Bank Concentration and Financial Constraints on Firm-Level Investment in Europe

by

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ABSTRACT

This study examines the effect of bank concentration on financing constraints of non-financial firms in fourteen European countries between 1992 and 2005. Using a series of large panels of firm-level data we analyze financial constraints with the Euler equation derived from the dynamic investment model. We find that with a highly concentrated banking sector firms are less financially constrained. Relaxation of financial constraint is significantly greater for smaller firms and significantly more marked during slowdown than during expansion. Results overall are consistent with an information-based hypothesis that more market power increases banks' incentives to produce information on potential borrowers. Findings are robust to consideration of country specific institutional factors.

*Key words***:** Firm level investment, Financial Constraints, Bank concentration

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1. Introduction

This paper examines the effect of bank concentration on financial constraints of firms' investment decisions in fourteen European countries between 1992 and 2005. European countries are an interesting area to consider the effect of bank concentration on non-financial firm level investment since in these countries there have been sweeping changes in bank concentration and integration and there is a higher reliance by firms on bank finance compared to the US.[1] Using a large panel of non-financial firm-level data and bank concentration and integration measures we analyze financial constraints with the Euler equation derived from the dynamic investment model. We control the cross-country differences of firms' size and country business cycle and institutional characteristics to check for the robustness of results.

Empirical work linking developments in the banking sector to real activity has grown out of studies documenting the robust relationship between financial development and real activity by King and Levine (1993), Demirgüc-Kunt and Maksimovic (1998), Levine and Zervos (1998), Rajan and Zingales (1998), and Levine *et al.* (2000) amongst others. The extensive literature on the role played by banks and bank concentration in the real economy is reviewed by Berger *et al.* (2004). Major competing hypotheses are that increases in banks' market power can either restrict firms' access to credit by lowering supply and charging higher prices, or because of incentives to produce information on potential borrowers, increase lending to firms that are informationally opaque.[2] Dick (2006) finds that for the US increased concentration in regional bank markets has been associated with greater consumer access to fee-free networks. In a multi-country studies that control for national approaches

[1] With the guarantee of a single market license, credit institutions in the EU member states can establish branches and provided capital services in other EU countries. The number of credit institutions in EU-15 declined by 18% from 1997 to 2003. Dermine (2005) surveys integration in banking within Europe and documents a gain in momentum in recent years, particularly in terms of domestic acquisitions. It should be noted that in most European countries not only is bank finance more important for firms than in the U.S., but the total bank asset to GDP ratio is much higher and has risen much more rapidly from 1990 to 2005 than in the U.S.

[2] Berger *et al.* (2004) and Dell'Ariccia and Marquez (2004) review models that relate bank competition, information, and credit allocation. A basic idea is that monopolistic power provides incentives to resolve asymmetric information problems. Beck *et al.* (2004) and Ergungor (2004) point out that bank concentration may proxy for (and be associated with) more effective regulation and greater diversification. Berger *et al.* (2007) consider the related issue of how market size influences competition.

to competition and property, Claessens and Laeven (2004) find no evidence that increased concentration is coupled with anticompetitive activity in the banking sector, and Demirgüc-Kunt, *et al.* (2004) find that increased concentration is not associated with increased net interest rate margins.

Recent research investigates the consequences of bank concentration for firm access to finance.[3] Beck, Demirgüc-Kunt and Maksimovic (2004), using the World Business Environment Survey across 74 countries, find that entrepreneurs are more to likely perceive finance as an obstacle to growth the greater is bank concentration in developing countries. The link is statistically insignificant for the effect of concentration on entrepreneur perception in difficulty in obtaining finance in economically well-developed countries. In studies using cross-country industry-level data, Cetorelli and Gambera (2001) find that industries with larger external finance requirements grow faster when the banking sector is more concentrated, and Cetorelli (2004) finds that banking deregulation and concentration reduce the average size of firms in EU member countries more than in non-member countries. Larrain (2006) concludes that countries with higher bank credit have lower volatility in industrial output.

Papers by Laeven (2003) and Love (2003) have examined the effect of financial development and liberalization on financing constraints of firms. This research connects financial development with studies in the finance area on imperfect credit markets due to asymmetric information and incentive difficulties causing firms to face a wedge between the cost of internal and external finance. Work by Fazzari, Hubbard and Peterson (1988), showing that financially constrained firms' sensitivity of investment to cash flow is greater than that for unconstrained firms, has been followed by a large empirical literature studying corporate investment decisions under imperfect capital markets. Surveys of the literature on financial friction and firm investment are provided by Hubbard (1998) and Stein (2003). Much empirical study on financial constraints has focused on data for the US. Evidence of financial constraints on behavior of firms in European countries has been provided by Bond *et al.*

[3] Related work on the effect of deregulation and increased bank concentration and integration on real economic activity includes recent studies for the US by Strahan (2003), with findings that removal of branching restrictions across states favors growth in state income and employment, and by Morgan *et al.* (2004), with findings that bank integration within a geographic area reduces volatility in employment.

(2003) and Chatelain *et al.* (2003), among others.[4] Recently, Cleary (2006) reports firm-level investment to be sensitive to cash flows measured by capital flow of the seven largest OECD countries.

In this paper we examine the impact of bank concentration on firms' financial constraints by estimating a dynamic model of investment based on the Euler equation approach. Development in the banking sector is linked to real activity by firms through influencing firms' stochastic discount factor. We find that with a highly concentrated banking sector firms are less financially constrained. The estimated coefficients on cash stock suggest that high concentration in the banking sector creates less information costs and that the magnitude of this effect is stronger for small firms, those firms which rely more on banks to finance their investment. We find that financial constraints are significantly tightened during recession. Greater bank concentration is associated with less tight financial constraint during both expansions and recession, with the easing of financial constraint during recession being significantly more marked than during expansion. These results are consistent with an information-based hypothesis that more market power increases banks' incentives to produce information on potential borrowers, since the effect is greater in those situations (i.e. for smaller firms and during recessions) when asymmetric information problems are more severe.

The results on institutional differences across countries indicate that firms' financial constraints are significantly reduced by an efficient legal structure, better accounting standards, increased director rights, lower risk of expropriation, and a stronger tradition of law and order. Greater creditor rights are not a statistically significant factor. Inclusion of these indicators of country specific institutional factors in the regression estimation did not affect the finding that increases in bank concentration significantly reduce financial constraints on firms.

In the next section we recap the dynamic investment model to investigate the role of banking structure on firms' access to capital markets. In section 3 we discuss the firm-level data and the cross-country database used in estimation. The econometric methodology to be used in estimating the

[4] Bond *et al.* (2003) estimate three different investment equations and conclude less excess sensitivity of investment to cash flow in the market oriented U.K than in three other large European countries. Chatelain *et al.* (2003) report that investment by firms in European countries show more sensitivity to liquidity if their balance sheets are weak.

dynamic panel model is given in Section 4. In section 5, we report the main empirical findings, and section 6 concludes.

2. Investment model

The dynamic model for firm value optimization under an imperfect capital market presented in this section is similar to the models in Laeven (2003) and Love (2003). It is a dynamic model of investment based on the Euler equation approach introduced by Abel (1980) with financial frictions modeled as in Gilchrist and Himmelberg (1998).[5] It is assumed that it is costly to adjust capital, the only input in production, and that there is debt finance. We consider managers or shareholders, who choose investment and debt, to maximize the present value of dividends subject to capital accumulation and external financing constraints. The objective function (1) is given by:

$$V_t(K_t, B_t, \xi_t) = \max_{\{I_{t+s}, B_{t+s+1}\}_{s=0}^{\infty}} D_t + E_t\left[\sum_{s=1} \beta^s D_{t+s}\right] \qquad (1)$$

subject to

$$D_t = \Pi(K_t, \xi_t) - C(I_t, K_t) - I_t + B_{t+1} - (1+r_t)(1+\eta(B_t, K_t, \xi_t))B_t \qquad (2)$$

$$K_{t+1} = (1-\delta)K_t + I_t \qquad (3)$$

$$D_t \geq 0 \qquad (4)$$

where $E_t[.]$ is the expectations operator conditional on information available at time t, D_t is non-negative dividend payment to shareholders at time t, and β is the firm's discount factor. In equation (2), net predetermined profits is given by $\Pi(K_t, \xi_t)$, where K_t is capital stock at the start of time t and ξ_t is a productivity shock, $C(I_t, K_t)$ is the convex adjustment cost function for investment, I_t, B_t is the firm's debt at time t, r_t is the risk free rate of return, and $\eta(B_t, K_t, \xi_t)$ is an external finance premium. The capital accumulation constraint is given by equation (3), where δ is the rate of capital depreciation.

[5] An extensive review of models of investment is provided by Bond and Van Reenen (2003). They note that the Euler equation approach relaxes assumptions required with the use of structure equations for investment and the need to use share price data. The latter factor is particularly important when considering investment by firms across countries.

As in Gilchrist and Himmelberg (1998), financial friction is incorporated with additional cost of external finance, $\eta(B_t, K_t, \xi_t)$, being an increasing function of the level of borrowing. The gross required rate of return on debt is $(1+r_t)(1+\eta(B_t, K_t, \xi_t))B_t$. Let λ_t denote the Lagrangian with the constraint (4) that debt is non-negative. λ_t is the shadow cost of external funds due to information and agency cost.[6]

The Euler equation for investment with an imperfect capital market from the first order condition is:

$$1+\frac{\partial C(I_t, K_t)}{\partial I_t} = E_t\left[\beta\left(\frac{1+\lambda_{t+1}}{1+\lambda_t}\right)\left\{\frac{\partial \Pi(K_{t+1}, \xi_{t+1})}{\partial K_{t+1}} + (1-\delta)\left(1+\frac{\partial C(I_{t+1}, K_{t+1})}{\partial I_{t+1}}\right)\right\}\right] \quad (5)$$

where $\partial C(I_t, K_t)/\partial I_t$ and $\partial \Pi(K_{t+1}, \xi_{t+1})/\partial K_{t+1}$ denote the marginal adjustment cost function of investment and the marginal benefit of investment, respectively. Equation (5) states that the marginal cost of investing at time t is equal to the discounted marginal cost of investing at time $t+1$. The stochastic discount factor, $\frac{1+\lambda_{t+1}}{1+\lambda_t}$, reflects the relative relative cost of external finance in periods $t+1$ and t.

Let the time varying stochastic discount factor for the relative cost of external finance in periods $t+s$ and t be defined as

$$\Phi_{t,t+s} = \frac{1+\lambda_{t+s}}{1+\lambda_t}. \quad (6)$$

Forward iteration on equation (5) yields:

$$1+\frac{\partial C(I_t, K_t)}{\partial I_t} = E_t\left[\sum_{s=1}\beta^s(1-\delta)^s\left(\prod_{k=1}^{s}\left(\Phi_{t+k-1,t+k}\right)\right)MPK_{t+s}\right], \quad (7)$$

where MPK_{t+s} denotes $\partial \Pi(K_{t+s}, \xi_{t+s})/\partial K_{t+s}$. By Taylor series approximation equation (7) becomes:[7]

[6] We assume that investment will be productive in the next period with restricted profit function, that tax consideration can be ignored, and that the price of the investment good is normalized to unity.

[7] We follow Gilchrist and Himmelberg (1998) and Love (2003) and ignore $(\partial C/\partial K)_{t+1}$ since this effect is small relative to $(\partial \Pi/\partial K)_{t+1}$ in equation (5) and assume $E(\Phi_{t+s}) \cong 1$ and $E(MPK_{t+s}) \cong \gamma$ due to the range of the mean of the stochastic discount factor. Therefore, $\Phi_{t,t+s}MPK_{t+s} \cong \gamma_0 + \gamma\Phi_{t,t+s} + MPK_{t+s}$.

$$1+\frac{\partial C(I_t,K_t)}{\partial I_t}=c+E_t\left[\sum_{s=1}^{\infty}\beta^s(1-\delta)^{s-1}MPK_{t+s}\right]+\gamma E_t\left[\sum_{s=1}^{\infty}\beta^s(1-\delta)^{s-1}\Phi_{t,t+s}\right] \quad (8)$$

We assume, as in Love (2003), that the stochastic discount factor for a firm may be approximated by the stock of liquid assets relative to total assets. The intuition is that the presence of an external finance premium guarantees a positive correlation between cash stock and investment. The main hypothesis of this paper is that bank concentration influences firms' financial constraint. To test this hypothesis, we incorporate the influence of bank concentration facing a firm at time t, Con_t, on the relationship between the firm's stochastic discount factor and the firm's cash as follows:

$$\Phi_{t,t+s}\cong\sigma_0+\sum_{k=1}^{s}(\sigma_1+\sigma_2 Con_t)Cash_{t+k-1}\,. \quad (9)$$

In equation (8), if the suffix i is introduced to indicate firm i, MPK_{it} is parameterized using a sales-based measure derived from the profit maximization problem with a Cobb-Douglas production function.[8]

$$MPK_{it}=\theta_i\frac{S_{it}}{K_{it}} \quad (10)$$

We assume a standard convex-adjustment cost function. This function includes lagged investment (to capital ratio) to capture strong persistence observed in the data.[9]

$$C(I_{it},K_{it})=\frac{\alpha}{2}\left(\frac{I_{it}}{K_{it}}-\rho\frac{I_{it-1}}{K_{it-1}}-v_i\right)^2K_{it} \quad (11)$$

where α is the cost of capital, v_i is a firm-specific effect on the level of investment, and ρ is measure of persistence.

If it is assumed that MPK_{it} and $Cash_{it}$ are vector autoregressive process of order one and that expectations are rational it can be shown, as in Laeven (2003), that equations (8), (9), (10) and (11) imply the empirical model:

[8] In the empirical framework, $MPK_{it}\approx const+\theta_i+\bar{\theta}(S/K_{it})$ and firm specific parameter θ_i is captured by fixed effect. θ_i is the ratio of capital share to markup.

[9] The marginal adjustment cost of investment is given by $\alpha((I_{it}/K_{it})-\rho(I_{it-1}/K_{it-1})-v_i)$ from which an estimate of ρ may be obtained to check persistence in the data.

$$\frac{I}{K_{it}} = \beta_1 \frac{I}{K_{i,t-1}} + \beta_2 \frac{S}{K_{i,t}} + \beta_3 Cash_{i,t} + \beta_4 Cash_{i,t} Con_{c,t} + f_i + d_{c,t} + u_{i,t} \quad (12)$$

where f_i is an unobserved firm-specific effect and $d_{c,t}$ denotes country-time dummies. u_{it} is an error term and orthogonal to any available information on time t. The interaction term in equation (12) identifies the role of bank concentration on the sensitivity of internal funds to investment. The main hypothesis focuses on the response of the banking sector to financial constraints on investment:

$$Ho: \beta_3 \geq 0 \text{ and } \beta_4 < 0 \quad (13)$$

We test the sign of the coefficients on cash stock and the interaction term as directly as possible. The negative sign on the interaction term suggests the positive sensitivity of investment to cash stock due to financial constraint decreases with higher bank concentration.

Note that in constructing the variables $\frac{I}{K_{it}}$ and $\frac{S}{K_{it}}$, investment flow is time t and the capital stock and sales are for time $t-1$, $Cash_{i,t}$, the cash stock to capital stock ratio, are both time $t-1$, and $Con_{c,t}$, the bank concentration ratio for firm i in country c is for time $t-1$. Thus, equation (12) could more revealingly be written as equation (12') belown but we will continue with the convention adopted in many papers and work with the notation of equation (12).

$$\frac{I_{i,t}}{K_{i,t-1}} = \beta_1 \frac{I_{i,t-1}}{K_{i,t-2}} + \beta_2 \frac{S_{i,t-1}}{K_{i,t-1}} + \beta_3 Cash_{i,t-1} + \beta_4 Cash_{i,t-1} Con_{c,t-1} + f_i + d_{c,t} + u_{i,t}. \quad (12')$$

3. Data

Our sample contains data on bank concentration and integration and non-financial firms from 14 European countries: Austria, Belgium, Finland, France, Germany, Ireland, Italy, Netherland, Portugal, Spain, Sweden, Switzerland and United Kingdom.

3.1. Firm-level data

Firm-level data are taken from the Compustat Global database from 1992 to 2005, which provides financial and income statements for publicly traded companies accounting for over 96% of European market capitalization. We have 14,467 observations and focus on total assets, capital

expenditures, sales, cash stock and debt.[10] All financial variables are converted to US dollar values by the appropriate exchange rates from the Compustat Global currency file. General rules with regard to the data are the following. We focus on non-financial firms (with SIC less than 6000). Firm-level data is eliminated if a firm has three or less years of coverage, if there are missing values for investment, capital stock, sales, cash stock, and cash flow, and if there are observations with negative values for assets, sales, or capital stock. In addition, we follow Gilchrist and Himmelberg (1998) and Love (2003) in excluding observations with ratio of investment to capital stock above 2.5, ratio of sales to capital stock above 20, ratio of cash stock to total assets above 0.6, and outliers in the top and bottom 1% of the data. Details on construction and calculation of financial variables are summarized in the Appendix and in Table A-1.

Tables 1, 2, and 3 provide information on the number of observations and firms across European countries, across years and industries, and descriptive statistics for firms' key financial variables in each country. In Table 1 the number of observations and the distribution of firm size in terms of total assets varies widely across countries.[11] In Table 2 tobacco and leather industries have higher internal funds compared to other industries, as expected. In Table 3 there are relatively fewer observations in the starting and ending periods. The total number of firms in the full sample is 1922, and the average number of firms is 137 for each country. We use a rank-based and weighting regression approach to correct the over-representive in the sample of a large number of observations from bigger countries.[12]

3.2. Banking and Institutional Characteristics by Country

Bank concentration index is defined as the share of the assets of the three largest banks in total banking sector assets in each country from BankScope database. We use the time-varying annual

[10]This paper uses cash stock as a measure of firms' internal funds instead of cash flow since use of cash flow to test sensitivity of investment is criticized by several recent papers, including Alti (2003) and Gomes(2001). Knyazeva *et al.* (2006) uses DATA 145 for I. We also obtain similar results with difference in capital stock.

[11] We also notice that cash stock scaled by total assets is on average more than 5 times higher for Austrian and Belgium firms than for Spanish and Finnish firms. However, there do not appear to be significant differences between Germany and the U.K as polar examples of bank-based and market-oriented financial systems.

[12]The alternative approach to compensate for unequal number of observations across countries is to estimate individual country regressions as in Bond *et al*. (2003) and Cleary (2005).

data for this index over 1992 to 2005.[13] Bank concentration by this measure tends to decrease with fluctuations except for Switzerland and Spain. Table 4 provides descriptive statistics for cross-country institutional characteristics including bank concentration. A number of financial and institutional variables for European countries will be introduced into regression equation to test the robustness of results. These include variables such as creditor and shareholder rights indices from La Porta *et al.* (1998). GDP growth rates are also shown. A business cycle effect on investment will be identified by recession dummies for each European country as the deviation of GDP from trend.

4. Econometric Issues

4.1. GMM-IV Estimation

Several difficulties arise in estimating the responsiveness of firm level investment to the change in banking structure for each country. The main empirical concerns are the treatment of fixed effects and possible endogeneity problems as obstacles to obtaining consistent estimators. A standard within group estimator can eliminate the individual effect, but this creates a correlation between the transformed dependent variable and transformed error due to the lagged variables on the right-hand side.[14] To avoid this dynamic panel bias, we can use either first difference or orthogonal deviation transformation. Both transformations are identical in estimation for the balanced panel, but forward mean differencing has an advantage in estimating unbalanced panel data in terms of sample size. The specification of the investment capital ratio in equation (12) is estimated after forward-mean differences and country-time differences to remove an unobserved firm-specific effect, f_i and country-time dummies, $d_{c,t}$.[15]

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[13] This bank concentration index has been used extensively in contributions by Beck *et al*. (2004) and Cetorelli (2004), among others. Usually the average of concentration over several years is used. Since most European countries show change in concentration during the 1990's we use time-varying data on concentration in the banking sector.

[14] With mean differencing, the transformed investment capital ratio $IK^{*}_{i,t-1} = IK_{i,t-1} - \frac{1}{T-1}(IK_{i,1} + \cdots + IK_{i,t} + \cdots + IK_{i,T-1})$ and the transformed error term $u^{*}_{i,t} = u_{i,t} - \frac{1}{T-1}(u_{i,2} + \cdots + u_{i,t-1} + \cdots + u_{i,T})$ are correlated since $-\frac{IK_{i,t}}{T-1}$ is correlated with $u_{i,t}$.

[15] Forward-mean differencing or "Orthogonal deviation", proposed by Arellano and Bover (1995), removes only

The orthogonality condition for the model is given by $E[\varepsilon_t \mid Z_{t-s}] = 0$ for $s \geq 0$, where Z are our instrumental variables. The instrument variables are taken to be the first and second ($t-1$ and $t-2$) lags of all the variables in equation (12) and 2-digit industry dummies. The GMM-IV estimator with an optimal weight matrix can solve efficiency and possible simultaneity issues. We provide Hansen statistics to check the validity of specified instruments. Hansen statistics are equal to the value of the GMM objective function at the estimated parameter value, which under the null hypothesis of instruments orthogonal to the error term is asymptotically distributed with degrees of freedom equal to the difference in the number of instruments and regressors. That is $S \xrightarrow{d} \chi^2(J-K)$, where J is the number of instruments and K is the number of regressors. All regressions are estimated using asymptotically robust standard errors with firm clusters. To counter the difference in the number of observations per country, we apply a linear weighting regression and rank-based estimator similar to Love (2003). The underlying idea for the rank-based model is the one need to compare firms under similar environments across countries. We experiment with different cutoff values because there is no criteria for cutoff values.

4.2. GMM Bootstrap

Since the properties of the sample distribution for the weighting regression are unknown we apply the GMM bootstrap method proposed by Hall and Horowitz (1996).[16] The GMM bootstrap methodology will provide a check of the large sample properties of the Hansen test for the overidentification of instrumental variables in the dynamic panel data and also provide the p-value of the Hansen test for the weighting regressions.

Hall and Horowitz (1996) draw a random sample in the traditional way and then recenter moment conditions with the bootstrap sample for the over-identification test to obtain bootstrap

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the mean of all future observations by defining $u_{it}^* = c_t\left[u_{it} - \frac{1}{T-t}\left(u_{it+1} + ... + u_{iT}\right)\right], t = 1,...,T-1$, where $c_t^2 = (T-t)/(T-t-1)$ to equalize the variances. This transformation "can be regarded as doing first differences to eliminate fixed effects plus a GLS transformation to remove serial correlation induced by differencing". Bond and Meghir (1994), Gilchrist and Himmelberg (1998), and Love (2003) use this transformation to remove individual effect.

[16] Hall and Horowitz (1996) argue that asymptotic theory "often provides poor approximations to the distributions of test statistics from GMM estimator" (p. 891).

Hansen-test statistics,

$$\tilde{g}_N^b = \frac{1}{N}\sum_{i=1}^{N} g\left(z_i^b, \beta\right) - \frac{1}{N}\sum_{i=1}^{N} g\left(z_i, \hat{\beta}\right) \tag{14}$$

where $g\left(z_i^b, \hat{\beta}\right)$ is the GMM estimation from the sample, b denotes the bootstrap sample, β and $\hat{\beta}$ are the parameters we wish to estimate with the bootstrap sample and the original sample, and z_i^b and z_i are the instrumental variables from the bootstrap and the original sample. Substituting linear relationship produces a moment condition as follows:

$$\tilde{g}_N^b = Z^{b'}\left(y^b - x^b\beta\right) - Z'\hat{u}, \tag{15}$$

where $\hat{u} = y - x\hat{\beta}$ and $Z'\hat{u} = \frac{1}{N}\sum_{i=1}^{N} g\left(z_i, \hat{\beta}\right)$. The first order condition with respect to the parameter we estimate is,

$$J^b(\beta) = \tilde{g}_N^b(\beta)' W \tilde{g}_N^b(\beta). \tag{16}$$

Let $\tilde{\beta}$ minimize J^b. The bootstrap GMM estimator in the linear model is

$$\tilde{\beta} = \left[x^{b'} Z^b W Z^{b'} x^b\right]^{-1}\left[x^{b'} Z^b W\left[Z^{b'} y^b - Z'\hat{u}\right]\right], \tag{17}$$

where $\hat{u} = Y - Z\hat{\beta}$ is the in sample residual. We have a final bootstrap version of the Hansen J test:

$$J^b(\tilde{\beta}) = \tilde{g}_N^b(\tilde{\beta})'\left(\tilde{V}^b\right)^{-1}\tilde{g}_N^b(\tilde{\beta}), \tag{18}$$

where $\tilde{V}^b$ is an optimal weighting matrix with the bootstrap sample.

5. Empirical Results

5.1. Single Country Investment Behavior

We start with basic single country regressions of investment on internal cash stock using GMM estimation. These results are reported in Table 5. The lagged investment term shows statistical significance in all single country regressions, except for Belgium. The results are consistent with Cleary (2006). The estimated statistically significant results imply reduced form persistence coefficients ranging from 0.17 to 0.47, which validates the assumption of a lagged term in the

adjustment cost function. The response of investment to marginal productivity of capital as measured by the sales to capital ratio is statistically significant in all the country regressions. Most countries have a positive response of investment to cash stock, indicating the presence of financial restrictions. Among the countries with a negative coefficient on cash stock, only Italy has a statistically significant negative sign. The cash flow sensitivity is significant and similar in magnitude for the three biggest economies, those of France, Germany, and the U.K.[17] The Hansen test statistics for over-identifying restrictions and the corresponding p -value indicates that most single country regressions are satisfactory (the exceptions are Spain and the U.K).

5.2. Bank Concentration Effects in European Countries

The accessment of the effect of structural change in the banking sector on mitigating firm use of internal funds is provided by estimation based on equation (12). Initial results for pooled country data are reported in Table 6. In Table 6, the models 1 through 4 are rank-based, in which firms are ranked based on the size of total assets and the 25 (or 50, 100, or 150) largest firms are taken from each (if available) country, and model 5 is a weighted regression, in which weights are equal to a value of one divided by the number of observations per country.

In Table 6, all coefficients are of the expected sign and significant at 1% and/or 5%. The cash coefficient enters with a positive sign and significance in all models, which is consistent with the existence of credit constraints. The interaction between cash stock and time varying bank concentration has negative and significant coefficients in all models, and these coefficients are uniformly higher with the cutoff value. The negative coefficient on the interaction term suggests that financial constraints are less severe in countries with highly concentrated banking sectors. Thus, time-varying concentration in the banking sector has a significant role on firm-level investment through the stochastic discount factor and relaxes financial constraints on European firms. The magnitude of the interaction effect for column (5) is large and suggests that moving from the first quartile to the second quartile of bank concentration will reduce the effect of internal funds by around 30% from 0.056 to

[17] This result is interesting in that Bond *et al.* (2003) report that the cash flow sensitivity to investment is more severe in the U.K than in the three continental countries, Belgium, France and Germany. Bond *et al.* (2003) emphasize caution in attributing the finding to a difference between market-based and relationship-based financial systems. We note that Bond *et al.* (2003) use accounting and income statement databases from different sources within each country for an earlier time period, 1978-89.

0.026. Finally, the partial effect of an one standard deviation of cash stock innovation on investment is equal to five cents.[18]

In results not shown, regressions for a sample divided into high and low concentration sections and then further separated by firm ranking according to total assets within each country, yields estimated coefficients on cash stock that are lower in the high bank concentration sample than in the low bank concentration sample. Thus, this method also indicates that high concentration in the banking sector creates a less severe external finance premium for firms than with low bank concentration.

5.3. Bank Concentration Effects and Winsorized Sample

The results in Table 6 and in most of the other regressions results to be reported are with regard rules for sample selection outlined in Gilchrist and Himmelberg (1998) and Love (2003). As robustness check we will re-estimate equation (12) using a winsorized sample as advocated by Cleary (1999; 2006). This is an important check for robustness since the literature has shown that results are sensitive to sample selection.[19]

With a winsorized sample outliers previously discarded are now censored to take what were previously cutoff values. The cutoff values are given by the top 1 and bottom 1 percentile of the main variables. The total number of observations is raised from a maximum of 7003 in Table 6 to a maximum of 8766 as reported in Table 7. A comparison across Tables 6 and 7 indicates that statistical significance and values parameters estimated do not vary greatly and that the conclusion that increased bank concentration reduces financial constraints remains unchanged.

5.4. Bank Concentration Effects and Leverage

The effect of including the lagged leverage ratio, measured by total debt over total assets, as an additional explanatory variable in the regression equation (12) are reported in Table 8. The sign of the

[18]The partial effect is equal to the standard deviation of cash stock (i.e. 0.087 in top 25 sample) times the coefficient on cash plus that same standard deviation times the coefficient on the interaction term times the level of bank concentration (first or second quartiles are equal to 0.463 and 0.637), respectively.

[19] In a debate about the importance of financial variables such as cash flow and cash stock for investment decisions, Allayannis and Mozumdar (2004), for example, arrived at different conclusions regarding relevance of investment cash sensitivity to financial constraints than Kaplan and Zingales (1997) and Cleary (1999) due primarily to sample selection procedures and strong outlier effects.

coefficient on leverage is negative as expected and is only statistically significant in models 2 and 5 in Table 8. In the models in Tables 6, 7 and 8, *P*-values for *J*-statistic test of over-identifying restrictions using Bootstrap simulation with 200 repetitions are consistent with a well chosen set of instrumental variables. The inclusion of leverage in the regressions in Table 8 does not materially affect the findings from Table 6 that increasing bank concentration relaxes the financial contraint on firm level investment.

5.5. Size Effect

Firm size will now be introduced into the baseline model. If countries with high bank conentration tend to have the largest firms in the sample, then results might be explained not by the structural differences in banking sector but by firm size. Firm size is now introduced into the basic model as follows:

$$\frac{I}{K}_{it} = \beta_1 \frac{I}{K}_{i,t-1} + \beta_2 \frac{S}{K}_{it} + \beta_3 Cash_{it} + \beta_4 Cash_{i,t} Con_{c,t} + \beta_5 Cash_{i,t} Z_{i,t} + \beta_6 Cash_{i,t} Z_{i,t} Con_{ct} + f_i + d_{c,t} + u_{it} \quad , \qquad (19)$$

where Z_{it} is either firm size, as indicated by the log of real dollar total assets, or a recession dummy variable defined below. The instruments when estimating equation (19), will include Z_{it} and interaction of Z_{it} with investment, cash and sales.

In model 1 in Table 9, is equation (19) estimated with $\beta_4 = \beta_6 = 0$, i.e. without bank concentration effects, in order to indicate the effect of size effect alone on the extent of financial constraint. In model 1 the coefficient of the interaction of size and cash is negative and statististically significant. This suggests that larger firms are less credit constrained than smaller firms. The overall cash coefficient on a firm with mean size is equal to 0.114 while the cash coefficient on a firm with one standard deviation below the mean is equal to 0.308, almost three times as large.[20]

The results from estimating equation (19) with a bank concentration effect and with the restriction $\beta_6 = 0$ appear as model (2) in Table 9. The statistical significance of the negative

[20] The mean of the log of total assets in U.S dollars is 6.121 and one standard deviation below mean is equal to 4.236. Approximately the same differential effect of firm size on the effect of cash on investment follows from model 2 as from model 1 in Table 10 for mean bank concentration of 0.72.

coefficient on the interaction of cash with bank concentration (β_4), is robust to the addition of firm size to the basic regression equation, and indicates that cross-country differences in banking sectors has explanatory power even though we control for the size of the firms.

To allow for different size effects across different bank concentration levels across countries equation (19) is estimated and appears as Model 3 in Table 9. The coefficient β_6 is positive and statistically significant, indicating that the size effect (of reducing the positive association between cash and investment) is more limited when bank concentration is greater. An alternative way to state this implication is that greater bank concentration reduces financial constraints more for small than for big firms.[21] In the models in Table 9 the *P*-values for *J*-statistic test of over-identifying restrictions using Bootstrap simulation is consistent with a well chosen set of instrumental variables.

5.6. Business Cycle Effect

We now check for robustness of results by allowing outcomes to vary over the business cycle. The relationship between financial friction and the business cycle is well-documented by Bernanke and Gertler (1989), Gertler and Gilchrist (1994), and Oliner and Rudebusch (1996), among others. The idea is that with imperfect capital markets more financially constrained or distressed firms are hit harder in a recession. Recent findings by Bernanke *et al.* (1996) for the U.S. and by Vermeulen (2002) for the four largest European countries support this design. Following Braun and Larrain (2005) we use the Hodrick-Prescott filter (Hodrick and Prescott (1980)) to identify country specific slowdowns in the economy. A dummy variable, $\mathrm{Re}c_{c,t}$, is defined to be equal to one if the real GDP is below the trend value (computed with the Hodrick-Prescott filter) for country c at time t, and equal to zero otherwise.

Estimation results when the business cycle indicator variable is added to the basic model are reported in models 4, 5 and 6 in Table 9. We find a significant effect of a recession on financial

[21] This result is consistent with Correa's (2006) finding that banking integration in the U.S. in recent years has benefited small firm more, and with Peterson and Rajan's (1995) finding that small firms in a highly concentrated banking sector have more bank credit than in a lower concentrated banking sector by the national survey of small business financial data in the U.S. Beck *et al.* (2004) find a negative relationship between market power in the banking sector and financial constraints for developing countries, in general, but suggest that market concentration possibly reduces financial obstacles in countries with a well developed financial system. This result is consistent with the finding by Beck et al. (2005) that small firms benefit more from relaxation of financial and legal constraints

constraints when we run pooled GMM regression, in that the estimated coefficient on the interaction variable of cash and business cycle dummy variable is positive in all three models. In models 5 and 6 the coefficient on the interaction of cash and bank concentration is statistically significant and negative, indicating robustness of the finding that increased bank concentration mitigates firm financial constraints in the presence of a business cycle dummy variable. Finally, in model 6, the coefficient on the triple interaction variable of cash stock, bank concentration, and business cycle dummy, is negative and statistically significant, consistent with the idea that during recession increases in financial constraint are less for firms in those countries with higher bank concentration.

5.7. Country Institutional Differences

In this subsection, we test whether indicators of institutional difference across countries are correlated with cash-investment sensitivity in European countries, and whether the inclusion of these indicators modify results for the effect of bank concentration on the presence of financial contraints. Demirgüc-Kunt and Maksimovic (1998) report the importance a variety of indicators of institutional differences for the growth rate of a firm. We use several indicators of country characteristics in this paper taken from La Porta *et al.* (1998). These are an accounting index capturing the thoroughness of examining and rating company reports, an efficiency and integrity index of the judicial system for business, a risk of expropriation index with lower scores indicating greater risk, an index for law and order tradition, and indices for the extent of creditor and of shareholder rights.

We have two models for each institutional indicator reported in Table 10, with and without the parameter β_5 restricted to be zero in the equation

$$\frac{I}{K_{it}} = \beta_1 \frac{I}{K_{i,t-1}} + \beta_2 \frac{S}{K_{it}} + \beta_3 Cash_{it} + \beta_4 Cash_{i,t}\mathrm{Ind}_c + \beta_5 Cash_{i,t} Con_{ct} + f_i + d_{c,t} + u_{it} \quad , \quad (20)$$

where Ind_c is a dummy variable indicating institutional differences across countries. The results in Table 10 indicate that more thorough accounting standards, more efficient legal system, a lower risk of expropriation, a stronger tradition of law and order, and decreased shareholder rights all significantly reduce financial constraints on business. The inclusion of these variables do not erode the finding that increases in bank concentration significantly reduce financial constraints on firms. In Table 10 an indicator variable for creditor rights is not significant. These results are consistent with

those of Love (2003) and Demirgüc-Kunt and Maksimovic (1998).

6. Conclusion

We study the effect of structural change in banking structure on financial constraints on firms in a dynamic investment model with a sample of 2286 listed firms in 14 European countries for the period 1992 to 2005. We further consider firm size, and business cycle and institutional differences across countries to check the robustness of our results. The empirical results show that increased concentration in the banking sector in European countries relaxes financial constraints on firm-level investment. This result is robust to inclusion of leverage as a variable and to use of a winsorized sample. We find that the banking structure of each country has an effect on firm-level investment through the stochastic discount factor, which affects inter-temporal decision for managers.

The estimated coefficients on cash stock suggest that high concentration in the banking sector creates less information costs and that the magnitude of this effect is stronger for small firms, those firms that rely more on banks to finance their investment. We find that financial constraints are tighter during contractions. Greater bank concentration is associated with less tight financial constraint during expansions and during recession, with the easing of financial constraint being more marked during recession. These results are consistent with an information-based hypothesis that more market power increases banks' incentives to produce information on potential borrowers, since smaller (and more opaque) firms compared to large firms, and all firms during recession when asymmetric information problems are greater than during expansion, have significantly greater relaxation of financial constraints with higher levels of bank concentration.

The finding that increases in bank concentration significantly reduce financial constraints on firms is robust to the inclusion of indicators of country specific institutional factors in the regression estimation. The results on institutional differences across countries indicate that firms' financial constraints are significantly reduced by better accounting standards, more efficient legal system, a lower risk of expropriation, a stronger tradition of law and order, and increased director rights.

Table 1: Firm-level data across countries: 1992-2005

Country	Code	Number of Observations	Percent of Observations	Number of Firms	TA	IK	SK	Cash	CF	TQ	LEV
Austria	AUT	367	2.54	51	1288	0.188	3.306	0.097	0.253	1.123	0.254
Belgium	BEL	304	2.10	43	2456	0.222	4.460	0.105	0.395	1.454	0.261
Switzerland	CHE	988	6.83	125	2775	0.161	3.668	0.314	0.135	1.609	0.253
Germany	DEU	2,041	14.11	280	5782	0.241	5.091	0.331	0.089	1.509	0.197
Denmark	DNK	697	4.82	86	929	0.232	4.536	0.321	0.118	1.358	0.278
Spain	ESP	452	3.12	66	5280	0.186	3.175	0.269	0.068	1.360	0.234
Finland	FIN	461	3.19	64	2267	0.225	4.246	0.371	0.085	1.232	0.291
France	FRA	1,267	8.76	200	5696	0.252	6.294	0.411	0.118	1.285	0.242
United Kingdom	GBR	5,712	39.48	701	1944	0.202	4.554	0.303	0.093	1.549	0.195
Ireland	IRE	209	1.44	23	1342	0.189	4.257	0.322	0.132	1.421	0.291
Italy	ITA	395	2.73	71	8231	0.200	3.946	0.336	0.117	1.213	0.242
Netherlands	NLD	870	6.01	101	2912	0.219	5.906	0.376	0.074	1.445	0.244
Portugal	PRT	86	0.59	14	2519	0.231	2.798	0.192	0.069	1.169	0.251
Sweden	SWE	618	4.27	97	2152	0.216	4.905	0.372	0.093	1.479	0.235
Total		14467	100	1922							
Mean		1033.4		137	3255	0.212	4.367	0.294	0.131	1.372	0.248
Median					2487	0.217	4.358	0.321	0.105	1.390	0.247
Std					2141	0.025	0.987	0.097	0.089	0.149	0.029

Notes: Data from Compustat Global. Variables are discussed and defined in Table A-1: TA - total assets in million U.S dollar units; IK - ratio of investment to capital stock; SK - ratio of sales to capital stock; Cash - ratio of cash stock to total assets; CF - ratio of cash flow to capital stock; TQ – Tobin's Q; LEV – leverage is ratio of total debt to total assets. General rules with regard to the data are the following. We focus on non-financial firms (with SIC less than 6000). Firm-level data is eliminated if a firm has three or less years of coverage, if there are missing values for investment, capital stock, sales, cash stock, and cash flow, and if there are observations with negative values for assets, sales, or capital stock. In addition, we follow Gilchrist and Himmelberg (1998) and Love (2003) in excluding observations with IK > 2.5, SK > 20, cash > 0.6, and outliers in the top and bottom 1% of the variable values.

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Table 2: Descriptive Statistics across Industries

Industry	SIC	Industry name	IK	SK	Cash	CF	TQ	LEV	Number of Observations	Percent of Observations
1	0	Agriculture, forestry and fishing	0.151	2.347	0.138	0.224	1.912	0.205	104	0.74
2	1	Mining	0.217	1.906	0.105	0.244	1.304	0.214	228	1.61
3	2	Construction	0.240	6.848	0.127	0.322	1.176	0.174	621	4.39
4	4	Transportation, communication, electric, gas and sanitary services	0.183	2.551	0.097	0.258	1.456	0.261	1,609	11.38
5	5	Wholesale trade and retail trade	0.231	6.329	0.090	0.329	1.473	0.212	2,232	15.79
6	20	Food and kindred products	0.193	4.139	0.080	0.286	1.355	0.252	1,118	7.91
7	21	Tobacco manufactures	0.172	3.609	0.179	0.576	1.712	0.347	23	0.16
8	22	Textile mill products	0.188	4.557	0.069	0.249	2.245	0.235	315	2.23
9	23	Apparel and fabrics-based products	0.199	6.501	0.085	0.339	1.250	0.218	296	2.09
10	24	Lumber and wood products	0.203	4.479	0.090	0.204	1.164	0.270	98	0.69
11	25	Furniture and fixtures	0.202	4.525	0.092	0.258	1.258	0.229	200	1.42
12	26	Paper and allied products	0.175	2.640	0.072	0.217	1.109	0.259	444	3.14
13	27	Printing and publishing	0.227	5.143	0.098	0.510	1.698	0.222	429	3.04
14	28	Chemicals and allied products	0.212	3.803	0.109	0.357	1.708	0.207	1,019	7.21
15	29	Petroleum refining	0.172	4.429	0.051	0.257	1.257	0.235	88	0.62
16	30	Rubber and plastics products	0.210	3.980	0.069	0.311	1.346	0.242	327	2.31
17	31	Leather and leather products	0.210	7.463	0.153	0.383	1.564	0.112	55	0.39
18	32	Stone, clay, glass, and concrete	0.183	2.945	0.078	0.253	1.184	0.220	682	4.83
19	33	Primary metal industries	0.198	3.888	0.075	0.282	1.185	0.220	462	3.27
20	34	Fabricated metal products	0.219	5.087	0.084	0.329	1.264	0.222	494	3.5
21	35	Machinery, except electrical	0.209	5.739	0.113	0.375	1.535	0.203	1,240	8.77
22	36	Electrical and electronic machinery, equipment and supplies	0.243	5.638	0.122	0.378	1.583	0.200	811	5.74
23	37	Transportation equipment	0.252	5.208	0.115	0.360	1.261	0.233	545	3.86
24	38	Instruments; Photographic, medical and optical goods; Clocks	0.255	5.327	0.132	0.542	2.137	0.199	510	3.61
25	39	Miscellaneous manufacturing industries	0.251	5.638	0.110	0.448	1.440	0.210	183	1.29

Notes: Data from Compustat Global. Variables are discussed and defined in Table A-1: TA - total assets in million U.S dollar units; IK - ratio of investment to capital stock; SK - ratio of sales to capital stock; Cash - ratio of cash stock to total assets; CF - ratio of cash flow to capital stock; TQ – Tobin's Q; LEV – leverage is ratio of total debt to total assets.

Table 3: Descriptive statistics across years

Year	IK	SK	Cash	CF	TQ	LEV	No. of Obs.	% of Obs.
1992	0.217	4.011	0.102	0.261	1.330	0.214	705	4.87
1993	0.192	3.996	0.106	0.269	1.500	0.208	758	5.24
1994	0.227	4.852	0.110	0.336	1.440	0.205	872	6.03
1995	0.235	4.846	0.103	0.325	1.466	0.213	986	6.82
1996	0.223	4.714	0.104	0.327	1.477	0.206	1,118	7.73
1997	0.213	4.453	0.104	0.323	1.542	0.207	1,373	9.49
1998	0.243	4.902	0.100	0.355	1.466	0.215	1,382	9.55
1999	0.205	4.263	0.093	0.309	1.680	0.227	950	6.57
2000	0.204	4.468	0.085	0.342	1.526	0.236	933	6.45
2001	0.206	4.430	0.085	0.288	1.376	0.246	1,097	7.58
2002	0.214	5.104	0.090	0.312	1.180	0.245	1,294	8.94
2003	0.198	5.242	0.096	0.347	1.324	0.234	1,206	8.34
2004	0.200	5.153	0.097	0.385	1.700	0.224	1,177	8.14
2005	0.175	4.685	0.098	0.380	1.553	0.218	616	4.26
Total	0.214	4.662	0.098	0.317			14467	100

Notes: Data from Compustat Global. Variables are discussed and defined in Table A-1: TA - total assets in million U.S dollar units; IK - ratio of investment to capital stock; SK - ratio of sales to capital stock; Cash - ratio of cash stock to total assets; CF - ratio of cash - flow to capital stock; TQ – Tobin's Q; LEV – leverage is ratio of total debt to total assets.

Table 4: Descriptive Statistics across Countries

Country	GDP growth 1992-2005	Accounting Index	Efficiency Index	Expropriat-ion Index	Rule of Law	Creditor's Rights	Director Rights	Bank Concent-ration 1992-2005
AUT	1.64%	0.65	9.50	9.69	10.00	3	2	0.72
BEL	1.72%	0.73	9.50	9.63	10.00	2	0	0.89
CHE	0.58%	0.82	10.00	9.98	10.00	1	2	0.64
DEU	1.17%	0.75	9.00	9.90	9.23	3	1	0.67
DNK	1.87%	0.75	10.00	9.67	10.00	3	2	0.80
ESP	2.37%	0.77	6.25	9.52	7.80	2	4	0.56
FIN	2.50%	0.93	10.00	9.67	10.00	1	3	0.99
FRA	1.40%	0.83	8.00	9.65	8.98	0	3	0.58
GBR	2.41%	0.94	10.00	9.71	8.57	4	5	0.57
IRL	5.64%	0.00	8.75	9.67	7.80	1	4	0.69
ITA	1.02%	0.75	6.75	9.35	8.33	2	1	0.44
NLD	1.92%	0.77	10.00	9.98	10.00	2	2	0.76
PRT	2.00%	0.43	5.50	8.90	8.68	1	3	0.88
SWE	2.07%	1.00	10.00	9.40	10.00	2	3	0.98
Mean	2.13%	0.72	8.80	9.62	9.24	1.93	2.50	0.73
Quartiles:								
25%	1.29	0.74	8.19	9.55	8.60	1	2	0.58
50%	1.90	0.76	9.50	9.67	9.62	2	2.5	0.71
75%	2.39	0.83	10.00	9.71	10.00	2.75	3	0.89

Notes: Real GDP growth rates from Eurostat. Bank concentration index-Assets of three largest banks as a share of assets of all commercial banks from WDI, World Bank. All other variables from La Porta *et al.* (1998).

Table 5: Single Country Regressions (GMM-IV)

$$\frac{I}{K}_{it} = \beta_1 \frac{I}{K}_{i,t-1} + \beta_2 \frac{S}{K}_{i,t} + \beta_3 Cash_{i,t} + f_i + d_{c,t} + u_{i,t}$$

Notes: Variables are defined in Table A-1. I is investment, K is capital stock, S is sales, Cash is ratio of cash stock to total assets, f_i is an unobserved firm-specific effect, $d_{c,t}$ denotes country-time dummies, and u_{it} is an error term and orthogonal to any available information on time t. Note that in constructing variables if investment flow is time t, the capital stock, sales, and Cash are for time $t-1$. Estimation is by GMM, country, time and fixed effects are removed by forward mean differencing prior to estimation prior. Instruments are first and second lags of I/K, S/K, Cash, CF, COGS (cost of goods scaled by prior periods capital stock) , and industry dummies. *P*-values for *J*-statistic (test of over-identifying restrictions) are obtained using χ^2 distribution. Heteroskedasticity adjusted standard errors in parentheses; ***, **, * represent significance at 1%, 5%, and 10% respectively.

	I/K_{t-1}			S/K_t			$Cash_t$			Hansen P-value	Number of Obs.
	Coeff.	St.error		Coeff.	St.error		Coeff.	St.error			
AUT	0.40	(0.053)	***	0.023	(0.008)	***	0.45	(0.169)	***	0.26	171
BEL	-0.02	(0.032)		0.038	(0.012)	***	0.03	(0.146)		0.83	129
CHE	0.26	(0.060)	***	0.024	(0.006)	***	0.14	(0.081)	*	0.19	547
DEU	0.24	(0.033)	***	0.017	(0.006)	***	0.21	(0.101)	**	0.75	950
DNK	0.31	(0.050)	***	0.014	(0.003)	***	-0.03	(0.050)		0.34	361
ESP	0.20	(0.041)	***	0.006	(0.011)		0.22	(0.164)		0.26	173
FIN	0.20	(0.035)	***	0.031	(0.008)	***	0.43	(0.145)	***	0.09	226
FRA	0.29	(0.051)	***	0.027	(0.006)	***	0.31	(0.073)	***	0.47	464
GBR	0.22	(0.031)	***	0.022	(0.005)	***	0.23	(0.060)	***	0.00	3169
IRL	0.17	(0.021)	***	0.004	(0.001)	**	-0.02	(0.055)		0.57	124
ITA	0.47	(0.030)	***	0.045	(0.004)	***	-0.35	(0.095)	***	0.51	109
NLD	0.36	(0.065)	***	0.014	(0.004)	***	0.08	(0.081)		0.77	445
PRT	0.22	(0.010)	***	0.173	(0.004)	***	2.00	(0.244)	***	0.31	54
SWE	0.31	(0.057)	***	0.048	(0.007)	***	-0.19	(0.146)		0.31	272
Mean	0.259	0.041		0.035	0.006		0.250	0.115			514
Quartiles:											
25%	0.203	0.031		0.015	0.004		-0.004	0.075			140
50%	0.247	0.038		0.023	0.006		0.171	0.098			249
75%	0.313	0.053		0.036	0.007		0.287	0.146			459

Table 6: Investment Regressions with Bank Concentration (GMM-IV)

$$\frac{I}{K}_{it} = \beta_1 \frac{I}{K}_{i,t-1} + \beta_2 \frac{S}{K}_{i,t} + \beta_3 Cash_{i,t} + \beta_4 Cash_{i,t} Con_{c,t} + f_i + d_{c,t} + u_{i,t}$$

Notes: Variables are defined in Table A-1. I is investment, K is capital stock, S is sales, Cash is ratio of cash stock to total assets, Con_{ct} is bank concentration, f_i is an unobserved firm-specific effect, $d_{c,t}$ denotes country-time dummies, and u_{it} is an error term and orthogonal to any available information on time t. Note that in constructing variables if investment flow is time t, the capital stock, sales, Cash, and Con are for time $t-1$. Estimation is by GMM, country-time and fixed effects are removed by country-time and forward mean differencing prior to estimation. Instruments are first and second lags of I/K, S/K, Cash, CF, COGS (cost of goods scaled by prior periods capital stock), interactions of Con with I/K, S/K and Cash, and industry dummies. The firms are ranked based on the size of total assets. The 25 (or 50, 100, or 150) largest firms are taken from each (if available) country. In the weighted regression, weights are equal to a value of one divided by the number of observations per country. *P*-values for *J*-statistic (test of over-identifying restrictions) are obtained using χ^2 distribution or Bootstrap simulation with 200 repetitions (the χ^2 p-value is not available for weighted regressions). Heteroskedasticity adjusted standard errors in parentheses; ***,**, and * represent significance at 1%, 5%, and 10% respectively.

Model	1 25 largest		2 50 largest		3 100 largest		4 150 largest		5 All weighted	
I/K_{it-1}	0.302	***	0.299	***	0.275	***	0.236	***	0.228	***
	(0.035)		(0.031)		(0.026)		(0.025)		(0.017)	
S/K_{it}	0.033	***	0.034	***	0.036	***	0.033	***	0.043	***
	(0.006)		(0.005)		(0.005)		(0.005)		(0.005)	
$Cash_{it}$	1.292	***	1.442	***	2.173	***	3.070	***	2.234	***
	(0.486)		(0.556)		(0.634)		(0.751)		(0.644)	
$Cash_{it}*Con_{ct}$	-1.706	**	-1.909	**	-2.912	***	-4.266	***	-2.746	***
	(0.709)		(0.792)		(0.900)		(1.092)		(0.895)	
Constant	-0.006		-0.002		-0.001		-0.002		-0.002	***
	(0.002)		(0.002)		(0.002)		(0.002)		(0.002)	
No. of obs.	1362		2275		3559		4119		7003	
No. of firms	280		506		853		1012		1700	
Hansen P-value:										
Chi-square	0.207		0.212		0.082		0.767		N/A	
Bootstrap	0.938		0.873		0.518		0.933		0.422	

Table 7: Investment Regressions with Winsorized Sample (GMM-IV)

$$\frac{I}{K}_{it} = \beta_1 \frac{I}{K}_{i,t-1} + \beta_2 \frac{S}{K}_{i,t} + \beta_3 Cash_{i,t} + \beta_4 Cash_{i,t} Con_{c,t} + f_i + d_{c,t} + u_{i,t}$$

Notes: With a winsorized sample outliers previously discarded are now censored to take cutoff values. Variables are defined in Table A-1. I is investment, K is capital stock, S is sales, Cash is ratio of cash stock to total assets, Con_{ct} is bank concentration, f_i is an unobserved firm-specific effect, $d_{c,t}$ denotes country-time dummies, and u_{it} is an error term and orthogonal to any available information on time t. Note that in constructing variables if investment flow is time t, the capital stock, sales, Cash, and Con are for time $t-1$. Estimation is by GMM, country-time and fixed effects are removed by country-time and forward mean differencing prior to estimation. Instruments are first and second lags of I/K, S/K, Cash, CF, COGS (cost of goods scaled by prior periods capital stock), interactions of Con with I/K, S/K and Cash, and industry dummies. The firms are ranked based on the size of total assets. The 25 (or 50, 100, or 150) largest firms are taken from each (if available) country. In the weighted regression, weights are equal to a value of one divided by the number of observations per country. *P*-values for *J*-statistic (test of over-identifying restrictions) are obtained using χ^2 distribution or Bootstrap simulation with 200 repetitions (the χ^2 p-value is not available for weighted regressions). Heteroskedasticity adjusted standard errors in parentheses; ***,**, and * represent significance at 1%, 5%, and 10% respectively.

Model	1 25 largest		2 75 largest		3 125 largest		3 150 largest		5 All weighted	
I/K_{it-1}	0.312	***	0.241	***	0.198	***	0.188	***	0.195	***
	(0.035)		(0.025)		(0.021)		(0.020)		(0.015)	
S/K_{it}	0.026	***	0.050	***	0.050	***	0.053	***	0.058	***
	(0.006)		(0.007)		(0.006)		(0.006)		(0.005)	
$Cash_{it}$	1.075	***	1.338	***	1.262	**	1.414	***	1.785	***
	(0.417)		(0.515)		(0.512)		(0.533)		(0.638)	
$Cash_{it}*Con_{ct}$	-1.499	***	-1.951	***	-1.766	**	-1.992	***	-2.352	***
	(0.586)		(0.734)		(0.735)		(0.775)		(0.885)	
Constant	-0.007	***	-0.002	***	-0.002		-0.001	***	-0.003	***
	(0.002)		(0.002)		(0.002)		(0.002)		(0.002)	
No. of obs.	1600		3717		4846		5142		8766	
No. of firms	309		825		1137		1217		2076	
P-value for Hansen										
Chi-square	0.113		0.014		0.001		0.000		N/A	
Bootstrap	0.963		0.498		0.228		0.252		0.883	

Table 8: Investment Regressions with Leverage (GMM-IV)

$$\frac{I}{K_{it}} = \beta_1 \frac{I}{K_{i,t-1}} + \beta_2 \frac{S}{K_{i,t}} + \beta_3 Cash_{i,t} + \beta_4 Cash_{i,t} Con_{ct} + \beta_5 LEV_{it} + f_i + d_{c,t} + u_{i,t}$$

Notes: Variables are defined in Table A-1. I is investment, K is capital stock, S is sales, Cash is ratio of cash stock to total assets, Con_{ct} is bank concentration, LEV is leverage ratio, f_i is an unobserved firm-specific effect, $d_{c,t}$ denotes country-time dummies, and u_{it} is an error term and orthogonal to any available information on time t. Note that in constructing variables if investment flow is time t, the capital stock, sales, Cash, LEV, and Con are for time $t-1$. Estimation is by GMM, country-time and fixed effects are removed by country-time and forward mean differencing prior to estimation. Instruments are first and second lags of I/K, S/K, Cash, CF, COGS, LEV, interactions of Con with I/K, S/K, Cash, LEV, and industry dummies. The firms are ranked based on the size of total assets. The 25 (or 50, 125, or 150) largest firms are taken from each (if available) country.In the weighted regression, weights are equal to a value of one divided by the number of observations per country. *P*-values for *J*-statistic (test of over-identifying restrictions) are obtained using χ^2 distribution or Bootstrap simulation with 200 repetitions(the χ^2 p-value is not available for weighted regressions). Heteroskedasticity adjusted standard errors in parentheses; ***,**, and * represent significance at 1%, 5%, and 10% respectively.

Model	1 25 largest		2 50 largest		3 125 largest		3 150 largest		5 All weighted	
I/K_{it-1}	0.301	***	0.233	***	0.195	***	0.185	***	0.186	***
	(0.034)		(0.026)		(0.021)		(0.020)		(0.016)	
S/K_{it}	0.029	***	0.051	***	0.050	***	0.053	***	0.059	***
	(0.006)		(0.007)		(0.006)		(0.006)		(0.005)	
$Cash_{it}$	1.348	***	1.402	***	1.326	**	1.453	***	1.737	***
	(0.463)		(0.521)		(0.524)		(0.541)		(0.625)	
$Cash_{it}*Con_{ct}$	-1.813	***	-2.103	***	-1.879	**	-2.066	***	-2.308	***
	(0.674)		(0.744)		(0.752)		(0.787)		(0.867)	
$Leverage_{it}$	-0.091		-0.115	**	-0.041		-0.039		-0.121	***
	(0.062)		(0.052)		(0.048)		(0.047)		(0.043)	
$Cons_t$	-0.006	***	-0.003		-0.002		-0.002		-0.003	
	(0.002)		(0.002)		(0.002)		(0.002)		(0.002)	
No. of obs.	1362		2275		3559		4119		7003	
No. of firms	280		506		853		1012		1700	
Hansen P-value:										
Chi-square	0.207		0.395		0.001		0.000		N/A	
Bootstrap	0.968		0.963		0.272		0.238		0.877	

Table 9: Investment Regressions with Size and Business Cycle Effects (GMM-IV)

$$\frac{I}{K_{it}} = \beta_1 \frac{I}{K_{i,t-1}} + \beta_2 \frac{S}{K_{it}} + \beta_3 Cash_{it} + \beta_4 Cash_{i,t} Con_{c,t} + \beta_5 Cash_{i,t} Z_{i,t} + \beta_6 Cash_{i,t} Z_{i,t} Con_{ct} + f_i + d_{c,t} + u_{it}$$

Notes: I is investment, K is capital stock, S is sales, Cash is ratio of cash stock to total assets, Con_{ct} is bank concentration, f_i is an unobserved firm-specific effect, $d_{c,t}$ denotes country-time dummies, and u_{it} is an error term and orthogonal to any available information on time t. Z_{it} is either firm size, equal to the (log of) total assets in US dollars, or a business cycle dummy equal to one if recession in country c at time t, and equal to zero otherwise. Estimation is by GMM, country-time and fixed effects are removed by country-time and forward mean differencing prior to estimation. Instruments are first and second lags of I/K, S/K, Cash, CF, COGS, size or business cycle dummy, and its interactions and interactions of Conc with I/K, S/K, Cash, LEV, and industry dummies. P-values for J-statistic(test of over-identifying restrictions) are obtained using Bootstrap simulation with 200 repetitions. All the regressions are weighted regressions, weights are equal to a value of one divided by the number of observations per country. Heteroskedasticity adjusted standard errors in parentheses; ***,**,* represent significance at 1%, 5%, and 10% level respectively.

	Size Effect						Business Cycles					
Model:	1		2		3		4		5		6	
I/K_{it-1}	0.239	***	0.215	***	0.228	***	0.225	***	0.220	***	0.223	***
	(0.017)		(0.008)		(0.017)		(0.016)		(0.017)		(0.016)	
S/K_{it}	0.048	***	0.018	***	0.047	***	0.046	***	0.042	***	0.040	***
	(0.004)		(0.004)		(0.004)		(0.004)		(0.005)		(0.005)	
$Cash_{it}$	0.744	***	3.472	***	4.919	**	0.239	***	2.375	***	3.092	***
	(0.187)		(0.860)		(1.722)		(0.052)		(0.659)		(0.706)	
$Cash_{it}*Size_{it}$	-0.103	***	-0.186	***	-0.578	***						
	(0.029)		(0.051)		(0.247)							
$Cash_{it}*Con_{ct}$			-2.862	***	-6.192	***			-3.332	***	-4.127	***
			(0.963)		(2.377)				(0.964)		(0.963)	
$Cash_{it}*Con_{ct}*Size_{it}$					0.343	**						
					(0.162)							
$Cash_{it}*Rec_{ct}$							0.078	**	0.447	***	1.610	***
							(0.044)		(0.150)		(0.385)	
$Cash_{it}*Rec_{ct}*Con_{ct}$											-0.228	***
											(0.055)	
Constant	0.015	**	-0.001	**	0.000		-0.001		-0.002		-0.002	*
	(0.002)		(0.002)		(0.002)		(0.001)		(0.002)		(0.002)	
Number of obs.	7003		7003		7003		7003		7003		7003	
Number of firms	1700		1700		1700		1700		1700		1700	
Bootstraped P-value for J-statistic:	0.427		0.532		0.257		0.213		0.643		0.873	

Table 10: Investment Regressions with Institutional Indicators (GMM-IV)

$$\frac{I}{K_{it}} = \beta_1 \frac{I}{K_{i,t-1}} + \beta_2 \frac{S}{K_{it}} + \beta_3 Cash_{it} + \beta_4 Cash_{i,t} \mathrm{Ind}_c + \beta_5 Cash_{i,t} Con_{ct} + f_i + d_{c,t} + u_{it}$$

Notes: Variables are defined in Table A-1. I is investment, K is capital stock, S is sales, Cash is ratio of cash stock to total assets, Con_{ct} is bank concentration, f_i is an unobserved firm-specific effect, $d_{c,t}$ denotes country-time dummies, and u_{it} is an error term and orthogonal to any available information on time t. Ind_c is a country indicator from La Porta *et al.* (1998). Note that in constructing variables if investment flow is time t, the capital stock, sales, Cash, and Con are for time $t-1$. Estimation is by GMM, country-time and fixed effects are removed by country-time and forward mean differencing prior to estimation. Instruments are first and second lags of I/K, S/K, Cash, CF, COGS (cost of goods scaled by prior periods capital stock), interactions of Con and appropriate Indicator with I/K, S/K and Cash, and industry dummies. All the regressions are weighted regressions, weights are equal to a value of one divided by the number of observations per country. All regressions include 7003 observations (1700 firms). P-values for J-statistic are obtained using Bootstrap simulation with 200 repetitions. Heteroskedasticity adjusted standard errors in parentheses; ***,**,* represent significance at 1%, 5%, and 10% respectively.

Model:	Indicator:	I/K_{it-1}		S/K_{it}		$Cash_{it-1}$		$Cash_{it}*Ind_c$		$Cash_{it}*Conc_{ct}$		Bootstraped P-value
I-1	Accounting	0.216	***	0.048	***	2.803	***	-0.041	***			0.267
		(0.016)		(0.005)		(0.385)		(0.006)				
I-2	Accounting	0.231	***	0.046	***	5.323	***	-0.050	***	-2.491	***	0.417
		(0.017)		(0.005)		(1.058)		(0.009)		(0.871)		
II-1	Efficiency	0.231	***	0.053	***	3.137	***	-0.318	***			0.603
		(0.014)		(0.004)		(0.380)		(0.041)				
II-2	Efficiency	0.234	***	0.051	***	4.233	***	-0.328	***	-1.245	**	0.537
		(0.015)		(0.005)		(0.607)		(0.046)		(0.629)		
III-1	Expropriation	0.232	***	0.046	***	13.751	***	-1.394	***			0.532
		(0.016)		(0.006)		(2.085)		(0.215)				
III-2	Expropriation	0.227	***	0.046	***	29.420	***	-2.823	***	-2.418	***	0.662
		(0.015)		(0.005)		(3.782)		(0.355)		(0.712)		
IV-1	English Origin	0.237	***	0.046	***	0.118	***	0.134				0.328
		(0.017)		(0.004)		(0.056)		(0.144)				
IV-2	English Origin	0.237	***	0.043	***	2.167	***	0.111		-2.690	***	0.377
		(0.017)		(0.006)		(0.478)		(0.159)		(0.665)		
VI-1	Creditor Right	0.223	***	0.049	***	0.095	***	-0.090				0.308
		(0.017)		(0.007)		(0.065)		(0.074)				
VI-2	Creditor Right	0.236	***	0.043	***	1.754	***	-0.121		-2.134	***	0.443
		(0.016)		(0.004)		(0.605)		(0.092)		(0.828)		
VII-1	Shareholder Right	0.231	***	0.052	***	0.231	***	0.170	**			0.402
		(0.017)		(0.007)		(0.065)		(0.075)				
VII-2	Shareholder Right	0.226	***	0.045	***	2.251	***	0.190	**	-2.666	***	0.453
		(0.017)		(0.005)		(0.601)		(0.095)		(0.851)		

Appendix: Data and Sample Selection

Firm level data are taken for 14 European Countries from the COMPUSTAT® Global database. The sample does not include firms for which the primary industry is either financial (one digit SIC code of 6) or service (one digit SIC codes of 7 and above). In addition the following are deleted:

- All firms with 3 or less years of coverage;
- All firm-years with missing investment, capital, sales, and cash;
- Observations with negative Assets, Sales and Capital;

Sample selection will also proceed as in Love (2003):

- Observations with IK > 2.5;
- Observations with SK > 20;
- Observations with cash/total assets > 0.6;
- Top 1 and bottom 1 percentile of I/K, S/K and Cash/K

Winsorized Observation Settings: Setting cutoff value for removing the influential effect from extreme observations while taking an advantage from the large number of the sample. Cutoff value: Top 1 and bottom 1 percentile of main variables.

Cleary (1999 and 2006): Sample Selection.

- Observations with IK > 2(-2);
- Observations with MTB > 10.
- Observations with cash flow/K > 5(-5);

Table A-1: The Construction of Financial Variables

Variable	Acronym	Definition	Compustat Data Item
Assets	TA	Total assets at the beginning of the period	DATA89
Capital stock	K	Net Property, Plant and Equipment.	DATA76
Current Ratio	CR	Current Assets (Total)/ Current Liabilities(Total)	DATA75/DATA104
Total Debt	TD	Debt in current liability + Long-term debt	DATA94+DATA106
Cost of good sold	COGS	Cost of good sold scaled by the capital stock lagged one period	DATA4
Leverage ratio	LEV	The ratio of Total Debt to Total Assets	DATA94+DATA106/DATA89
Cash Stock	Cash	Cash and equivalents scaled by total assets	DATA60/DATA76
Interest Coverage	COV	Operating income / Interest and Related expenses	DATA14/DATA15
Cash Flow	CF	Income Before Extraordinary Items + Depreciation and Amortization scaled by capital stock	DATA32+DATA11
Net Sales	SK	Net sales at the end of period t-1. Scaled by capital.	DATA1/DATA76
Net Sale growth	NSG	the first difference scaled by net sales	
Investment	I	Net Capital Expenditure	DATA 145
Market value	MV	Close price of equity * Shares Outstanding	PRCCIxSHOI [a]
Book Value	BV	Book value of common equity	DATA146
Net Income Margin	NIM	Net Income before extraordinary items scaled by net sales.	DATA177/DATA1
Return on Equity	ROE	Net Income before extraordinary items scaled by book value of common equity	(DATA177/DATA135)*100
Tobin's Q :	TQ	Market value plus book value of assets minus common equity and deferred taxes scaled by the book value of assets	(DATA89-DATA135-DATA105 + PRCCI* SHOI) [a] /DATA89)

Notes: Data from Compustat Global industrial/commercial and issue files; [a] PRCCI is the close-price and SHOI is the shares outstanding. General rules with regard to the data are the following. We focus on non-financial firms (with SIC less than 6000). Firm-level data is eliminated if a firm has three or less years of coverage, if there are missing values for investment, capital stock, sales, cash stock, and cash flow, and if there are observations with negative values for assets, sales, or capital stock. In addition, we follow Gilchrist and Himmelberg (1998) and Love (2003) in excluding observations with IK > 2.5, SK > 20, cash > 0.6, and outliers in the top and bottom 1% of the variable values.

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