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Does bank market power affect SME financing constraints?

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ABSTRACT

This paper examines the extent to which bank market power alleviates or magnifies SME credit constraints using a large panel dataset of more than 118,000 SMEs across 20 European countries over the period 2005–2008. To our knowledge, this is the first study to examine bank market power and SME credit constraints in an international, developed economy setting. Moreover, our study is the first to address a number of econometric considerations simultaneously, in particular by controlling for the availability of profitable investment opportunities using a structural Q model of investment. Our results strongly support the market power hypothesis, namely, that increased market power results in increased financing constraints for SMEs. Additionally, we find that the relationship exhibits heterogeneity across firm size and opacity in a manner that suggests that the true relationship between bank market power and financing constraints might not be fully explained by the existing theory. Finally, we find that the effect of bank market power on financing constraints increases in financial systems that are more bank dependent.

1. Introduction

This paper investigates the impact of bank market power on investment financing constraints experienced by small and medium sized enterprises (SMEs). Using a large sample of approximately 118,000 SMEs across 20 European countries over the period 2005–2008, we provide evidence on (i) the extent to which SMEs are constrained by limited access to external finance—as measured by their reliance on internal funds for investment financing, (ii) whether the severity of those constraints is related to the level of bank market power in their domestic lending market, (iii) whether this relationship is heterogeneous across firm size categories and opacity, and (iv) whether the effect of bank market power on financing constraints differs depending on the structure of the financial system.

The theoretical literature on the relationship between bank market power and firm financing constraints proposes two competing mechanisms through which limited competition between banks may impact positively or negatively on firm access to debt financing. The traditional industrial organisation prediction—the *market power hypothesis*—argues that increased market power results in restricted loan supply and higher lending rates, thereby intensifying financing constraints.[1]

In contrast, the *information hypothesis* (Petersen and Rajan, 1995) argues that market power enables banks to forgo any interest rate premiums they might otherwise have to charge when lending to firms that are relatively opaque or risky—i.e. young, small and/or distressed firms—and, in return, establish a lending relationship that will allow them to extract informational rents in subsequent periods. Conversely, banks operating in a competitive market must break even in each period and thus must hold risk-adjusted returns constant by charging higher interest rates on lending where the borrower's returns exhibit greater uncertainty. Moreover, in the presence of competition, banks cannot capitalise on this informational advantage and so the incentive to build these relationships would be negated. Market power is therefore predicted to result in greater investment in banking relationships, reduced information asymmetries and agency costs, and thus improved access to debt finance by potential borrowers.

Given that these theoretical channels produce contrasting predictions about the direction of the effect of bank market power

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[1] For this research, a firm faces a financing constraint if it has a profitable investment opportunity at the current market cost of capital, but it cannot get the financing to undertake the investment.

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on firms' access to finance, most recent work has focused on resolving this question empirically.

A 'first wave' of empirical research into this question generally adhered to the structure-conduct-performance (SCP) paradigm, which posits that formal measures of market structure are strong predictors of firms' competitive behaviour. Many such studies relied on concentration measures such as the five-firm concentration ratio CR (5) or the Herfindahl index (HHI). Employing bank concentration measures as a proxy for bank market power, Petersen and Rajan (1995) find that increased concentration is associated with greater access to finance for a cross-section of US firms spread across local banking markets. Fischer (2000) also finds that higher bank concentration is associated with improved information flows and better credit access for a cross-section of German manufacturing firms. In contrast, Beck et al. (2004) find the opposite result for a survey of firms in 74 countries, but only where the level of economic development is low. This finding is corroborated by Chong et al. (2012) for a survey of Chinese SMEs.[2]

Increasingly, however, empirical research into bank market power has moved away from using "structural" concentration measures for a number of reasons. First, banking sectors are often observed to be simultaneously concentrated *and* competitive (or diluted and uncompetitive) and so concentration may be considered a poor proxy for underlying market power. Moreover, a more serious issue is that market structure and concentration may proxy for a whole range of conduct-determining bank and market characteristics, including average bank size, bank complexity in terms of product variety and activities, the ease of information flow within the market and the overall size of the market itself, for instance. As such, the aforementioned studies may fail to cleanly identify a competitive effect; indeed, this limitation may have contributed to the mixed results produced thus far.

An emerging 'second wave' of research focuses on more direct measures of the extent to which we observe the exercise of market power by banks—including the Lerner index (markup of price over marginal cost) in particular—and the results have been more consistent. Carbo et al. (2009) find that, when using regional bank Lerner indices to measure market power, greater bank market power is associated with *greater* credit constraints for a sample of Spanish SMEs, supporting the market power hypothesis. Furthermore, they find the same result when using HHI as a measure of market power, but *only* when the HHI is adjusted to control for oft-omitted confounding factors, demand elasticity in particular.[3]

Love and Peria (2012) also find that bank market power reduces access to finance for a repeated cross-section of firms across 53 primarily developing countries. However, they find this effect to be dependent on the wider economic and financial environment in which the firms operate. In particular, they find that higher levels of financial development and greater availability of credit information reduce this adverse effect, while high levels of government ownership of bank assets are associated with a stronger negative impact of bank market power.

Using a cross-country panel of European firms, we estimate the impact of bank market power on firm credit constraints in a way that addresses a number of issues that have not yet been overcome in the extant literature. These issues and our solutions are as follows:

First, the identification of financial constraints by Carbo et al. (2009) depends on two measures, namely (i) firms' dependence on trade credit as a source of finance and (ii) sales growth. The former measure may be best interpreted as a proxy for the constraints faced by firms in raising short-term liquidity for operational purposes, but not necessarily in raising debt finance for capital investment. The determinants of short-term and long-term financing constraints may, in fact, be very different. The latter measure—sales growth—may not allow for clear conclusions to be drawn regarding the welfare implications of a significant bank market power effect, given that increased turnover may be offset by commensurately higher costs.

We employ a well-established identification strategy by examining the sensitivity of firm-level investment to changes in the availability of internal funds, an approach first established by Fazzari et al. (1988) and since employed widely in the financing constraints literature.[4] Importantly, we identify the key criticisms of our approach and provide argument supporting the robustness of our findings to these critiques.

Second, no research has, to our knowledge, examined the relationship between direct measures of banks' competitive behaviour and SME investment while controlling for the availability of investment opportunities. The presence of profitable investment opportunities to a given firm is a vital determinant of its investment behaviour and is highly likely to be correlated with many of the explanatory variables, especially as firms with profitable avenues for future expansion are likely to already enjoy profitable operations, positive cashflows and, therefore, a relative abundance of internal funds. We robustly control for investment fundamentals by estimating a 'Q' structural model of investment.

Third, our sample is the first cross-country sample to examine bank market power and SME investment (as opposed to investment by large, listed firms) in a primarily developed-country setting. This will allow us to exploit richer variation in bank market power than is likely to arise using an interregional sample as in Carbo et al. (2009), while also testing the extent to which the results from Love and Peria (2012) can be generalised beyond a largely developing country setting.

Fourth, the panel dimension allows us to build on the repeated cross-sectional work of Love and Peria (2012) by allowing us to control for potentially important firm-level heterogeneity.

Finally, in constructing our Lerner indices, we focus only on banking institutions for which corporate or commercial lending is actually observed in order to isolate actual market power within this sub-sector of the wider credit market, which improves on existing estimation.

We find that firms' investment is sensitive to the availability of internal funds and interpret this as being indicative of a wedge between the cost of internal and external financing. Furthermore, we find that bank market power is associated with lower levels of SME investment and, moreover, that this adverse impact of bank market power on investment is driven by the effect of market power on financing constraints. In fact, much of the variation in cash-investment sensitivity is captured by the bank market power effect.

We separately estimate our empirical model to test for heterogeneous effects of bank market power on financing constraints across different categories of firm size. We find that the adverse effect of bank market power on financing constraints is reduced for the subset of smallest firms—defined as "micro" enterprises—and argue that this is evidence of an information hypothesis-type effect that dampens, but is ultimately outweighed by, the direct market power effect.

Finally, we test whether the effect of bank market power on financing constraints differs dependent on whether the financial structure of a country is more bank-based or market-based. To

[2] Finally, Ratti et al. (2008) finds evidence in support of the information hypothesis using observed investment data for a panel of European listed firms, although is not clear that this finding can be generalised to the case of SMEs.

[3] The empirical literature on concentration as a measure of competition—as reviewed by Carbo et al. (2009)—concludes that the extent to which changes in concentration are reflected in changes in the degree of competition depend especially on the extent to which the market is contestible and demand is elastic.

[4] See Hubbard (1998) and Chirinko (1993) for reviews.

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Table 1
Firm data summary statistics: 2005–2008 mean values.

	Mean	St. dev.	Median	Minimum	Maximum
Investment	0.51	2.25	0.15	−0.99	305.65
Fundamental Q	−0.16	1.73	−0.30	−70.73	121.07
Cash stock	0.87	2.65	0.18	0.00	136.00
Debt overhang	0.61	2.17	0.23	0.00	249.00
Depreciation (or Revaluation) (%)	0.22	0.39	0.18	−0.07	122.30
External finance (% total finance)	0.70	0.31	0.82	0.00	1.00
Debt (% of all external finance)	0.90	0.22	1.00	0.00	1.00
Short-term loans (% of all debt)	0.52	0.40	0.54	0.00	1.00
Sales (EUR millions)	3.07	4.23	1.32	0.00	48.06
Net income (EUR millions)	0.07	0.54	0.02	−128.22	56.12
Fixed assets (EUR millions)	0.97	2.73	0.25	0.00	232.33
Total assets (EUR millions)	2.76	4.78	1.06	0.00	235.68
Firm age (years)	17.63	13.87	15.00	1.00	458.00
Liquidity ratio	1.19	1.54	0.94	0.00	96.58
Observations	304,645				

conduct this evaluation, we interact a measure of bank dependence (the share of bank credit to the private sector relative to bank credit and market capitalisation) with our interaction of bank market power and financing constraints. We find that increases in bank dependency exacerbate the effect of bank market power on financing constraints, i.e. as firms are more reliant on banks to fund external finance, the effect of bank market power on financing constraints heightens.

Our research provides a number of relevant insights at a time when the structure of European SMEs' funding for investment and working capital is an issue at the top of the European economic policy agenda. The heterogeneous impact of the financial crisis on domestic banking sectors in Europe has led, in many cases, to a retrenchment towards domestic activity (Barrell et al., 2011). This has been driven by a need for banks to deleverage after excessive pre-crisis asset accumulation, by changing attitudes to risk as lenders aim to avoid repetition of previous events, as well as by regulatory and governmental pressures in cases where public money has been used to ensure bank survival. The trend toward increased capital requirements and more stable banking which forms part of the impending Basel III regulatory framework is also likely to contribute to a reduction in competitive pressures in banking. According to our results, all of these patterns should be a cause for concern for policy makers, as the likely result will be a further deterioration in SMEs' access to finance, *ceteris paribus*. Such credit constraints, if binding in the medium term, will inevitably lead to lower investment and potential output.

Policy makers in the EU have begun to recognise the urgency of the SME credit access problem, with numerous potential policy options being published and debated throughout 2013 right up to the level of the informal meeting of national Ministers of Finance, ECOFIN[5] (see European Commission (2013) and Department of Finance (2013)). The policy debate in the area has focused on two strands: (1) stimulating bank credit flow and (2) developing non-bank alternative sources of funding.

On bank credit, the debate has focused on regulatory changes, the potential for securitization of pools of SME loans to free up bank capital, and the involvement of the European Investment Bank in providing credit and credit guarantees. The findings of our study, combined with the trend towards decreased bank competition in Europe outlined above, suggest that policy makers must also aim at increasing competition in the banking sector. This could be achieved through the reduction of regulatory entry barriers, the cross-country synchronisation of national credit registry data collection and bad debt recovery legislation, and the work of national investment promotion agencies.

Our findings on the exacerbation of the impact of bank competition on SME credit constraints in bank-dependent jurisdictions provide justification for policy measures in the area of non-bank funding. A range of proposals in areas such as the development of retail bond markets for SMEs, tax incentives for SME equity issuance, state investment banks which leverage private funding, crowdfunding, peer-to-peer lending and venture capital have been made at European level. All can play a role in alleviating the risk to European SMEs posed by the continued trend towards decreased competition in banking.

2. Data

We construct a dataset using the Bureau van Dijk's AMADEUS database, which comprises financial and legal information based on standardised financial statements and records for private and public companies across Europe. We combine this firm dataset with bank data from the Fitch IBCA Bankscope database as well as country-level data on macroeconomic, regulatory and institutional characteristics from a number of standard sources, including the World Bank, IMF and Penn World Tables.

For our initial firm sample, we collect data on fixed and total assets; depreciation; debt, including short-term loans and long-term debt; turnover; cash and cash equivalents; debtors; creditors; net income; equity capital; incorporation date; legal status; and industrial category.

We use four-digit NACE industrial category codes[6] to restrict our sample to firms involved in manufacturing, corresponding to NACE codes 1000–3799 inclusive. We do not examine firms in service-oriented sectors as changes in physical capital are less likely to accurately describe their investment behaviour. Appendix A.1 describes the distribution of firms across the main industrial categories in our final sample.

As our intention is to examine SMEs, we also restrict our sample by applying two size filters. The first is based on the EU definition of SMEs: firm-years are excluded if they have (i) 250 or more employees *or* (ii) operating revenue in excess of EUR 50 million *and* total assets in excess of EUR 43 million, evaluated at purchasing power parity. This step excludes 4.5% of firm-year observations.

Our second size filter is designed to address the fact that the EU definition applies a single ruler to all firms in our sample regardless

[5] For an example of a press release regarding discussion of SME credit at ministerial level see http://www.eu2013.lt/en/news/pressreleases/ecofin-ministers-approve-bank-supervision-discuss-steps-towards-banking-union.

[6] These codes are the narrowest available definition of sub-sectors provided for under the official Statistical Classification of Economic Activities in the European Community.

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of their size *relative* to their domestic market. This would ignore the fact that, for example, a firm that is considered small in Germany—and hence small relative to the German banking sector—would more accurately be considered very large were it to operate in the Maltese economy and borrow from the Maltese banking system. In order to ensure we do not include firms that are large in relative terms, we apply a definition by Gibson and van der Vaart (2008) and exclude any firm achieving a turnover in excess of 1000 times the mean per capita GNI at purchasing power parity of the country in which it is located. This step excludes an additional 2.2% of firm-year observations.[7]

We apply a number of rules to remove non-representative firm data. We remove firms from the sample if they are considered outliers in terms of investment, debt-to-capital, sales-to-capital, sales-growth-to-capital, profits-to-capital and cash-to-capital (i.e. if they lie more than three standard deviations from the mean with respect to any of those variables).

We do not exclude firms with negative net investment during the period of our study. This is because firms with relatively low cash balances in a given period may choose to liquidate some or all of their fixed assets in the following period, giving rise to a statistically positive relationship between cash and investment which can be argued to represent financial constraints. Nevertheless, we separately estimate our model strictly including only firm-year observations with positive investment and find our results to be robust.

Our final sample contains approximately 118,000 firms across 20 countries over the period 2005–2008; Table 1 provides summary statistics.

3. Empirical approach

3.1. Identifying financing constraints

In order to identify financing constraints, we follow a well-established approach first proposed by Fazzari et al. (1988). They argue that financially constrained firms can be identified by the relatively high sensitivity of their investment to the availability of internal financing. The reasoning behind this is that financing constraints—i.e. obstacles to raising external financing (such as transaction costs or credit rationing)—will give rise to a differential between the costs of external and internal financing. Thus, if financing constraints are relatively severe, firms' cost of capital—and therefore their levels of investment—should depend heavily on the availability of internal funds. Conversely, if financing constraints are slight, the cost advantage of internal financing should also be small and investment levels should be less dependent on the availability of internal funding.

Therefore, our dependent variable in all specifications is *Investment* and we include *Cash Stock* as an explanatory variable. *Investment* is firm *i*'s net accumulation of fixed assets (accounting for depreciation, amortisation and/or revaluations) in a given year, normalised by their stock of fixed assets at the beginning of the year. *Cash Stock* is the value of firm *i*'s balance of cash and cash equivalents, normalised by its capital stock. A positive and statistically significant coefficient on *Cash Stock* would indicate a positive sensitivity of investment to cash and therefore, based on the premise above, the presence of financing constraints. More important, if bank market power aggravates financing constraints, we should observe a greater cash-investment sensitivity among firms in country-years where banks have greater market power.

The cash-investment sensitivity approach to identifying financing constraints has been applied widely in the existing research[8] but the literature highlights a number of reasons to interpret cash-investment sensitivities with care.

First, Gross (1995) produces an intertemporal investment model and predicts that firms anticipating future financing constraints will reduce investment and increase liquid assets in the current period in order to smooth their constraint over time, giving rise to a negative (or less positive) cash-investment relationship despite the presence of financing constraints. This point relates to our research in an important way as it increases the probability of a false negative: identifying financially constrained firms as unconstrained. As such, in specifications where *Cash Stock* is not statistically significant in explaining *Investment*, this result should be interpreted with caution. Conversely, however, results indicating positive cash-investment sensitivity should thus be interpreted as particularly robust evidence of financing constraints.

Second, Kaplan and Zingales (1997) suggest that financially distressed firms may be inclined to use available liquidity to service debts rather than for capital investment. As such, cash-investment sensitivity may become less pronounced—and thus identification more difficult—where financially constrained firms are also distressed. Again, this finding suggests that insignificant results should be interpreted with caution but that positive coefficients are likely to be robust. Nevertheless, in Section 3.3 we outline some popular indicators of financial distress that we include in our empirical model in order to reduce any effect this may have.

Finally, a third point made by Kaplan and Zingales (1997) suggests that managers' irrational decision-making or excessive risk aversion may cause them to prefer internal over external financing, even in the absence of any objective cost difference. In the presence of any such exogenous preference for internal financing, positive cash-investment sensitivities may not necessarily reflect the presence of financing constraints.

Our empirical approach accounts for this endogeneity problem on a number of fronts. First, to the extent that these preferences are fixed, exogenous features of the firms in our sample, the panel aspect of our dataset allows us to remove their influence when controlling for firm fixed effects. Moreover, where such preferences vary over time—for example, due to changes in management—this variation should nevertheless be uncorrelated with bank market power. As such, it should still be possible to interpret correlations between bank market power and cash-investment sensitivity in the usual way.

3.2. Measuring bank market power

Measuring competition in the banking sector is empirically challenging due to banks' international operations. As noted in Section 1, we focus on the non-structural measures of banking market competition and estimate the Lerner index as our main indicator. A number of studies to date have provided consistent estimates of the Lerner index across countries in Europe (Carbo et al., 2009; Fernandez de Guevara et al., 2005).

We follow this existing research in our empirical estimates of the Lerner index. In this paper, *Lerner* is the average bank Lerner index in country *k* in year *t*. The Lerner index effectively captures the extent to which banks can maintain a price level above their own marginal costs and, as such, greater values of the Lerner index should be associated with greater levels of market power. While we take bank competition to be an exogenous independent variable which explains SMEs' access to finance, previous studies have attempted to identify the determinants of market power across

[7] Our main results are unchanged if these firms are included. The results are available on request from the authors.

[8] See Guariglia (2008), Hubbard (1998) and Chirinko (1993) for useful reviews.

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banks and countries. Carbo et al. (2009) find that a higher Lerner index (greater market power) is observed when banks are more cost-efficient, when inflation is high, and where banks earn a higher share of their income from non-interest sources such as fees. Market power is found to be lower when GDP growth is higher, suggesting that banking becomes more competitive in response to increased investment opportunities. Fernandez de Guevara et al. (2005) also find that cost-efficient banks have higher Lerner indices, while also showing that larger banks have higher market power. They find that market concentration is associated with lower Lerner indices, suggesting that concentration and competition should not be used interchangeably.

We construct bank Lerner indices by estimating translog cost functions for our sample of 20 countries in order to generate approximations of individual banks' marginal costs and, therefore, the ratio of prices to marginal costs. We model banks as producing a single output, total assets, using three inputs; physical capital, financial capital and labour. Values of the Lerner Index in our sample range from a minimum of 0.27 up to a maximum of 0.63; the mean and median values are 0.44 and 0.41, respectively.

We include an interaction between *Lerner* and *Cash Stock* to capture the extent to which financing constraints vary with bank market power. Therefore, this interaction term is of key interest as a positive (and statistically significant) coefficient should be indicative of an aggravating effect of bank market power on financing constraints, while a negative coefficient should be interpreted as bank market power reducing financing constraints.

3.3. Firm size and other controls

The information hypothesis provides an important reason as to why the impact of bank competition on financing constraints may exhibit heterogeneity across firms of different sizes. Under this hypothesis, banks use market power to effectively "subsidise" firms that are opaque or offer uncertain returns in order to generate a relationship and/or soft information that they can exploit in subsequent periods to extract economic rents. Under this premise, we would expect the impact of bank market power on financing constraints to be "more positive" for relatively small firms when compared to the impact on larger firms' financing constraints because of their relative opacity and riskiness.

$Micro^{EU}$ is a dummy which takes a value of one if the firm is classified, according to the EU definition, as a "micro" enterprise. This applies to firms that have fewer than 10 employees *and* either a turnover *or* balance sheet total of less than 2 million euro. Approximately 45% of our sample comprises micro firms, while "small" and "medium" enterprises make up a further 42% and 13%, respectively. $Micro^{EU}$ is included in some specifications to determine whether the impact of bank market power on firm financing constraints varies across firm size categories.

As alluded to above, it is necessary to control for the availability of profitable investment opportunities, as firms operating in profitable sectors will likely invest more but also enjoy greater cash reserves. We therefore estimate *Fundamental Q*—a proxy for the marginal profit arising from additional capital, controlling for the informational content of *Cash Stock*—using a structural investment model. An outline of our structural investment model is given in Appendix A.2.

Debt Overhang is firm *i*'s debt overhang, measured as its ratio of total debt to capital stock. Recently issued debt may boost cash reserves, while also restricting investment because (i) high levels of debt relative to the overall value of capital implies a lower availability of collateral to support additional bank finance and (ii) high leverage may be indicative of recent investment, decreasing the likelihood that the firm will invest again until their next investment cycle.

Four *Firm Age* category variables are included to account for the fact that younger firms are likely to invest a relatively large amount in their early years while also experiencing limited initial cash stocks as they establish revenue streams. Each category dummy takes a value of one if the firm is aged zero to three (6% of firms), four to seven (16%), eight to 11 (16%) or 12 to 15 years old (16%), respectively, and zero otherwise. The excluded category here is firms aged 16 years or older, which represents the remaining 47% of the sample.

Short-Term Debt Finance is the ratio of short-term loans to total debt. *Debt Finance* is the ratio of debt finance to total external finance, comprising debt and trade credit. We include these variables in order to capture the possibility that firms avoid becoming financially constrained as bank market power increases by substituting (i) from short-term to long-term finance and/or (ii) from bank debt to trade finance. The extent to which such substitution is possible may determine their investment, but may also be correlated with their creditworthiness and, therefore, the availability of cash reserves.

Fails is a dummy variable indicating whether, according to AMADEUS records, the firm fails during the sample period. Firms may leave the regression for non-random reasons, such as the dissolution of the firm. This dummy variable will control for the possibility that the relationships we are attempting to identify may operate differently for firms that are entering into liquidation or bankruptcy proceedings.

3.4. Country-level controls

HHI is the Herfindahl–Hirschman index of concentration for country *k*'s banking sector, based on total assets. This is included to control for any additional impact the distribution of bank assets may have on firm borrowing and investment, beyond the impact of concentration on market power.

We also control for *Inflation*, *M2 Growth*, *EMU Membership*, *Private Credit Growth*, *GDP Growth*, *GDP Level*, *Government Gross Debt*, *Government Expenditure*, *Government Revenue* and *Foreign Bank Ownership*, each for their potential to simultaneously determine firm investment behaviour and firm credit constraints, independent of any impact on the degree to which banks compete. Table 2 provides summary statistics of our country-level variables averaged across country-years.

4. Econometric specification

Our model takes the investment of firm *i* as a function of firm *i*'s investment fundamentals, a measure of credit constraints for firm *i*, banking market power in country *k* as well as a host of controls for other characteristics of firm *i*, sector *j*, country *k* and year *t*. The basic econometric specification is as follows:

$$\begin{aligned}\text{Investment}_{ijkt} = {} & \alpha_0 + \beta_1 \text{Q}_{ijk,t-1} + \beta_2 \text{Cash Stock}_{ijk,t-1} + \beta_3 \text{Lerner}_{kt} \\ & + \beta_4 (\text{Cash Stock}_{ijk,t-1} \times \text{Lerner}_{kt}) + \boldsymbol{\theta}\mathbf{F}_{ijkt} + \boldsymbol{\gamma}\mathbf{C}_{kt} \\ & + \boldsymbol{\delta}\overline{\mathbf{C}}_k + \boldsymbol{\tau}\mathbf{T}_t + \epsilon_{ijkt}\end{aligned}$$

where $\mathbf{F}_{ijkt}, \mathbf{C}_{kt}, \mathbf{K}_k, \mathbf{T}_t$ are vectors of firm controls, country controls, country dummies and year dummies, respectively.

There are a number of factors that must be considered when selecting an appropriate econometric methodology to use when estimating the above investment equation. First, the measure we use for investment fundamentals, *Fundamental Q*, is subject to measurement error as it is a proxy for the unobservable marginal Q. To solve this measurement error problem—and thus derive consistent parameter estimates—we follow Gilchrist and Himmelberg (1995) and use a GMM approach, instrumenting for *Fundamental Q*

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Table 2
Country data summary statistics.

	Mean	St. dev.	Median	Minimum	Maximum
Lerner	0.44	0.10	0.41	0.27	0.63
HHI (Gross Loans)	0.38	0.21	0.25	0.04	0.98
liquidity_ratio	1.19	1.54	0.94	0.00	96.58
GDP growth	1.90	1.80	2.20	−3.67	11.15
GDP (PPP)	1489.05	656.78	1812.11	10.57	2929.89
Inflation (%)	2.56	1.06	2.22	0.45	13.52
Government gross debt (% GDP)	72.96	26.43	66.67	3.69	112.62
Credit information index	4.61	0.82	5.00	0.00	6.00
Government revenue (% GDP)	45.60	4.43	45.93	32.40	56.59
Government expenditure (% GDP)	47.59	5.11	48.45	34.21	53.57
M2 growth (%)	13.89	7.18	12.41	1.97	60.12
Private credit growth (%)	105.27	29.09	95.14	25.91	272.80
Observations	304,645				

using the third and fourth lagged values[9] of the elements of the *Fundamental Q* VAR estimated in Appendix A.2.

It is also imperative to control for any unobserved firm fixed effects that may be simultaneously correlated with both investment levels and financing constraints. As is standard in panel data models, we eliminate any time-invariant effects by transforming our data. Standard transformations include within-group orthogonal deviations, first differences or the Helmert transformation. As we require the use of lagged variables as instruments, this invalidates the use of the orthogonal deviations as these rely on a strong exogeneity assumption such as $E[u_{it}|c_i, x_{i1}, \ldots, x_{i1}, \ldots, x_{iT}] = 0$. Of the remaining options, we choose to apply the Helmert transformation, which transforms the data to deviations from the forward mean, as this maximises the time dimension of our panel.

In order to control for country and year fixed effects, we include country and annual dummies. We choose to include country dummies in particular because, although less parsimonious than a transformation of the data, this will ensure that any country-level fixed effects are not inadvertently captured by our country-level variables of interest—bank market power in particular.

Our final transformation transforms all of the data to deviations from sector means in order to control for sector-level fixed effects.

To avoid endogeneity problems caused by potential reverse causality running from *Investment* to the explanatory variables *Fundamental Q, Cash Stock*, *Debt Overhang* and $Micro^{EU}$, the latter are lagged by one period when included in the model.

In order to ensure valid inference, our standard errors and test statistics are robust to heteroskedasticity and clustering on both country and sector. Given the small number of clusters, we apply a finite-sample adjustment, which inflates our standard errors by $\frac{M}{M-1}\frac{N-1}{N-K}$ where M is the number of country clusters, N is the total number of observations and K is the total number of regressors.

5. Results

5.1. Main results

Table 3 shows the main results for firm investment estimated by two-stage GMM. In our baseline specification (1), *Cash Stock* enters positively and significantly, implying that firm-level investment is sensitive to the availability of internal funds. Specifically, an increase in the ratio of cash to fixed assets of 10 points—e.g. from the median to the 58th percentile—is on average associated with a 1.82% point increase in the rate of investment. At median levels of investment, this would correspond to an economically significant 12.4% increase in the investment rate (from 14.63–16.45%). We interpret this as being indicative of a 'wedge' between the cost of internal and external financing, implying that the firms in our sample are financially constrained.

In our second specification (2), *Lerner* is added and enters negatively and highly significantly, implying a negative association between bank market power and SME investment. Moreover, in our third specification (3), the coefficient on *Cash Stock* becomes insignificant while the interaction between *Lerner* and *Cash Stock* is positive and significant, suggesting that the association between market power and investment is largely explained by variation in the degree of financing constraints.

In order to make valid inferences about the direction and economic significance of the relationships implied by these point estimates, we estimate and plot, in Fig. 1, the marginal effect of a 10% point increase in cash on investment across different levels of bank market power together with 95% confidence intervals. The positive slope indicates that investment is more cash-sensitive (and therefore firms are more financially constrained) when bank market power is high. This relationship is statistically significant at the 5% level for all values of the Lerner index above approximately 0.36. This range includes almost 80% of country-years in the sample, and includes both the mean and median values of the Lerner index—0.44 and 0.41, respectively.

Moreover, this relationship has considerable economic significance. Moving from the median Lerner index to the 75th percentile—an increase of 0.1—increases the sensitivity of investment to cash by 43.9%. An increase from the median to the maximum causes cash-investment sensitivity to more than double. Taken together, this empirical evidence suggests our first main result: that **bank market power exacerbates SME financing constraints**, in line with the market power hypothesis.

To ensure our main findings are robust we undertook a number of additional checks. Firstly, it may be the case that there are cultural influences that impact the financing activities of firms in specific countries. Such preferences may alter the relationship between cash and investment, i.e. firms traditionally have a preference for cash or a mistrust of financial institutions that is country specific and cultural in origin. To control for this, we re-estimated the regression including interactions between country dummies and cash stock to control for any country specific influences on the investment-cash stock relationship. Our main result remains statistically significant and of the aforementioned sign.

In addition, we tested whether our results are stable over time by reestimating the model excluding 2008. The main results hold in this case. Finally, we included the square term for Lerner × Cash

[9] Using the panel VAR to estimate Q means that the first and second lag variables are not valid instruments as these have been included in the differenced VAR equation. Our selection of valid instruments starts from the third level variable backwards. We therefore use the third level of the elements of the fundamental VAR to treat measurement error in Q.

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Table 3
Results using Lerner index and/or HHI.

Dep var: Invest	(1)	(2)	(3)	(4)	(5)
L. Fundamental Q	0.396***	0.393***	0.323***	0.377***	0.290***
	(0.076)	(0.074)	(0.094)	(0.070)	(0.082)
L. Debt overhang	−0.117***	−0.117***	−0.116***	−0.116***	−0.115***
	(0.026)	(0.025)	(0.025)	(0.024)	(0.024)
Firm age 0–3 years	0.148	0.149	0.178**	0.137	0.185**
	(0.100)	(0.098)	(0.072)	(0.102)	(0.077)
Firm age 4–7 years	0.083***	0.082***	0.089***	0.080***	0.092***
	(0.018)	(0.019)	(0.014)	(0.021)	(0.016)
Firm age 8–11 years	0.052*	0.049	0.052**	0.044	0.050*
	(0.028)	(0.031)	(0.025)	(0.027)	(0.024)
Firm age 12–15 years	−0.014	−0.014	−0.011	−0.012	−0.011
	(0.013)	(0.013)	(0.014)	(0.017)	(0.016)
L. Cash stock	0.182***	0.183***	0.051	0.178***	0.019
	(0.032)	(0.031)	(0.048)	(0.032)	(0.029)
Lerner		−1.648***	−1.286**		−0.457
		(0.480)	(0.573)		(0.795)
Lerner × L. Cash stock			0.447***		0.522***
			(0.100)		(0.092)
HHI (Loans)				−5.359***	−4.726***
				(0.911)	(1.264)
HHI × L. Cash stock				−0.062	−0.309
				(0.276)	(0.237)
Country dummies	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes
Firm-year observations	304,645	304,645	304,645	304,645	304,645
Number of countries	20	20	20	20	20
Number of sectors	306	306	306	306	306
Hansen's J (*p*-value)	.597	.571	.541	.476	.435
Cluster 1	Country	Country	Country	Country	Country
Cluster 2	Nace	Nace	Nace	Nace	Nace

Estimates efficient for, and statistics robust to, arbitrary heteroskedasticity and clustering by country and four-digit NACE sector. Q instrumented by the third and fourth lags of profits and sales, normalised by fixed assets.
*, ** and *** represent significance at the 90%, 95% and 99% levels, respectively.

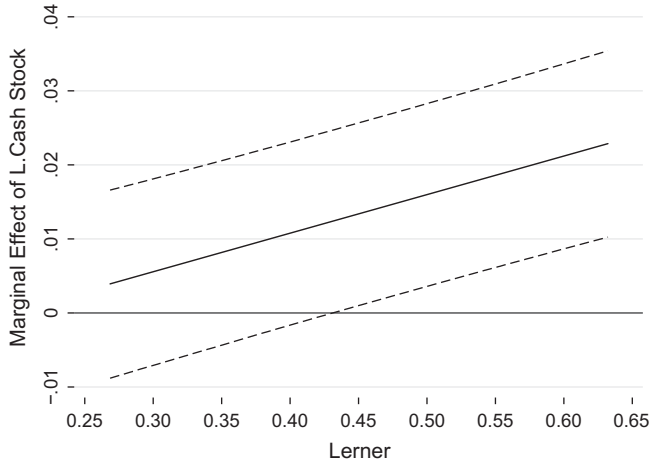

Fig. 1. Estimated marginal effect on *Investment* of a change in *L.Cash Stock* at different levels of *Lerner*.

interaction to test whether the effects are non-linear. This variable is insignificant so no non-linearities are evident.

5.2. Firm heterogeneity

Although the results thus far indicate support for the market power hypothesis, it is possible that we might observe heterogeneity across certain firm characteristics. This is particularly likely as the market power and information hypotheses are not mutually exclusive and may affect different types of firm in different ways or magnitudes.

Based on the reasoning outlined in Section 3.3, we might expect the adverse effect of bank market power to be dampened or exacerbated among firms that are (i) relatively small or (ii) relatively opaque.

Table 4 presents results for the extension of our empirical model to allow for heterogeneous effects across categories of firm size. We include $L.Micro^{EU}$, a dummy for 'micro' firms[10]—lagged by one period to avoid reverse causality—as well as interactions between this dummy and our key regressors.

Importantly, the main coefficients do not change between this and the original specification. However, the newly-included regressors tell an interesting story. First, the coefficient on $L.Micro^{EU}$ indicates that micro firms expand their capital stock at a faster rate than their small and medium counterparts, likely reflecting their smaller initial stock. Second, the interaction term $L.CashStock \times Micro^{EU}$ enters positively and significantly, suggesting that micro firms are relatively constrained, in line with the conventional wisdom. Third, and most important, the three-way-interaction term, $Lerner \times L.CashStock \times L.Micro^{EU}$ enters negatively and significantly, suggesting that the constraint-inducing effect of market power is *smaller* for micro than small and medium firms.

This story is supported by the estimated marginal effects. In Fig. 2 we reproduce the marginal effect graph of Fig. 1 except this time separating micro firms from the small and medium enterprises.[11] The relative slopes of these lines indicate that, for a given increase in bank market power, the increase in cash-investment

[10] Micro firms have an annual turnover of less than 10 times average national income and thus include the smallest—and hence most opaque—firms in our sample

[11] For clarity we do not show the confidence intervals; however, the vertical dotted line at Lerner = 0.36 reflects the point at which the overall marginal effect is no longer statistically significant at the 5% level.

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Table 4
Results using micro firm interaction terms.

Dep var: Invest	Size variable definition	
	(1)	(2)
L. Fundamental Q	0.290***	0.293***
	(0.082)	(0.080)
L. Cash stock	0.019	−0.065**
	(0.029)	(0.026)
Lerner	−0.457	0.087
	(0.795)	(1.039)
Lerner × L. Cash stock	0.522***	0.719***
	(0.092)	(0.116)
HHI (Loans)	−4.726***	−4.550***
	(1.264)	(1.364)
HHI × L. Cash stock	−0.309	−0.264
	(0.237)	(0.226)
L. Micro^{EU}	0.089**	0.113**
	(0.034)	(0.049)
Lerner × L. Micro^{EU}		−1.055
		(0.942)
Lerner × L. Cash stock × L. Micro^{EU}		−0.307***
		(0.105)
L. Cash stock × L. Micro^{EU}		0.117**
		(0.049)
Country dummies	Yes	Yes
Year dummies	Yes	Yes
Firm-year observations	304,645	304,645
Number of countries	20	20
Number of sectors	306	306
Hansen's J (p-value)	.435	.519
Cluster 1	Country	Country
Cluster 2	Nace	Nace

Estimates efficient for, and statistics robust to, arbitrary heteroskedasticity and clustering by country and four-digit NACE sector. Q instrumented by the third and fourth lags of profits and sales, normalised by fixed assets.
*, ** and *** represent significance at the 90%, 95% and 99% levels, respectively.

Table 5
Results using *L. Opacity* interaction terms.

Dep var: Invest	Size variable definition	
	(1)	(2)
L. Fundamental Q	0.290***	0.287***
	(0.082)	(0.083)
L. Cash stock	0.019	0.026
	(0.029)	(0.028)
Lerner	−0.457	−0.388
	(0.795)	(0.817)
Lerner × L. Cash stock	0.522***	0.510***
	(0.092)	(0.094)
HHI (Loans)	−4.726***	−4.592***
	(1.264)	(1.302)
HHI × L. Cash stock	−0.309	−0.312
	(0.237)	(0.239)
L. Opacity	−0.038	0.163
	(0.166)	(0.338)
Lerner × L. Opacity		−0.676
		(0.746)
Lerner × L. Cash stock × L. Opacity		0.524*
		(0.297)
L. Cash stock × L. Opacity		−0.168*
		(0.080)
Country dummies	Yes	Yes
Year dummies	Yes	Yes
Firm-year observations	304,645	304,645
Number of countries	20	20
Number of sectors	306	306
Hansen's J (p-value)	.435	.482
Cluster 1	Country	Country
Cluster 2	Nace	Nace

Estimates efficient for, and statistics robust to, arbitrary heteroskedasticity and clustering by country and four-digit NACE sector. Q instrumented by the third and fourth lags of profits and sales, normalised by fixed assets.
*, ** and *** represent significance at the 90%, 95% and 99% levels, respectively.

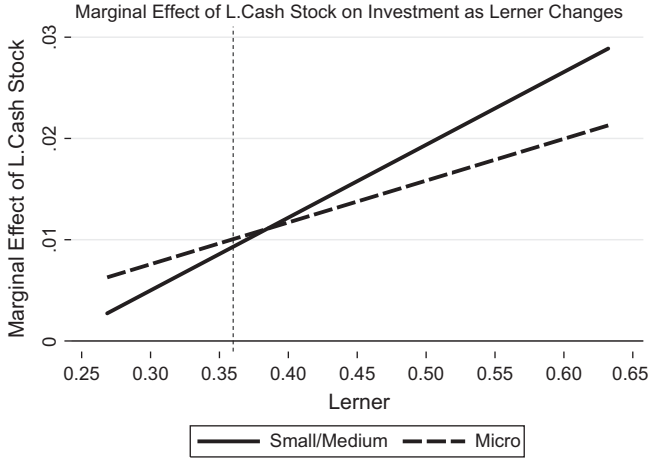

Fig. 2. Estimated marginal effect on *Investment* of a change in *L.Cash Stock* at different levels of *Lerner* for micro versus small and medium enterprises.

sensitivity—and thus, financing constraints—is 51% greater for small and medium firms than for micro firms.

This could provide evidence that the information hypothesis does indeed play a role in the nexus between bank competition and financing constraints, but that this channel is outweighed by the direct bank market power effect.

Table 5 presents results for the extension of our empirical model to allow for heterogeneous effects varying with the degree of firms' opacity. We include the continuous variable *Opacity*, given by the ratio of firm *i*'s intangible to total fixed assets and ranging from 0 to 1. We lag *Opacity* by one period to avoid reverse causality caused by investment in tangible or intangible assets.

Again, our main results are stable: bank market power exacerbates financing constraints. In this case, however, the marginal effects plotted in Fig. 3 indicate that cash-investment sensitivity (and hence, the degree of financial constraint) increases more severely for opaque firms than their more transparent counterparts.

This suggests an opposite conclusion regarding the information hypothesis than is suggested by the evidence from micro firms. Opaque firms in this cases "suffer more" under bank market power. The most important conclusion here is that bank market power affects firms in a heterogeneous fashion, but that the true relationship may be more complex than is accounted for by

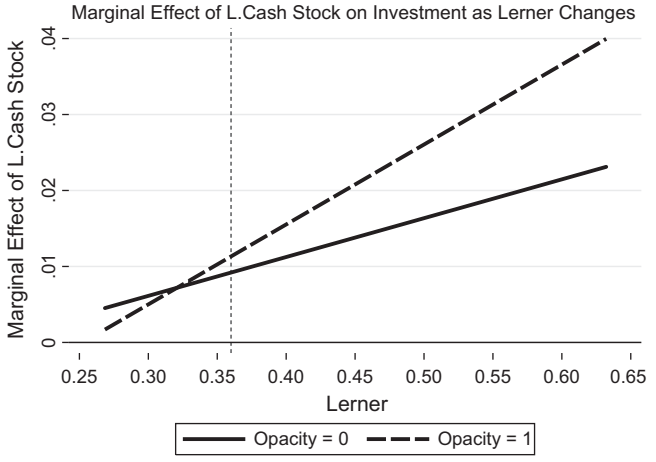

Fig. 3. Estimated marginal effect on *Investment* of a change in *L.Cash Stock* at different levels of *Lerner* for different levels of opacity.

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existing theoretical models. Further investigation of the complexity of the relationship between bank market power and firms' access to finance represents a potentially fruitful avenue for further research. In particular, empirical work at a more disaggregated level, where specific relationships between banks and borrowers can be identified, may shed further light on this issue.

5.3. Bank market power, financing constraints and financial structure

Our main results indicate that financing constraints increase for firms as bank market power increases. In this section, we test whether or not this dynamic differs depending on the structure of the financial system, i.e. how bank-based or market-based the financial sector (see Demirguc-Kunt et al., 2012). We expect that for firms in countries whose main source of external finance is bank credit the effect of bank market power on financing constraints should be even more intense. In these countries, firms are forced to seek bank credit as they have few alternatives. We therefore hypothesis that the effect of bank market power on financing constraints should increase in countries that have more bank-based financial systems.

To measure the degree to which a system is bank-based or market-based, we follow Demirguc-Kunt et al. (2012) and define a financial structure ratio, FinStr, as:

$$FinStr = \frac{Bank\ Credit}{Bank\ Credit + Market\ Capitalisation} \quad (1)$$

where bank credit is credit extended to the private sector by banks and market capitalisation is the total value of listed companies market capitalisation. The higher the values of FinStr the more finance is intermediated through the banking sector and the less outside market financing options that are available to firms. By interacting this variable with our key interaction above, we can test how the relationship between bank market power and financing constraints differs depending on the countries financial structure.

Table 6 presents the results including the interaction of financial structure with the Lerner index and cash stock. As in previous regressions, controls for debt overhang and firm age are included but suppressed for presentational purposes. As before, we find that Q is positive and significant at the 1% level as expected. We also find that cash stock is not significant on its own but the interaction between cash stock and Lerner is significant at the 1% level, confirming our main finding. FinStr is not significant on its own, or when interacted jointly with either cash stock or Lerner. However, when we interact FinStr with both Lerner and cash stock, the estimate is positive and significant at the 5% level. This indicates that as the financial structure of the economy becomes more bank based, the effect of bank market power on financing constraints increases. This is intuitive as firms, in countries where alternative liquid sources of financing are available, are less reliant on banks to fund investment expenditure. This finding is important as it suggests that providing liquid market financing alternatives to bank credit can help reduce the effect of bank market power on firms ability to fund investment expenditure.

Table 6
Results including financial structure.

Dep var: Invest	(1)	(2)	(3)	(4)
L. Fundamental Q	0.396***	0.393***	0.323***	0.411***
	(0.076)	(0.074)	(0.094)	(0.096)
L. Cash stock	0.182***	0.183***	0.051	0.05
	(0.032)	(0.031)	(0.048)	(0.060)
Lerner		−1.648***	−1.286**	−1.438**
		(0.48)	(0.573)	(0.501)
Lerner × L. Cash stock			0.447***	0.459***
			(0.100)	(0.128)
FinStr				1.254
				(1.302)
FinStr × L. Cash stock				−0.411
				(0.342)
FinStr × Lerner				−0.394
				(3.542)
FinStr × Lerner × L. Cash stock				1.913**
				(0.784)
Firm-year observations	304,645	304,645	304,645	304,549
Hansen's J (*p*-value)	.597	.571	.541	.52

Estimates efficient for, and statistics robust to, arbitrary heteroskedasticity and clustering by country and four-digit NACE sector. Q instrumented by the third and fourth lags of profits and sales, normalised by fixed assets. Firm age controls, country dummies, sector dummies and debt overhang included. Estimates are clustered at the country and sector levels. No. of countries: 20, no. of sectors 306.
*, ** and *** represent significance at the 90%, 95% and 99% levels, respectively.

6. Conclusions

This paper investigates the impact of bank market power on investment financing constraints experienced by small- and medium-sized enterprises (SMEs). Our sample extends the coverage of both countries and firms relative to existing research by using a large sample of approximately 118,000 SMEs across 20 European countries over the period 2005–2008. Our main contribution is to test the degree to which firms are financially constrained and investigate how such financial constraints vary by the degree of market competition between domestic banks. We also explore whether this relationship is heterogeneous across firm size categories.

We find that firms' investment is sensitive to the availability of internal funds and interpret this as being indicative of a wedge between the cost of internal and external financing. Furthermore, we find that bank market power is associated with lower levels of SME investment and, moreover, that this adverse impact of bank market power on investment is driven by the adverse effect of market power on financing constraints. In fact, much of the variation in cash-investment sensitivity is captured by the bank market power effect.

We separately estimate our empirical model to test for heterogeneous effects of bank market power on financing constraints across different categories of firm size. We find that the adverse effect of bank market power on financing constraints is reduced for the smallest subset of firms—defined as "micro" enterprises—and argue that this is evidence of an information hypothesis-type effect that dampens, but is ultimately outweighed by, the direct market power effect.

Our research provides a number of important insights for SME credit policy in the context of Europe's economic recovery and in terms of financial stability. The very heterogeneous impact of the financial crisis on domestic banking sectors in Europe has led, in many cases, to a retrenchment towards domestic activity (Barrell et al., 2011). This is a result of the extensive, but necessary, state intervention to provide banking sector support and restructuring (see Petrovic and Tutsch, 2009). If such restructuring significantly lessens competition between financial institutions, our findings suggest that this will lead to an increase in financing constraints for SMEs. Such credit constraints, if binding in the medium term, will inevitably lead to lower investment and potential output. Policy actions which ensure financial stability but provide for additional (or even just restore) competition in the European lending market for SMEs will be a necessary condition for future SME growth and be supportive of economic development.

Additionally, as we find that the effect of bank market power on financing constraints is stronger in financial systems that are more bank dependent, this would imply that further developing alternative liquid financing sources for SMEs in Europe would help

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develop a more stable financing environment. This would provide firms with a number of financing choices and the possibility of following a more diversified financial structure.

Appendix A

A.1. Sample breakdown

Tables 7 and 8.

A.2. Q model of investment

A theoretical outline of the Q model of finance in the context of a standard dynamic investment model is presented in Erickson and Whited (2000) and readers are directed there for a full treatment of the model. In summary, however, the Q statistic is an estimate of the marginal benefit of an additional unit of capital to the firm, consisting of any "marginal additions to profit and reductions in installation costs" (Erickson and Whited, 2002, p. 1032). From a theoretical perspective, Q is the Lagrangian shadow price and is unobservable to the econometrician. However, obtaining a reliable proxy for unobservable Q is important as it allows us to control for the availability of profitable investment opportunities in our own investment model.

The majority of studies attempting to approximate Q use financial market data, taking the ratio of the market value of the firm to the accounting book value. However, most SMEs are privately owned and financial market data is not available.

This has a number of consequences and relies on some very strict assumptions. One important corollary is that significant measurement error arises in taking a proxy for the unobservable Q: a detailed outline of the problems relating to this is provided in Erickson and Whited (2000).

As we have noted above, these are the very firms that are potentially most constrained in terms of accessing external financing and of particular interest in this research. Gilchrist and Himmelberg (1995) outline an approach to proxy Q from firm level fundamentals where market information is unavailable or expected to be particularly noisy. They specify a first order vector autoregressive approach which uses variables of firms' performance. The vector includes firm level fundamentals which relate to the profitability of the organisation. The panel VAR is outlined as follows:

$$\mathbf{x_{it}} = \mathbf{A}\mathbf{x_{i,t-1}} + \zeta_{\mathbf{i}} + \phi_{\mathbf{t}} + \epsilon_{\mathbf{it}} \quad (2)$$

$$q_{it} = (\mathbf{d}'[\mathbf{I} - \tau\mathbf{B}])\mathbf{x_{it}} \quad (3)$$

The system of equations that is governed by the panel VAR relates measures of firm level profitability to the Q model through the coefficient matrix B.[12] $\mathbf{x_{it}}$ is the vector of fundamentals. An important consideration in using this model is the selection of the appropriate variables for this vector. In line with other studies such as Benjamin and Phimister (2002) and Bierlen and Featherstone (1998) we include the marginal value product of capital (mvpk) and the sales to capital ratio. The mvpk is defined as in Gilchrist and Himmelberg (1995) as the profit to capital ratio and captures the increments to profitability of an additional unit of capital. τ is the combined discount and depreciation rate and is set by the econometrician. For this paper, we have set τ at a value of 0.8 in line with Gilchrist and Himmelberg (1995).[13] The matrix d is an identifier that highlights the coefficients on the marginal product value of capital in the project of $\mathbf{x_{it}}$ onto q_{it}.

As well as the normal error component, $\epsilon_{\mathbf{it}}$, the VAR equation has a composite error structure which includes a time specific effect, $\phi_{\mathbf{t}}$, to capture the impact of the general macroeconomic climate and business environment on firm performance, and a firm specific effect $\zeta_{\mathbf{i}}$ to capture unobserved heterogeneity. The panel VAR is estimating using the GMM methodology outlined by Holtz-Eakin et al. (1988) and used by Gilchrist and Himmelberg (1995). The resulting estimate for Q, known as fundamental Q, can be included in the standard empirical investment equation.

A.3. Estimating the Lerner Index

The Lerner Index used to measure market power in the banking sector is defines as follows:

$$Lerner = \frac{P_{TA} - MC_{TA}}{P_{TA}} \quad (4)$$

Table 7
Firm-year observations by NACE two-digit industrial category.

NACE rev. 2 primary code	No.	%
Fabricated metal products except machinery and equipment	57,857	18.99
Food products	38,503	12.64
Machinery and equipment	25,064	8.23
Printing or reproduction of recorded media	18,643	6.12
Other non-metallic mineral products	16,927	5.56
Repair and installation of machinery and equipment	16,618	5.45
Rubber and plastic products	15,036	4.94
Wood; products of wood and cork; articles of straw and plaiting materials	14,784	4.85
Furniture	14,339	4.71
Other manufacturing	11,860	3.89
Textiles	10,462	3.43
Wearing apparel	10,260	3.37
Chemicals and chemical products	8264	2.71
Electrical equipment	8029	2.64
Computer, electronic and optical products	7304	2.40
Leather and related products	6133	2.01
Beverages	5095	1.67
Paper and paper products	4272	1.40
Motor vehicles, trailers and semi-trailers	3995	1.31
Basic metals	3853	1.26
Electricity, gas, steam and air conditioning supply	3606	1.18
Other transport equipment	2275	0.75
Basic pharmaceutical products and pharmaceutical preparations	1035	0.34
Coke and refined petroleum products	396	0.13
Tobacco products	35	0.01
Total	304,645	100.00

Table 8
Sample size per country-year, firm level data.

Country	2005	2006	2007	2008	Total
Belgim	502	496	492	504	1,994
Czech Republic	1263	1570	1850	0	4683
Germany	281	389	457	559	1686
Estonia	649	692	782	607	2730
Spain	20,143	18,489	3070	4591	46,293
Finland	1874	1891	1945	1974	7684
France	23,202	24,068	24,598	25,042	96,910
Greece	282	300	315	328	1225
Croatia	1573	1642	1492	1534	6241
Hungary	17	23	18	0	58
Iceland	24	32	29	23	108
Italy	18,929	27,879	29,392	28,314	104,514
Latvia	7	8	8	0	23
Norway	1967	0	0	0	1,967
Poland	401	414	551	0	1366
Portugal	2823	4056	8624	8828	24,331
Sweden	360	355	348	0	1063
Slovenia	0	0	0	82	82
Slovakia	188	268	260	0	716
Ukraine	339	324	308	0	971
Total	74,824	82,896	74,539	72,386	304,645

[12] A detailed outline of the mechanisms behind this relationship are outside the scope of this paper and can be found in Gilchrist and Himmelberg (1995).

[13] τ is set in line with Gilchrist and Himmelberg (1995). It assumes a depreciation rate, δ, of 0.15% and a discount rate, r, of 6%. λ is calculated as $\frac{1-\delta}{1+r}$.

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where the price, P_{TA}, is proxied as the interest income over total assets. Our banking data are taken from Fitch for the period 2005–2008. We explicitly limit the estimates of market power to only those banks which indicated they had corporate loans on their balance sheet. This is to ensure that we are capturing the financial institutions which actually finance SMEs corporate activity.

We estimate marginal cost using a translog cost function with three cost inputs: (1) cost of capital (P_1) (interest expense/total deposits), (2) cost of labour inputs (P_2) (personnel expenses/total assets) and (3) cost of physical assets (P_3) (other operating expenses/fixed assets). The cost function for the total cost C of producing output Y as follows:

$$lnC = \alpha + \sum_i \beta_i lnP_i + 0.5\sum_i\sum_j \theta_{ij} lnP_i lnP_j + \beta_y lnY + 0.5\beta_{yy} lnY^2 + \sum_i \theta_{iy} lnP_i lnY$$

where C is the sum of interest expense, personnel expense and other operating expenses, i, j index costs 1, 2, 3 and Y is total assets. The associated share equations are:

$$S_i = \beta_i + \sum_j \theta_{ij} lnP_j + \theta_{iy} lnY$$

To ensure symmetry and linear homogeneity, we impose the following constraints: (1) $\theta_{ij} = \theta_{ji}$, (2) $\sum_i \beta_i = 1$, (3) $\sum_j \theta_{ij} = 0$, and (4) $\sum_j \theta_{iy} = 0$. Marginal cost is derived using the following expression:

$$mc(\varepsilon_{cy}) = \left(\frac{tc}{y}\right) \cdot \left(\beta_y + \beta_{yy} lnY + \sum_{i=1} \theta_{iy} lnP_i\right)$$

We estimated the cost function, simultaneously with the share equations, on a panel fixed effects basis for all countries.

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