypotheses. The first one will benchmark our paper with previous studies while the second represents the main contribution:

Hypothesis 1: *There is an inverse relationship between bank market power and firm financing and investment. As bank market power increases, firm financing and the firm investment rate declines.*

Hypothesis 2: *The impact of bank market power is greater in the short run than in the long run, as the effects of bank market power will gradually ease.*

3. Data and methodology

3.1. Data

The main data source for the firm-level data is the *Bureau van Dijk's* SABI (2010) database. SABI contains comprehensive information on balance sheets, financial statements and financial ratios for around 1 million Spanish and Portuguese firms for the period 1998 to 2009. Our sample consists of 61,174 Spanish firms, representing a data panel consisting of 578,188 company-bank observations.

For each company SABI reports the main bank of each firm. This allows us to complement company information with the features of its corresponding bank balance sheet and financial statement each period; this way, we are able to link company and bank information in a single database. Note that the SABI database is updated regularly and information on bank-firm relationships is overwritten. We solve this issue by comparing information from previous versions of the database.

The second set of variables are those related to bank information. We construct the bank dataset from the financial statements provided by the Spanish Banking Association (AEB), the Spanish Savings Banks Association (CECA), and the National Union of Credit Cooperatives (UNACC).[4] After constructing company and bank panel data, we merge both datasets by adding the bank information to each firm data point. Table 1 contains the definition of and explanatory comments on the variables employed in this paper. We winsorize the variables at 1%.

3.2. Empirical approach

The empirical strategy relies on three important features. Firstly, while most of the previous approaches analyse the effects of bank market structure –market power and concentration indicators- using static estimators, we employ dynamic specifications to estimate the steady-state relationship.[5] We take the short-term relationship as a benchmark with previous studies. Secondly, we use the Lerner index as measure of bank

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[4]The acronyms correspond to the Spanish denominations: Asociación Española de Banca (AEB), Confederación Española de Cajas de Ahorros (CECA), and Unión Nacional de Cooperativas de Crédito (UNACC).

[5] We thank this suggestion to an anonymous referee and the editor.

market power in line with the literature on industrial organization applied to banking. Furthermore, we also introduce the HHI based on total assets to test the robustness of our results. Finally, we also investigate the role of firm credit availability as the transmission channel of bank market power to firm investment. To this purpose, we estimate the impact of market power not only on firm investment but also on firm credit availability.

As our data consists of both time series and cross-section information, we use panel data. As for the time series dimension, we use an Augmented Dickey-Fuller (ADF hereafter) test to examine whether the time series are affected by transitory or permanent shocks (Dickey and Fuller, 1979, 1981). Importantly, the financial crisis may incorporate a structural break that would affect firm variables, particularly investment. In the presence of a structural break the standard ADF tests are biased towards the non-rejection of the null hypothesis. Thus, we follow the Perron's (1989) methodology which includes the single exogenous shock (known) break according to the underlying asymptotic theory by using a modified ADF test. We test for unit root in investment and bank market structure variables in the following three equations:

$$y_{it} = \theta_0 + \theta_1 y_{i,t-1} + \theta_5 DT_t + \theta_4 t + \sum_{i=1}^{L} \vartheta_i \Delta y_{i,t-i} + e_{it} \quad (1a)$$

$$y_{it} = \theta_0 + \theta_1 y_{i,t-1} + \theta_2 T_t + \theta_3 Crisis_t + \theta_4 t + \sum_{i=1}^{L} \vartheta_i \Delta y_{i,t-i} + e_{it} \quad (1b)$$

$$y_{it} = \theta_0 + \theta_1 y_{i,t-1} + \theta_2 T_t + \theta_3 Crisis_t + \theta_4 t + \theta_5 DT_t + \sum_{i=1}^{L} \vartheta_i \Delta y_{i,t-i} + e_{it} \quad (1c)$$

where y_{it} represents the variables to be tested, i.e. investment and bank market structure variables defined in Table 1; T_t represents the change in the level and takes the value one if t = 2007, and zero otherwise; the slope dummy DT_t represents the change in the trend of the slope function DT_t = 1 if t < 2007 and zero otherwise; a crisis dummy $Crisis_t$ = 1 if t = 2007 +1, and zero otherwise. Each of the three models has a unit root with a break under the null hypothesis, as the dummy variables are incorporated in the system. The alternative hypothesis is a broken trend stationary process.

The cointegration model presented in this research follows the Johansen-Fisher panel cointegration test proposed by Maddala and Wu (1999). The Johansen-Fisher test is a panel version of the individual Johansen (1988) cointegration test. Based on the same fundamentals of the Fisher ADF panel unit root test, the Johansen-Fisher panel cointegration test adds the p-values of the Johansen individual eigenvectors and trace statistics. Thus, if π_i is the p-value from an individual cross-section i = 1…N, under the null hypothesis for the panel, the following statistical test is derived:

$$\lambda = -2\sum_{i=1}^{N} \log(\pi_i) \sim \chi^2_{2N} \quad (2)$$

The next step of this research is to assess the relationship between bank market power and firm credit availability (and investment) by running the following autoregressive distributed lags (ADL hereafter) model with structural break in order to show the impact of bank market power over time besides the steady state:[6]

$$\left(\frac{I}{K}\right)_{it} = \beta_0 + \beta_1 \left(\frac{I}{K}\right)_{i,t-1} + \beta_2 LERNER_{ijt} + \beta_3 LERNER_{ij,t-1} + \beta_4 Crisis_t +$$

$$+ \sum_{k=1}^{K} \theta_k IND_{ik} + \sum_{h=1}^{H} \vartheta_h REG_{ih} + \mu_t + \varepsilon_{it} \quad (3)$$

where the subscripts i=1…N refers to the firm, j=1…J refers to the bank with which the firm operates, k=1…K refers to the industry sector in which the firm operates, and finally, h = 1… H refers to a dummy indicating the region where the firm operates.

The main endogenous variable to measure firm investment is the ratio of investment to company capital $(I/K)_{it}$,. Firm investment (I_{it}) will be proxied as the annual

[6] Recall that substituting $(I/K)_{it} = (I/K)_{it-1} + \Delta(I/K)_{it}$, and $LERNER_{ijt} = LERNER_{ijt-1} + \Delta LERNER_{ijt}$ yields the error-correction mechanism equivalent to the ADL model proposed in model (3). Additionally, in the error correction mechanism is the adjustment of (I/K) to equilibrium deviations in the previous period, $(I/K)_{it-1} - \beta LERNER_{ijt-1}$.

change in the net tangible fixed assets plus the depreciation, while company capital (K_{it}) represents *the firm's fixed assets* on its balance sheet. We include two alternative variables to measure firm investment and control for robustness in our results.[7] Firstly, we include asset growth ($\Delta A_{it}/A_{it-1}$), measured as the change in a firm's total assets over its lagged total assets. This variable predicts future abnormal returns. Secondly, we also include the ratio of investment to total assets $(I/A)_{it}$. As we have explained above, the relationship between investment and bank market power may be influenced by a structural break after the beginning of the financial crisis in Spain. In this regard, Table 2 demonstrates that the level of firm investment has been significantly reduced after the crisis. Consequently, we control for the structural break after the banking crisis in Spain by including the variable $Crisis_t$ as defined before.

We include an industry dummy variable (IND_{ik}) to control for the industry effects of company parameters, a regional dummy variable (REG_{ih}) to control for geographic influence on firm performance. Additionally, we include time dummies (μ_t).

The ADL allows us to test if the relationship between the main variables are actually dynamic (i.e. H_0: $\beta_1 = \beta_3 = 0$) and the contemporaneous effect, that we will call the short term effect (i.e. H_0: $\beta_2 = 0$). If the former null hypotheses are rejected, the steady-state or long term effect is estimated as $\frac{\beta_2+\beta_3}{1-\beta_1}$ if $|\beta_1| < 1$.

As for the transmission channel of bank market power to firm investment, we also test the effects of bank market power on firm credit constraints. Since firms borrow from banks in order to invest in fixed capital assets, we repeat the procedure proposed before in order to assess whether the effects of bank market power on firm credit availability

[7] See Huang et al. (2011).

(proxied by firm leverage) is also negative in the short term and positive in the long term. Thus, we propose the following ADL estimation:

$$\left(\frac{B}{K}\right)_{it} = \delta_0 + \delta_1 \left(\frac{B}{K}\right)_{i,t-1} + \delta_2 LERNER_{ijt} + \delta_3 LERNER_{ij,t-1} + \delta_4 Crisis_t + $$

$$+ \sum_{k=1}^{K} \theta_k IND_{ik} + \sum_{h=1}^{H} \vartheta_h REG_{ih} + \mu_t + \varepsilon_{it}$$

(4)

where firm leverage $(B/K)_{it}$ is expressed by the ratio of SABI items *Non-current liabilities: long-term debt* and *Current liabilities: loans* over *the firm's fixed assets*., and the other variables and subscripts are defined above. Furthermore, we complete our analysis by estimating the transmission from firm leverage to firm investment in fixed capital which is expected to be positive in the short term and the long term (i.e. δ_2 and $\delta_3 > 0$ and $|\delta_1| < 1$) to ensure the full transmission of bank market power estimated in model (4). Thus, we propose the following ADL specification:

$$\left(\frac{I}{K}\right)_{it} = \delta'_0 + \delta'_1 \left(\frac{I}{K}\right)_{i,t-1} + \delta'_2 \left(\frac{B}{K}\right)_{it} + \delta'_3 \left(\frac{B}{K}\right)_{ij,t-1} + \delta'_4 Crisis_t + + \sum_{k=1}^{K} \theta_k IND_{ik} + $$

$$\sum_{h=1}^{H} \vartheta_h REG_{ih} + \mu_t + \varepsilon_{it} \quad (5)$$

where the whole variables and the subscripts are defined above.

In order to avoid problems of misspecification, we follow the well-established approach proposed by Fazzari et al. (1988) and Bond and Meghir (1994) for the investment rate. Furthermore, according to previous papers, bank market power may be a source of financial constraints. Consequently, we include the effect of bank market power with four lags in the complete empirical specification to show that the effect of bank market power on firm investment remains regardless the number of lags. Thus, the empirical investment equation to be estimated is given by:

$$\left(\frac{I}{K}\right)_{it} = \varphi_0 + \varphi_1 \sum_{l=1}^{L} LERNER_{ij,t-l} + \varphi_2 \left(\frac{I}{K}\right)_{it-1} + \varphi_3 \left(\frac{CF}{K}\right)_{it-1} + \varphi_4 \left(\frac{I}{K}\right)_{it}^{2} + \varphi_5 \left(\frac{Y}{K}\right)_{it-1} + \varphi_6 \left(\frac{B}{K}\right)_{it-1}^{2} + \varphi_7 MA_{jt} + \varphi_8 GDP_{ht} + \varphi_9 Crisis_t + \sum_{k=1}^{K} \theta_k IND_{ik} + \sum_{h=1}^{H} \vartheta_h REG_{ih} + \mu_t + \varepsilon_{it} \quad (6)$$

The ratio of cash flow over capital $(CF/K)_{it-1}$ controls for cash flow-investment sensitivity (see Bond and Soderbom, 2010; Kaplan and Zingales, 1997, 2000). Cash flow (CF_{it-1}) is measured as *profit before tax* plus *depreciation*. We measure output $(Y/K)_{it-1}$ as sales generated by the firm over *the firm's fixed assets*. We also include the dummy variable MA_{jt} to control for bank merger and acquisitions processes. It takes the value 1 if the bank has been involved in a process of M&A. We also control for the effects of the overall economic conditions by including GDP_{ht} which is the growth rate of gross domestic product. Finally, industry and regional dummy variables are also included in the terms defined before.

3.3. Measuring bank market power: Lerner index, and HHI

We employ the Lerner index as a measure of market power:

$$LERNER_{jt} = \frac{r_{jt} - r_t - C'_{jt}}{r_{jt}} = \frac{p_{jt} - C'_{jt}}{p_{jt}} \quad (7)$$

where r_{jt} is the interest rate that the bank *j* charges to borrowers, and r_t is the interest rate of the inter-bank market, as noted above, and C'_{jt} is the bank's marginal cost (see Appendix A). The margin ($r_{jt} - r_t - C'_{jt}$) determines market power, whereas p_{jt} is the ratio of *interest income* plus *other operating income* to *the bank's total assets*.

As a robustness check we substitute the $LERNER_{jt}$ for the Hirschman-Herfindhal index (HHI_{jt}) based on bank assets. The *HHI* controls for further impacts on the distribution of banks assets may have on firm borrowing and investment, beyond the impact of Lerner index.

3.4. Granger predictability test

We use the Granger predictability test to study the direction of the relationship between the Lerner index and firm leverage (and) investment, controlling for the other financial measures. We employ four lags (l) of the variables in order to capture the long-term effects of bank market power (and concentration) measures on firm investment rates. Since we are using panel data, the empirical specification follows Holtz-Eakin et al. (1988) and consider fixed effects (f_i), N firms (i = 1,…, N), and T periods (t = 1,…, T). The statistical significance of the Granger predictability test is measured using an F-test. In order to state that bank market power predicts firm investment, two conditions should be met:

i) Bank market power must be statistically significant in explaining the firm investment rate:

$$\left(\frac{I}{K}\right)_{it} = \psi_0 + \sum_{l=1}^{L} \psi_l \left(\frac{I}{K}\right)_{i,t-l} + \sum_{l=1}^{L} \chi_l LERNER_{j,t-l} + \nu_t + f_i + u_{it} \quad (8a)$$

ii) Firm investment rate should not be significant in explaining bank market structure:

$$LERNER_{jt} = \psi'_0 + \sum_{l=1}^{L} \psi'_l \left(\frac{I}{K}\right)_{i,t-l} + \sum_{l=1}^{L} \chi'_l LERNER_{j,t-l} + \nu_t + f_i + u_{it} \quad (8b)$$

4. Results

4.1. Summary statistics and parametric and non-parametric tests

Table 2 reports the summary statistics of the variables employed in this study. In Panel A we observe that the firm investment rate $(I/K)_t$ has a mean of 0.23, ranging from 0.00 to

0.99, while asset growth ($\Delta A_{it}/A_{it-1}$) and the investment to assets ratio show a mean value of 0.11 and 0.07, respectively. Regarding control variables, the ratio of cash flow over capital $(CF/K)_{it}$ displays a mean of 0.89, while the ratio of leverage over capital $(B/K)_{it}$ has a mean of 1.57. The Lerner index (LERNER_t) is the variable of interest, showing a mean value of 0.22 and ranging between 0.001 and 0.68, while the mean value for the HHI is 1.29 per cent. Panel B reports the mean values of investment variables divided in four quartiles of the Lerner index. This first statistical test shows, for the whole sample, that $(I/K)_{it}$ ranges from 0.32 in the first quartile to 0.28 in the fourth quartile, whilst $(I/A)_{it}$ ranges from 0.09 in the first quartile to 0.08 in the fourth quartile. This observation suggests that investment variables decrease as bank market power increases. Additionally, we break the sample down into large firms and SMEs. The mean values show similar ratios for both groups of companies, as well as similar behaviour and significance. On the other hand, as for $(\Delta A_{it}/A_{it-1})$ we find that the average ratio is higher for the group of large firms, although the pattern of the variable evolves similarly for both groups of firms. Finally, the F overall test rejects the null that investment ratios are independent of the four quartiles of the Lerner index (H_0: $\beta_{n\text{-quartile}} = 0$), which support the hypothesis that the amount of firm investment in fixed capital, measured through $(I/K)_{it}$ and $(I/A)_{it}$, decreases insofar as the level of bank market power, measured through the Lerner index, increases.

To complement the above results we perform a mean-difference test, as shown in Table 3. In the first step, we create the dummy variable Lerner_D_{jt} which takes the value of one for values of LERNER_{it} from the third quartile in order to proxy for an environment of high bank market power. We show that the parametric test rejects the null hypothesis (H_0: mean(0) – mean(1) = 0) for all our investment variables, and further show that the alternative hypothesis is confirmed for $(I/K)_{it}$ and $(I/A)_{it}$ for an environment with a lower level of bank market power at one per cent (H1: mean(0) – mean (1) > 0). Contrary to our expectations, the asset growth ($\Delta A_{it}/A_{it-1}$) variable displays higher values in an environment of high bank market power. Regarding $(CF/K)_{it}$, we show that firms tend to maintain higher liquidity levels in higher bank market power environments, which reveals a conservative attitude of firms regarding investment. The other variable of interest is leverage $(B/K)_{it}$, and we expect to be easier for firms to obtain bank financing in a more competitive banking market, as well as $(r^B/TA)_{it}$ which shows that in a more competitive banking market it is cheaper to obtain bank financing. These tests suggest that, in the presence of bank market power, firms are less able to obtain bank financing since credit availability is also restricted. Additionally, we find that the cost of bank financing is also higher in environments of higher bank market power. This result is consistent with previous papers, which show that an increase in bank market concentration leads to a reduction in the availability of loans and a subsequent increase in the interest rates that banks charge firms (see Canales and Nanda, 2012; Erel, 2011; Kano et al., 2011; Rice and Strahan, 2010 and Panetta et al., 2009; Beck et al., 2004, 2006b; Carbó et al., 2009).

As a first test of the impact of the crisis, we split the sample in two parts: before and after 2007. We show that the parametric tests reject the null hypothesis (H_0: Pre-crisis (0) – Crisis (1) = 0) for all investment variables, and the alternative hypothesis is confirmed for an environment of financial crisis (H_1: Pre-crisis (0) – Crisis (1) > 0).

Finally, Table 4 show the main estimation of the translog cost function described in Appendix B.

4.2. Short term and long term analysis of bank market power

Before analysing the effects of bank market power on firm investment from a dynamic perspective, we should test for the existence of unit roots in the single variables, and cointegration between the target variables taking into consideration the structural change. Panel A of Table 5 shows the results of the ADF test before the financial crisis (1a), after the crisis (1b), and for the whole period (1c). The results reject the null hypothesis of unit roots at the 1 per cent and the 5 per cent level. Panel B of Table 5 shows the results of the Johansen-Fisher panel cointegration test. The trace tests indicate that two cointegration relationships exist before and after the financial crisis.

The estimation of the expression (3) is shown in Panel A of Table 6 by using the Arellano and Bond (1991) GMM estimator in order to test our hypotheses. Two and three-period-lagged values of the explanatory variables are used as instruments.[8] The results suggest that a 1 per cent increase in bank market power, measured as $LERNER_{jt}$, reduces the firm investment rate $(I/K)_{it}$ by 0.55 per cent on average in the short term. This result remains robust when taking into consideration other measures of investment. Similarly, increasing bank market power by 1 per cent implies an estimated short-term reduction of 0.14 per cent and 0.01 per cent of firm total assets ($\Delta A_{it}/A_{it-1}$) and investment over fixed assets $(I/K)_{it}$, respectively (H_0: $\beta_2 = 0$). Furthermore, the β_3 estimate for expression (3) – positive, significant, and higher than β_2 in absolute value- indicates that firm investment becomes positive in subsequent periods -increasing investment by 0.55 per cent (p-value < 0.000) after the first period, and 0.05 per cent (p-value < 0.000) after the second period. A one-standard-deviation increase in bank market power augments firm investment by 0.05 per cent (p-value < 0.000) in the long term for the median observation. The results for ($\Delta A_{it}/A_{it-1}$) are qualitatively similar confirming that after the first period investment

[8] This treatment eliminates the most common source of endogeneity, although it would be not completely eliminated if errors are correlated over time. We include Sargan test as well as the AR(2) and the AR(3) tests to confirm the validity of the instruments used in our estimations.

growth is increased by 0.33 per cent (p-value < 0.000) and 0.02 per cent (p-value < 0.000) after the second period. A one-standard-deviation increase in bank market power augments the dependent variable by 0.20 per cent (p-value < 0.000) in the long term for the median observation. We find similar results for $(I/A)_{it}$ growing towards the steady state of 0.0001 (p-value < 0.000). However, we find a negative sign for large firms since, as we previously found, the effect is significant for total assets (denominator) but not for fixed capital (numerator).

Taken together, these results confirm that firm investment is affected negatively by bank market power in the short term as predicted by the first hypotheses. Notwithstanding, firm investment is gradually increasing after the shock provoked by the bank market power reaching positive levels in the long term. This last result confirms our second hypothesis. The standard Sargan and AR(2) and AR(3) tests reject the null and demonstrates the orthogonality of the employed instruments.

We are also interested in studying whether the effect of bank market power has a similar effect on large firms, and SMEs. We obtain the expected signs for all firms but the short-term impact of bank market power is higher for SMEs (-0.5539) than for large companies (-0.4794). Likewise, we obtain similar results when the variables ($\Delta A_{it}/A_{it-1}$) and $(I/K)_{it}$ are taken into consideration. Similarly, the analysis of the steady state also shows that SMEs are more sensible to changes in bank market power in the long term than large firms.

4.3. The transmission channel

It may be argued that the relationship between firm investment and bank market power is driven by firm borrowing to invest in fixed assets. The estimations of the equations (4) and (5) are shown in Table 7. Using the Arellano-Bond GMM estimator, we test the effect of bank market power on firm leverage $(B/K)_{it}$. Two and three period-lagged values of the explanatory variables are used as instruments. The estimation of the parameter δ_2 indicates that increasing bank market power by 1 per cent reduces firm leverage by 0.48 per cent in the short term in consonance with the result obtained in the previous section. As for the long-term, the results reject the joint null hypothesis for bank market power measures –both LERNER_{jt} and HHI_{jt}- (H_0: $\delta_2 = \delta_3 = 0$) and the null for the adjustment parameter in both cases (H_0: $\delta_1=0$ and $\delta_1=1$). Additionally, we also find that the estimation of the parameter δ_3 is positive, significant and higher than δ_2 indicating that, in the long term, a one-standard-deviation increase in bank market power augments firm leverage by 0.08 per cent (p-value < 0.002), which means that firms are able to borrow more despite the impact of bank market power. As explained in the previous sub-section, we are also concerned to study the differences in the effects for SMEs and large firms. We find that SMEs reduce firm leverage by 45 per cent (p-value < 0.000) in the short term, while the result is not significant for large firms.

The second question to be addressed in this sub-section is whether the effects described before are fully transmitted to firm investment. To proceed we estimate the equation (5) also using the Arellano-Bond GMM estimator. We find that the effects in the short term and the long term are positive and significant rejecting the null jointly for both leverage parameters (H_0: $\delta'_2 = \delta'_3 = 0$) and the adjustment parameter (H_0: $\delta'_1 = 0$ and $\delta'_1 = 1$), as expected. These estimations suggest that leverage acts as a transmission channel for the effects of bank market power. The standard Sargan and AR(2) and AR(3) tests reject the null and demonstrates the orthogonality of the instruments.

4.4. Results of the augmented model

The estimations of equation (6) are shown in Table 8. Two and three-period-lagged values of the explanatory variables are used as instruments. The results are consistent with those presented in previous sections. The number of lags in this analysis is four. No significant results are found for lags larger than four periods. In line with our hypotheses, we find that an increase in bank market power leads to a reduction of firms' investment rate $(I/K)_{it}$ for the first two lags, i.e. -0.0311 and -0.0659 for LERNER_{jt-1} and LERNER_{jt-2}, respectively. We find a positive and significant relationship for the subsequent periods-i.e. 0.2396 and 0.1108 for LERNER_{jt-4} and LERNER_{jt-4}, respectively. These results are robust if we substitute $(I/K)_{it}$ for asset growth $(\Delta A_{it}/A_{it-1})$ and if we use investment over assets ratio $(I/A)_{it}$ as the dependent variable.

We are also interested in studying whether the effect of bank market power has a similar effect on large, medium and small firms. We obtain the expected signs for all three types of firms but also find that the effect of bank market power is higher and significant at 1 per cent for SMEs (0.3533) than for large companies (0.3272). Moreover, we find that the correction for firm investment is also higher for SMEs (0.2899) than for large firms (0.2108). These results are robust to the consideration of merger activities, MA_{jt}, since we obtain negative and significant coefficients for the whole sample (-0.0284), being significant for SMEs (-0.0298) suggesting that bank merger processes have a stronger influence on smaller firms than larger ones.

4. 5. Granger predictability test: results

We are also interested in studying the predictability between firm investment and bank market power. We employ the Granger predictability test with four lags for bank market power and concentration variables, and the firm investment rate. The vector for instrumental variables includes the first difference of the ratios sales over fixed capital $(Sales/K)_{it-1}$ and the variable $(EBITDA/K)_{it-1}$ to proxy for creditworthiness, and the variable $(CF/K)_{it-1}$ in first differences is considered as a endogenous regressor because firm's generation of cash flow might be influenced by other factors such as the volume of sales. The standard Hansen-J test rejects the null and demonstrates the orthogonality of the employed instruments, and the endogeneity test rejects the null that $(CF/K)_{it-1}$ could be treated as an exogenous regressor.[9] Finally, valid inference is ensured since the standard errors and test statistics are robust to heterokedasticity and clustering on regional level.

The results shown in Table 9 suggest that bank market power ($LERNER_{jt}$) predicts firm investment, but firm investment does not predict bank market power. To check the robustness of this result, we incorporate the HHI as an alternative measure of bank market power. The results are qualitatively similar to those obtained above in signs and significance. The results are in line with the GMM estimations of the previous section.

4. 6. Robustness check: the effects of bank concentration

The specifications of the models presented in Table 6 and Table 8 suggest that bank market power exerts a negative effect on the company interest rate in the short-term, although this relationship turns positive in the long-term.

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[9] Endogeneity test is computed, like the C statistic, as the difference of two Sargan-Hansen statistics in which the first model is treated as an equation with a smaller set of instruments in which the suspect regressor/s is treated as endogenous, and the second model is treated as a large set in which the suspect regressor/s is treated as exogenous.

To check the robustness of our previous results, we estimate in Panel B of Table 6 and Table 10 four alternative specifications replacing LERNER_{jt} by HHI_{jt}, and breaking down the sample into large firms and SMEs. The correspondence of the HHI and Lerner indices, and their relationship with firms' investment, depends on the evolution of market contestability and bank information production (see Carbó et al., 2009; Ongena et al., 2012; Panetta et al., 2009; Presbitero and Zazzaro, 2011). Our results ar similar to those obtained using the Lerner index.

5. Conclusions

This paper investigates the relationship between bank market power and firm investment over time. The main finding is that bank market power exerts a negative effect on firm investment in the short-term (e.g. Carbó et al., 2009; Ryan et al., 2014). However, we find that this relationship turns positive in the long-run.

To the best of our knowledge, this is the first paper that analyses the repercussions of bank market power on long-term firm investment. The transmission channel is also tested. We find that firm borrowing is affected by bank market power in the same way that investment in fixed capital.

We also perform a Granger predictability test in order to determine the predictability relationship between bank market power and the firm investment rate. Our results confirm that bank market power is a determinant of firm investment, but no predictability is found in the opposite direction. The results are robust to different measures of concentration and market power.

Table 1:

Definition of variables

Variable	Definition
Company	
Firm investment $(I/K)_{it}$	This ratio is the endogenous variable and represents the rate of investment. It is defined as the annual change in the net tangible fixed assets plus the depreciation (I) over the amount of tangible fixed assets at year end.
Asset growth $(\Delta A_{it}/A_{it-1})$	This ratio constitutes an alternative proxy for investment growth in terms of total assets. This ratio is defined as the growth rate of firm's total assets.
Investment over assets $(I/A)_{it}$	This ratio is defined as the difference between firm investment, as defined above (I), and a firm's total assets (A). This ratio is also a proxy for the investment level of firms.
Cash flow over capital $(CF/K)_{it}$	This ratio is defined as cash flow relative to the proportion of capital. Cash flow is defined as net income plus depreciation plus changes in deferred taxes (Kaplan and Zingales, 1997, 2000; Fazzari et al., 2000).
Firm leverage $(B/K)_{it}$	This ratio measures company leverage over the proportion of capital. This variable represents the level of risk which the firm is able to run.
Bank interest rate for I $(r^B/TA)_{it}$	This ratio measures the financial cost over a firm's total assets. The term r^B represents the interest rate paid by the firm to obtain bank financing.
Company output $(Y/K)_{it}$	This variable represents company output. This ratio is proxied as total sales plus the variation in stocks during the year over the amount of tangible fixed assets.
Bank variables	
$LERNER_{jt}$	The Lerner index measures the degree of competition in banking markets. This index is defined as the difference between the price and the bank's marginal cost, divided by the price, and measures the capacity of the bank to set a price above the marginal cost, being an inverse function of the elasticity of demand and the number of banks.
$LERNER\_D_{ji}$	This dummy variable takes the value of one if Lerner is above the median, and zero otherwise.
HHI_{jt}	The Herfindhal-Hirschman concentration index measures the degree of market concentration. This index is defined as the squared market shares of each of the banks operating in the Spanish market.
$\mathrm{Ln}(TA_{jt})$	This measure represents bank size. The variable is measured by a natural logarithm.
Price of labour $(w_1)_{jt}$	This ratio is defined as personnel costs over total assets. The variable is measured by a natural logarithm (Ryan et al., 2014).
Price of capital $(w_2)_{jt}$	This ratio is defined as operating costs (except personnel costs) over fixed assets. The variable is measured by a natural logarithm.
Price of deposits$(w_3)_{jt}$	This ratio is defined as financial costs over deposits. The variable is measured by a natural logarithm.
Mergers and acquisitions (MA_{jt})	This dummy controls for mergers and acquisitions processes, and takes the value of one if the financial institution has been involved in a process of M&A.
Regional GDP growth (GDP_{ht})	Real GDP growth (%) at regional level.

Table 2:
Summary statistics

Panel A: Summary statistics						
Variable	Observations	Mean	Median	SD	Min.	Max.
Company variables						
$(I/K)_{it}$	427,912	0.2312	0.1539	0.2299	0.0000	0.9999
$(I/K)^2_{it}$	427,912	0.1062	0.0236	0.1833	0.0000	0.9999
$(\Delta A_{it}/A_{it-1})$	435,816	0.2309	0.1698	0.2563	-0.1169	0.9244
$(\Delta A_{it}/A_{it-1})^2$	435,816	0.1220	0.0334	0.2142	0.0004	0.8546
$(I/A)_{it}$	427,901	0.0774	0.0380	0.1082	0.0000	0.9988
$(I/A)^2_{it}$	427,901	0.0177	0.0014	0.0572	0.0000	0.9976
$(CF/K)_{it}$	483,066	0.8941	0.3741	1.3287	-0.0972	5.2827
$(B/K)_{it}$	362,192	1.5671	0.6961	2.2459	6.30e-06	8.7223
$(B/K)^2_{it}$	362,192	7.4995	0.4845	19.0803	3.97e-11	76.0772
$(r^B/TA)_{it}$	451,584	0.0182	0.0139	0.0164	1.49e-06	0.0843
$(Y/K)_{it}$	391,289	18.1589	8.4391	21.0276	1.5789	67.1924
Bank variables						
LERNER_{jt}	286,305	0.2194	0.1983	0.1494	0.0007	0.6833
HHI_{jt}	578,093	0.0129	0.0025	0.0198	0.0001	0.0786
$\ln(TA_{jt})$	577,021	18.0254	18.1683	1.6188	10.6366	20.8281
Price of labour ($\ln(w_{1jt})$)	575,320	-4.5695	-4.5281	0.3245	-6.7916	-1.3615
Price of capital ($\ln(w_{2jt})$)	568,459	-2.4709	-2.4125	1.5716	-10.4102	5.8064
Price of deposits ($\ln(w_{3jt})$)	577,021	-3.7199	-3.7291	0.4123	-8.6997	-0.8854
MA_{jt}	578,188	0.3408	0.0000	0.4739	0.0000	1.0000
GDP_{ht}	578,188	0.0289	0.0342	0.0241	-0.0452	0.0713

Panel B: Means of investment variables, cash flow and leverage depending on the quartiles of LERNER_{jt}. Standard errors in parentheses.

		Observations	1st Quartile	2nd Quartile	3rd Quartile	4th Quartile	F-test [p-value]
$(I/K)_{it}$	Complete sample	427,912	0.3151*** (0.0007)	0.2853*** (0.0007)	0.2975*** (0.0007)	0.2835*** (0.0007)	268.09 [0.0000]
	Large firms	49,887	0.3216*** (0.0019)	0.3046*** (0.0021)	0.3133*** (0.0021)	0.3089*** (0.0022)	10.83 [0.0000]
	SME	378,025	0.3137*** (0.0008)	0.2828*** (0.0008)	0.2952*** (0.0008)	0.2799*** (0.0008)	254.49 [0.0000]
$(\Delta A_{it}/A_{it-1})$	Complete sample	435,816	0.2173*** (0.0008)	0.2128*** (0.0008)	0.2337*** (0.0008)	0.2579*** (0.0008)	667.80 [0.0000]
	Large firms	52,047	0.2551*** (0.0023)	0.2439*** (0.0025)	0.2530*** (0.0025)	0.2709*** (0.0024)	21.09 [0.0000]
	SME	383,769	0.2112*** (0.0009)	0.2089*** (0.0008)	0.2314*** (0.0008)	0.2562*** (0.0008)	690.04 [0.0000]
$(I/A)_{it}$	Complete sample	427,901	0.0874*** (0.0003)	0.0721*** (0.0003)	0.0736*** (0.0003)	0.0788*** (0.0003)	404.89 [0.0000]
	Large firms	49,885	0.0943*** (0.0009)	0.0783*** (0.0009)	0.0807*** (0.0009)	0.0939*** (0.0009)	70.12 [0.0000]
	SME	378,016	0.0860*** (0.0003)	0.0713*** (0.0003)	0.0725*** (0.0003)	0.0766*** (0.0003)	326.75 [0.0000]

Notes: *, **, *** statistically significant at the 10, 5 and 1% level

Table 3:
Parametric test for comparison of means for equality of distribution functions by LERNER_D$_{jt}$. and the financial crisis (2007-2009).

Variable		Mean differences are reported. Diff = Low Lerner (0) – High (1) under H_0: Diff = 0. Coefficient (t-statistics)	Standard errors	Mean differences are reported. Diff = Pre-crisis (0) – Crisis (1) under H_0: Diff = 0. Coefficient (t-statistics)	Standard errors
$(I/K)_{it}$	Complete sample	0.0080*** (10.6653)	0.0008	0.0445*** (54.4846)	0.0008
	Large firms	0.0026* (1.3092)	0.0021	0.0233*** (18.5596)	0.0013
	SME	0.0085*** (10.5588)	0.0008	0.0087*** (25.3075)	0.0003
$(\Delta A_{it}/A_{it-1})$	Complete sample	-0.0306*** (-39.1897)	0.0008	0.0364*** (46.0235)	0.0008
	Large firms	-0.0120*** (-5.0591)	0.0024	0.0465*** (17.0032)	0.0028
	SME	-0.0335*** (-40.5033)	0.0008	0.0349*** (41.9932)	0.0008
$(I/A)_{it}$	Complete sample	0.0029*** (9.8421)	0.0003	0.0099*** (29.5336)	0.0003
	Large firms	0.0001 (0.2149)	0.0009	0.0237*** (18.5965)	0.0013
	SME	0.0032*** (10.1658)	0.0003	0.0078*** (22.1385)	0.0004
$(CF/K)_{it}$	Complete sample	-0.0312*** (-8.0834)	0.0039	0.1022*** (24.4209)	0.0042
	Large firms	0.0049*** (0.4717)	0.0104	-0.0570*** (-3.8600)	0.0148
	SME	-0.0362*** (-8.7393)	0.0042	0.1209*** (27.3894)	0.0044
$(B/K)_{it}$	Complete sample	0.0851*** (12.5158)	0.0068	-0.4555*** (-53.2683)	0.0086
	Large firms	0.0033*** (0.1884)	0.0178	-0.6861*** (-22.6777)	0.0303
	SME	0.0998*** (13.5713)	0.0074	-0.4348*** (-48.3391)	0.0089
$(r^B/TA)_{it}$	Complete sample	0.0015*** (30.3264)	0.0001	-0.0013*** (-25.6102)	0.0001
	Large firms	0.0005*** (4.0171)	0.0001	-0.0001 (-0.0587)	0.0002
	SME	0.0015*** (31.1480)	0.0001	-0.0014*** (-26.8265)	0.0001
$(Y/K)_{it}$	Complete sample	-0.6092*** (-8.98)	0.0678	2.0660*** (28.32)	0.0729
	Large firms	-0.5374*** (-2.73)	0.1962	1.8669*** (7.01)	0.2661
	SME	-0.6112*** (-8.46)	0.0723	2.1718*** (28.41)	0.0764

Notes: T-statistics in parentheses. Standard errors are reported.
*, **, *** statistically significant at the 10, 5 and 1% level, respectively.

Table 4:
Cost function coefficient estimates.

SUR estimation. Cost shares are the predicted share of costs spent on each input.		
	Coefficient	**Standard Error**
Intercept	-0.8707***	0.3198
$Ln(TA_{jt})$	1.1969***	0.0278
$Ln(TA_{jt})^2$	0.0010	0.0014
$ln(w_{1jt})$	1.2785***	0.0458
$ln(w_{2jt})$	0.0474***	0.0159
$ln(w_{3jt})$	0.4790***	0.0485
$ln(w_{1jt})^2$	0.1477***	0.0032
$ln(w_{2jt})^2$	0.0006	0.0004
$ln(w_{3jt})^2$	0.0111***	0.0011
$ln(w_{1jt}) \times ln(w_{2jt})$	0.0071***	0.0058
$ln(w_{1jt}) \times ln(w_{3jt})$	0.1673***	0.0031
$ln(w_{2jt}) \times ln(w_{3jt})$	0.0112***	0.0011
$ln(w_{1jt}) \times Ln(TA_{jt})$	0.0183***	0.0062
$ln(w_{2jt}) \times Ln(TA_{jt})$	0.0060***	0.0019
$ln(w_{3jt}) \times Ln(TA_{jt})$	0.0935***	0.0063
Trend	0.0003***	0.0002
$Trend^2$	0.0000***	0.0000
Trend × $Ln(TA_{jt})$	0.0000*	0.0000
Trend × $ln(w_{1jt})$	-0.0001*	0.0000
Trend × $ln(w_{2jt})$	0.0002***	0.0000
Trend × $ln(w_{3jt})$	0.0000	0.0000
Number of banks	111	
R^2	0.9855	
F-overall test	0.0000	

Notes: *, **, *** statistically significant at the 10, 5 and 1% level, respectively.

Table 5: Unit root test and cointegration analysis with structural break

Panel A: Augmented Dickey-Fuller tests with four lags.

	Model A (1998-2006)		Model B (2007-2009)		Model C (1998-2009)	
	Coefficient (θ_1)	t-stats	Coefficient (θ_1)	t-stats	Coefficient (θ_1)	t-stats
$(I/K)_{it}$	-0.6461***	-11.42	-0.7794***	-14.12	-0.6427***	-11.55
	(0.0565)		(0.0551)		(0.0556)	
$(\Delta A_{it}/A_{it-1})$	-0.0571***	-3.75	-0.0453**	-2.37	-0.0558***	-3.67
	(0.0152)		(0.0190)		(0.0152)	
$(I/A)_{it}$	-0.2502***	-9.95	-0.8157***	-9.15	-0.2515***	-10.11
	(0.0252)		(0.0892)		(0.0248)	
$(B/K)_{it}$	-0.2583***	-12.74	-0.2781***	-13.42	-0.2570***	-12.75
	(0.0203)		(0.0207)		(0.0202)	
LERNER_{jt}	-0.1042***	-18.85	-0.0109***	-2.90	-0.0185***	-4.51
	(0.0055)		(0.0037)		(0.0041)	
HHI_{jt}	-0.0041**	-1.99	-0.0156***	-5.57	-0.0082***	-3.99
	(0.0020)		(0.0028)		(0.0021)	

Notes: *, **, *** Rejection of the null hypothesis of unit roots at the 10, 5 and 1% level, respectively. Robust standard error in parentheses.

Panel B: Johansen-Fisher's panel cointegration test. Endogenous variables include investment, leverage, and bank market power measures. Trace (statistical t) is reported.

		1998 - 2006		2007 - 2009	
	H_0: range = r	LERNER_{jt}	HHI_{jt}	LERNER_{jt}	HHI_{jt}
$(I/K)_{it}$	r = 0	100.7801***	98.2332***	40.4592***	40.2532***
	r ≤ 1	53.0434***	49.9557***	24.9599***	25.6017***
	r ≤ 2	24.6713***	20.0231***	11.5603***	12.8025***
$(\Delta A_{it}/A_{it-1})$	r = 0	95.5716***	92.5612***	40.0731***	40.4480***
	r ≤ 1	53.6084***	50.3792***	24.3659***	25.6961***
	r ≤ 2	24.5128***	20.7696***	11.3835***	12.9843***
$(I/A)_{it}$	r = 0	92.0451***	89.4943***	39.3427***	40.8908***
	r ≤ 1	53.6996***	49.0433***	24.6134***	25.0168***
	r ≤ 2	24.4557***	20.6823***	11.4716***	12.1602***

Notes: *, **, *** Cointegration exists at the 10%, 5%, and 1% level, respectively.

Table 6: ADL model

Panel A: The effects of Lerner index on firm investment

Arellano and Bond (1991) dynamic panel data regression.
White (1980) heteroskedasticity-robust standard errors in parentheses.

	$(I/K)_{it}$			$(\Delta A_{it}/A_{it-1})$			$(I/A)_{it}$		
	Complete sample	SME	Large firms	Complete sample	SME	Large firms	Complete sample	SME	Large firms
Intercept	0.2560***	0.2554***	0.2611***	0.2328***	0.2297***	0.2531***	0.0001***	0.0001***	0.0001***
	(0.0028)	(0.0031)	(0.0063)	(0.0051)	(0.0050)	(0.0050)	(0.0000)	(0.0000)	(0.0000)
$Dependent_{it-1}$	0.0670***	0.0661***	0.1038***	0.0442***	0.0455***	0.0289**	0.0380***	0.0360***	0.0844***
	(0.0046)	(0.0048)	(0.0172)	(0.0048)	(0.0051)	(0.0134)	(0.0060)	(0.0066)	(0.0223)
$LERNER_{jt}$	-0.5467***	-0.5539***	-0.4794***	-0.1413***	-0.1454***	-0.0813***	-0.0002***	-0.0002***	-0.0002***
	(0.0176)	(0.0186)	(0.0628)	(0.0112)	(0.0120)	(0.0220)	(0.0000)	(0.0000)	(0.0000)
$LERNER_{jt-1}$	0.5898***	0.5986***	0.4903***	0.3363***	0.3329***	0.3493***	0.0003***	0.0003***	-0.0000
	(0.0128)	(0.0132)	(0.0774)	(0.0177)	(0.0171)	(0.0437)	(0.0000)	(0.0000)	(0.0000)
$Crisis_t$	-0.0001***	-0.0001***	-0.0001***	-0.0001***	-0.0001***	-0.0001***	-0.0001***	-0.0001*	-0.0001***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Industry dummies	YES	YES	YES	YES	YES	YES	YES	YES	YES
Regional dummies	YES	YES	YES	YES	YES	YES	YES	YES	YES
Time dummies	YES	YES	YES	YES	YES	YES	YES	YES	YES
Steady state	0.0463**	0.0478**	0.0121	0.2040***	0.1963***	0.2759***	0.0001***	0.0001***	-0.0004*
	(0.0252)	(0.0264)	(0.1005)	(0.0189)	(0.0183)	(0.0532)	(0.0000)	(0.0000)	(0.0000)
Obs	363,934	325,733	38,201	372,207	332,384	39,823	363,924	325,725	38,199
Sargan test (p-value)	0.055	0.054	0.221	0.510	0.380	0.486	0.057	0.058	0.114
m2 (p-value)	0.750	0.719	0.702	0.074	0.078	0.192	0.663	0.788	0.555
m3 (p-value)	0.514	0.644	0.174	0.010	0.009	0.226	0.836	0.702	0.470

Panel B: The effects of HHI on firm investment

Arellano and Bond (1991) dynamic panel data regression.
White (1980) heteroskedasticity-robust standard errors in parentheses.

	$(I/K)_{it}$			$(\Delta A_{it}/A_{it-1})$			$(I/A)_{it}$		
	Complete sample	SME	Large firms	Complete sample	SME	Large firms	Complete sample	SME	Large firms
Intercept	0.2302***	0.2310***	0.2269***	0.2847***	0.2842***	0.2914***	0.0001***	0.0001***	0.0001***
	(0.0026)	(0.0027)	(0.0088)	(0.0046)	(0.0047)	(0.0080)	(0.0000)	(0.0000)	(0.0000)
$Dependent_{it-1}$	0.0562***	0.0563***	0.0484	0.2024***	0.1997***	0.2272***	0.0341***	0.0317***	0.0723**
	(0.0082)	(0.0084)	(0.0313)	(0.0116)	(0.0116)	(0.0355)	(0.0065)	(0.0070)	(0.0227)
HHI_{jt}	-0.0624***	-0.0656***	-0.0213	-0.0682***	-0.0677***	-0.0601***	-0.0000***	-0.0000***	-0.0000***
	(0.0098)	(0.0101)	(0.0352)	(0.0057)	(0.0064)	(0.0101)	(0.0000)	(0.0000)	(0.0000)
HHI_{jt-1}	0.0657***	0.0689***	0.0249	0.0691***	0.0689***	0.0621***	0.0000***	0.0000***	0.0000**
	(0.0104)	(0.0107)	(0.0359)	(0.0061)	(0.0068)	(0.0100)	(0.0000)	(0.0000)	(0.0000)
$Crisis_t$	-0.2302***	-0.2310***	-0.2269***	-0.0812***	-0.0834***	-0.0502***	-0.0001***	-0.0001***	-0.0001***
	(0.0026)	(0.0027)	(0.0088)	(0.0035)	(0.0036)	(0.0027)	(0.0000)	(0.0000)	(0.0000)
Industry dummies	YES	YES	YES	YES	YES	YES	YES	YES	YES
Regional dummies	YES	YES	YES	YES	YES	YES	YES	YES	YES
Time dummies	YES	YES	YES	YES	YES	YES	YES	YES	YES
Steady state	0.0035***	0.0035***	0.0038*	0.0012*	0.0014**	0.0026**	0.0001*	0.0001*	0.0001*
	(0.0008)	(0.0008)	(0.0019)	(0.0006)	(0.0006)	(0.0011)	(0.0000)	(0.0000)	(0.0000)
Obs	274,913	250,371	24,542	283,329	257,706	25,623	332,603	300,529	32,074
Sargan test (p-value)	0.341	0.396	0.596	0.335	0.293	0.106	0.279	0.583	0.374
m2 (p-value)	0.636	0.684	0.249	0.003	0.003	0.006	0.608	0.115	0.567
m3 (p-value)	0.109	0.118	0.177	0.115	0.105	0.878	0.366	0.488	0.428

Notes: *, **, *** statistically significant at the 10, 5 and 1% level, respectively.

Table 7: Transmission channel of bank market power, leverage, and firm investment

Arellano and Bond (1991) dynamic panel data regression. White (1980) heteroskedasticity-robust standard errors in parentheses.

	$(B/K)_{it}$						$(I/K)_{it}$		
	Lerner			HHI					
	Complete sample	SME	Large firms	Complete sample	SME	Large firms	Complete sample	SME	Large firms
Intercept	0.1412***	0.1575***	0.0034	0.0661***	0.0735***	0.0563**	0.0936***	0.0907***	0.0897**
	(0.0303)	(0.0225)	(0.0982)	(0.0071)	(0.0075)	(0.0235)	(0.0105)	(0.0107)	(0.0334)
$Dependent_{it-1}$	0.4773***	0.4461***	0.7585***	0.6957***	0.6827***	0.7097***	0.0715***	0.0716***	0.0834***
	(0.0485)	(0.0380)	(0.1714)	(0.0048)	(0.0050)	(0.0150)	(0.0090)	(0.0092)	(0.0119)
MARKET $POWER_{jt}$	-0.4240***	-0.4512***	-0.0714	-0.0161***	-0.0135**	-0.0227			
	(0.0671)	(0.0711)	(0.1236)	(0.0044)	(0.0046)	(0.0131)			
MARKET $POWER_{jt-1}$	0.6229***	0.6512***	0.3173*	0.0247***	0.0234***	0.0160			
	(0.0802)	(0.0802)	(0.1751)	(0.0040)	(0.0042)	(0.0129)			
$(B/K)_{it}$							0.0836***	0.1025***	0.5652***
							(0.0176)	(0.0189)	(0.0906)
$(B/K)_{it-1}$							0.0643***	0.0589***	0.2176***
							(0.0145)	(0.0150)	(0.0438)
$Crisis_t$	-0.0413**	-0.0422**	-0.0482**	-0.2249***	-0.2290***	-0.1356***	-0.1394***	-0.1458***	-0.1088***
	(0.0185)	(0.0203)	(0.0223)	(0.0110)	(0.0118)	(0.0323)	(0.0124)	(0.0131)	(0.0144)
Industry dummies	YES	YES	YES	YES	YES	YES	YES	YES	YES
Regional dummies	YES	YES	YES	YES	YES	YES	YES	YES	YES
Time dummies	YES	YES	YES	YES	YES	YES	YES	YES	YES
Steady state	0.3806***	0.3610***	1.0180	0.0284*	0.0311**	-0.0233	0.1592***	0.1738***	0.8540***
	(0.1254)	(0.1101)	(1.4930)	(0.0155)	(0.0158)	(0.0518)	(0.0147)	(0.0149)	(0.1411)
Obs	155,608	136,932	18,676	111,498	97,816	13,682	231,470	222,228	166,539
Sargan test (p-value)	0.502	0.618	0.502	0.249	0.481	0.624	0.519	0.606	0.197
m2 (p-value)	0.346	0.010	0.346	0.014	0.025	0.360	0.000	0.523	0.362
m3 (p-value)	0.268	0.835	0.268	0.228	0.327	0.263	0.675	0.580	0.918

Notes: *, **, *** statistically significant at the 10, 5 and 1% level, respectively.

Table 8: The impact of bank market power on firm investment, 1998-2009

Arellano and Bond (1991) dynamic panel data regression.
White (1980) heteroskedasticity-robust standard errors in parentheses.

	$(I/K)_{it}$			$(\Delta A_{it}/A_{it-1})$			$(I/A)_{it}$		
	Complete sample	SME	Large firms	Complete sample	SME	Large firms	Complete sample	SME	Large firms
Intercept	0.2857***	0.2899***	0.2108***	0.2280***	0.2298***	0.2236***	0.0002***	0.0002***	0.0002***
	(0.0085)	(0.0088)	(0.0299)	(0.0030)	(0.0031)	(0.0096)	(0.0000)	(0.0000)	(0.0000)
$Dependent_{it-1}$	0.3294***	0.3360***	0.2210***	0.0188*	0.0193	0.0011	0.1092***	0.1058***	0.1082***
	(0.0155)	(0.0161)	(0.0545)	(0.0098)	(0.0102)	(0.0321)	(0.0046)	(0.0049)	(0.0169)
$Dependent^2_{it}$	-0.9314***	-0.9437***	-0.8088***	-0.5026***	-0.5145***	-0.4722***	-0.0005	-0.0005	-0.0003
	(0.0248)	(0.0259)	(0.0860)	(0.0123)	(0.0129)	(0.0395)	(0.0005)	(0.0005)	(0.0008)
$LERNER_{jt-1}$	-0.0311*	-0.0412*	-0.0764*	-0.0452***	-0.0438***	-0.0798***	-0.0001***	-0.0001***	-0.0000
	(0.0204)	(0.0215)	(0.0645)	(0.0074)	(0.0079)	(0.0226)	(0.0000)	(0.0000)	(0.0000)
$LERNER_{jt-2}$	-0.0659***	-0.0610***	-0.1153*	-0.0534***	-0.0526***	-0.0364	-0.0001***	-0.0001***	-0.0001***
	(0.0208)	(0.0220)	(0.0614)	(0.0067)	(0.0071)	(0.0202)	(0.0000)	(0.0000)	(0.0000)
$LERNER_{jt-3}$	0.2396***	0.2309***	0.3026***	0.0323***	0.0338***	-0.0083	0.0000*	0.0000	0.0000
	(0.0215)	(0.0229)	(0.0603)	(0.0091)	(0.0097)	(0.0268)	(0.0000)	(0.0000)	(0.0000)
$LERNER_{jt-4}$	0.1108***	0.1061***	0.1441*	0.0001***	0.0001***	0.0001***	0.0000*	0.0000	0.0000
	(0.0287)	(0.0305)	(0.0807)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
$(CF/K)_{it-1}$	0.0941***	0.0969***	0.0724***	0.0097***	0.0094***	0.0115**	0.0000***	0.0000***	0.0000***
	(0.0046)	(0.0049)	(0.0130)	(0.0015)	(0.0015)	(0.0041)	(0.0000)	(0.0000)	(0.0000)
$(Y/K)_{it-1}$	0.0290***	0.0289***	0.0265***	0.0016***	0.0016***	0.0013***	0.0000***	0.0000***	0.0000***
	(0.0004)	(0.0005)	(0.0015)	(0.0001)	(0.0001)	(0.0004)	(0.0000)	(0.0000)	(0.0000)
$(B/K)^2_{it-1}$	-0.0001***	-0.0001***	-0.0002***	-0.0001***	-0.0001***	-0.0001***	-0.0000	-0.0000	-0.0000
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
GDP_{ht}	0.6696***	0.7813***	0.1098	0.8499***	0.8393***	1.0511***	0.0004***	0.0004***	0.0001
	(0.1810)	(0.1937)	(0.5270)	(0.0726)	(0.0772)	(0.2168)	(0.0001)	(0.0001)	(0.0001)
MA_{jt}	-0.0284***	-0.0298***	-0.0012	-0.0042	-0.0025	-0.0029	-0.0000**	-0.0000*	-0.0000
	(0.0075)	(0.0077)	(0.0290)	(0.0025)	(0.0026)	(0.0080)	(0.0000)	(0.0000)	(0.0000)
$Crisis_t$	-0.0135*	-0.0147**	0.0079	-0.0810***	-0.0872***	-0.0256***	-0.0000***	-0.0000***	-0.0000
	(0.0053)	(0.0056)	(0.0152)	(0.0035)	(0.0038)	(0.0094)	(0.0000)	(0.0000)	(0.0000)
Industry dummies	YES	YES	YES	YES	YES	YES	YES	YES	YES

Regional dummies	YES	YES	YES	YES	YES	YES	YES	YES	YES
Time dummies	YES	YES	YES	YES	YES	YES	YES	YES	YES
Steady state	0.3778***	0.3533***	0.3272*	0.0027	0.0128	-0.0965	0.0001**	0.0001**	0.0001
	(0.0813)	(0.0875)	(0.1867)	(0.0204)	(0.0217)	(0.0540)	(0.0000)	(0.0000)	(0.0000)
Obs	73,853	66,577	7,276	129,727	116,306	13,421	156,669	139,736	16,933
Sargan test (p-value)	0.199	0.179	0.568	0.563	0.467	0.465	0.141	0.127	0.164
m2 (p-value)	0.391	0.601	0.503	0.454	0.175	0.194	0.514	0.549	0.087
m3 (p-value)	0.652	0.716	0.270	0.753	0.315	0.121	0.653	0.599	0.828

Notes: *, **, *** statistically significant at the 10, 5 and 1% level, respectively.

Table 9: Granger Predictability Test

Instrumental variable regression with fixed effects. Instrumented variable: $\Delta(CF/K)_{it}$. Instrumental variables: $\Delta(Sales/K)_{it-1}$ and $\Delta(EBIDTA/K)_{it-1}$
Whole variables expressed in first differences.
Standard errors in parentheses.

	$(I/K)_{it}$	$LERNER_{jt}$	$(I/K)_{it}$	HHI_{jt}
$(I/K)_{it-1}$	-1.1834***	0.0062	-1.1863***	0.0001
	(0.0240)	(0.0063)	(0.0231)	(0.0001)
$(I/K)_{it-2}$	-1.2619***	0.0069	-1.2659***	0.0001
	(0.0212)	(0.0055)	(0.0211)	(0.0001)
$(I/K)_{it-3}$	-1.1692***	0.0048	-1.1727***	0.0001
	(0.0186)	(0.0046)	(0.0203)	(0.0001)
$(I/K)_{it-4}$	-0.9725***	0.0049	-0.9830***	0.0001
	(0.0171)	(0.0038)	(0.0185)	(0.0001)
MARKET	0.1618***	-1.0365***	-0.0161	-0.8301***
$POWER_{jt-1}$	(0.0503)	(0.1024)	(0.4772)	(0.0109)
MARKET	0.2835***	-1.1926***	0.2008	-0.8224***
$POWER_{jt-2}$	(0.0896)	(0.1031)	(0.4774)	(0.0071)
MARKET	0.6861***	-1.8909***	2.6591***	-0.4875***
$POWER_{jt-3}$	(0.0660)	(0.0467)	(0.3474)	(0.0068)
MARKET	0.8228***	-2.4157***	-2.3555**	-0.5721***
$POWER_{jt-4}$	(0.0710)	(0.1108)	(0.8215)	(0.0214)
$(CF/K)_{it}$	-0.0032	0.0112	-0.0260	0.0005
	(0.1003)	(0.0220)	(0.0853)	(0.0003)
$(Y/K)_{it}$	0.0027	-0.0005	0.0037	-0.0000
	(0.0042)	(0.0009)	(0.0035)	(0.0000)
$(B/K)^2_{it}$	-0.0000***	-0.0000	-0.0000***	-0.0000***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
GDP_{ht}	3.3549**	11.2628***	0.6338*	0.0723***
	(1.2191)	(1.4282)	(0.3615)	(0.0035)
MA_{jt}	-0.0033*	0.0763***	-0.0016	0.0014**
	(0.0057)	(0.0138)	(0.0059)	(0.0005)
$Crisis_t$	0.0193	-0.0449***	0.0559***	0.0010***
	(0.0101)	(0.0137)	(0.0040)	(0.0001)
Industry dummies	YES	YES	YES	YES
Regional dummies	YES	YES	YES	YES
Time dummies	YES	YES	YES	YES
Cluster	Region	Region	Region	Region
Obs	97,159	99,096	106,213	108,394
R^2	0.207	0.415	0.194	0.821
F-test (p-value)	0.0000	0.0000	0.0000	0.0000
Hansen J test (p-value)	0.1315	0.6781	0.4523	0.2318
Endogeneity test (p-value)	0.7894	0.3938	0.8874	0.7976

Notes: *, **, *** statistically significant at the 10, 5 and 1% level, respectively

Table 10: Robustness check. The impact of bank market concentration (HHI) on firm investment, 1998-2009.

Standard errors in parentheses (White (1980) heteroskedasticity-robust standard errors).
Arellano and Bond (1991) dynamic panel data regression.

	$(I/K)_{it}$.			$(\Delta A_{it}/A_{it-1})$			$(I/A)_{it}$		
	Complete sample	SME	Large firms	Complete sample	SME	Large firms	Complete sample	SME	Large firms
Intercept	0.2701***	0.2762***	0.1923***	0.1996***	0.1990***	0.2130***	0.0002***	0.0002***	0.0002***
	(0.0111)	(0.0119)	(0.0371)	(0.0040)	(0.0042)	(0.0128)	(0.0000)	(0.0000)	(0.0000)
$Dependent_{it-1}$	0.3376***	0.3436***	0.2252***	0.0263***	0.0322***	0.0202	0.1154***	0.1120***	0.1124***
	(0.0145)	(0.0151)	(0.0517)	(0.0085)	(0.0089)	(0.0272)	(0.0044)	(0.0047)	(0.0163)
$Dependent^2_{it}$	-0.9422***	-0.9552***	-0.8039***	-0.0263***	-0.0322***	-0.0202	-0.0005	-0.0005	-0.0003
	(0.0234)	(0.0243)	(0.0823)	(0.0085)	(0.0089)	(0.0272)	(0.0005)	(0.0005)	(0.0007)
HHI_{jt-1}	-0.6129***	-0.5760**	-0.6005	-0.0344	-0.0712	-0.0312	-0.0004***	-0.0004***	-0.0001
	(0.2228)	(0.2376)	(0.6718)	(0.1195)	(0.1265)	(0.3608)	(0.0001)	(0.0001)	(0.0004)
HHI_{jt-2}	-0.4554**	-0.4240*	-0.3336	-0.3603***	-0.3315**	-0.5347	-0.0008***	-0.0007***	-0.0006*
	(0.2235)	(0.2370)	(0.6672)	(0.1064)	(0.1121)	(0.3344)	(0.0001)	(0.0001)	(0.0003)
HHI_{jt-3}	1.1519***	1.1629***	1.5257	0.4599***	0.4955***	0.3357	0.0003***	0.0004***	0.0002
	(0.4372)	(0.4875)	(0.9270)	(0.1077)	(0.1160)	(0.2812)	(0.0001)	(0.0001)	(0.0003)
HHI_{jt-4}	1.1264***	1.0715***	1.3114	0.0305	0.0532	0.3817	0.0004***	0.0003***	0.0003
	(0.3143)	(0.3399)	(0.7602)	(0.0992)	(0.1054)	(0.2870)	(0.0001)	(0.0001)	(0.0003)
$(CF/K)_{it-1}$	0.0942***	0.0972***	0.0678***	0.0035***	0.0029*	0.0070	0.0000***	0.0000***	0.0000***
	(0.0044)	(0.0047)	(0.0124)	(0.0013)	(0.0014)	(0.0038)	(0.0000)	(0.0000)	(0.0000)
$(Y/K)_{it-1}$	0.0292***	0.0292***	0.0266***	0.0011***	0.0010***	0.0012**	0.0000***	0.0000***	0.0000***
	(0.0004)	(0.0004)	(0.0015)	(0.0001)	(0.0001)	(0.0004)	(0.0000)	(0.0000)	(0.0000)
$(B/K)^2_{it-1}$	-0.0001***	-0.0001***	-0.0002***	-0.0000***	-0.0000***	-0.0000**	-0.0000	-0.0000	-0.0000
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
GDP_{ht}	0.5258***	0.5934***	0.1824	1.7627***	1.8345***	1.4279***	0.0004***	0.0004***	0.0005***
	(0.0806)	(0.0874)	(0.2291)	(0.0360)	(0.0383)	(0.1112)	(0.0000)	(0.0000)	(0.0001)
MA_{jt}	-0.0219***	-0.0233***	0.0083	-0.0036	-0.0024	-0.0143	-0.0000**	-0.0000*	-0.0000
	(0.0073)	(0.0075)	(0.0292)	(0.0025)	(0.0026)	(0.0081)	(0.0000)	(0.0000)	(0.0000)
$Crisis_{it}$	-0.0052*	-0.0058*	0.0048	-0.0439***	-0.0431***	-0.0280***	-0.0000***	-0.0000***	-0.0000***
	(0.0033)	(0.0035)	(0.0102)	(0.0015)	(0.0015)	(0.0051)	(0.0000)	(0.0000)	(0.0000)
Industry dummies	YES	YES	YES	YES	YES	YES	YES	YES	YES
Regional dummies	YES	YES	YES	YES	YES	YES	YES	YES	YES

Time dummies	YES	YES	YES	YES	YES	YES	YES	YES	YES
Steady state	1.8265*	1.8808*	2.4563	0.0982	0.1509	0.1547	-0.0004	-0.0004	-0.0002
	(0.9897)	(1.0968)	(2.0729)	(0.2401)	(0.1963)	(0.6977)	(0.0004)	(0.0004)	(0.0006)
Obs	84,123	75,925	8,198	171,317	152,815	18,502	170,045	151,694	18,351
Wald test (p-value)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Sargan test (p-value)	0.233	0.207	0.207	0.135	0.121	0.150	0.292	0.372	0.346
m1 (p-value)	0.133	0.447	0.636	0.619	0.647	0.120	0.198	0.565	0.649
m2 (p-value)	0.426	0.813	0.037	0.844	0.778	0.017	0.369	0.674	0.172

Notes: *, **, *** statistically significant at the 10, 5 and 1% level, respectively.

Appendix A: Computing the Lerner index.

The computation of the marginal cost (C'_{jt}) of the Lerner index given in expression (11) is based on the specification of the following translog cost function:

$$\ln C_{jt} = \alpha_0 + \ln TA_{jt} + \tfrac{1}{2}\alpha_k (\ln TA_{jt})^2 + \sum_{h=1}^{3} \beta_h \ln w_{hjt} + \tfrac{1}{2}\sum_{h=1}^{3}\sum_{k=1}^{3} \beta_{hk} \ln w_{hjt} \ln w_{kjt}$$
$$+ \tfrac{1}{2}\sum_{h=1}^{3} \gamma_h \ln TA_j \ln w_{hjt} + \mu_1 Trend + \mu_2 \tfrac{1}{2} Trend^2 + \mu_3 Trend \ln TA_j \qquad (16)$$
$$+ \sum_{h=1}^{3} \lambda_h Trend \ln w_{hjt} + \ln u_j$$

where C_{jt} is a bank's total cost (financial and operating costs), TA_{jt} is total assets, and w_{jt} the cost of inputs (labour, capital, and the cost of deposits). We include the variable *Trend* to control for technological changes over time. A system of factor demand (share) equations is derived, according to Shephard's lemma, as:

$$\frac{\partial \ln c_j}{\partial \ln w_{hj}} = m_{hjt} \equiv \beta_h + \sum_{j=1}^{3} \beta_k \ln w_{kjt} + \tfrac{1}{2}\gamma_h \ln TA_{jt} + \lambda_h Trend \qquad (17)$$

where m_{hjt} is the cost share of factor *h* for bank *j* in period *t*.

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