Firm Access to Capital Markets in Europe

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ABSTRACT

This dissertation estimates and compares bank concentration and integration effects on real activities with firm level data under different stances of the capital market structure and different consequences from the creation of a single currency regime. This is a comparative empirical study of 14 European countries between 1992 and 2005. Using firm level data and a series of large panel of bank concentration and integration measures, this paper examines and analyzes financial constraints of European countries with the Euler equation derived by the dynamic investment model. The main purpose of this paper is to find inferences from the relative response of corporate investment decisions across countries and the effect of bank concentration and integration on firm- and industry-specific investment. This paper also addresses the effect of the adoption of a single currency by the European Union after 1999 and the difference between member and non-member countries.

We control the cross-country differences of firms' size, business cycles and institutional backgrounds to check for the robustness of our estimator as possible instruments for the cost of external finance. The empirical results show that the concentrated banking sector in European countries in addition to a deregulation process helps to relax financial constraints on firm level investment in general. The magnitude of this effect is bigger for big firms than for small ones. The heteroge-

neous firms in countries with a highly concentrated banking sector are less financially constrained than those with a low concentrated banking sector, highlighting a scale-efficient banking sector. In other words, the estimated coefficients on cash flow suggest that high concentration in the banking sector creates fewer information costs than low concentration, suggesting the structural intensity in the banking sector creates more the external finance premium for small firms which have high reliance on banks to finance their investment. However, the measures of financial integration have no significant effects on the financial constraints faced by firms.

1 Introduction

The European Commission and Council of Ministers have reduced legal barriers for European countries since the Treaty of Rome (1957), which promised the recognition and the coordination of regulation of six European countries. The council applied directive in 1973 to achieve a higher degree of freedom to entry and services of banks and financial institutions across countries, which was far from its ultimate goals and effectiveness.[1]

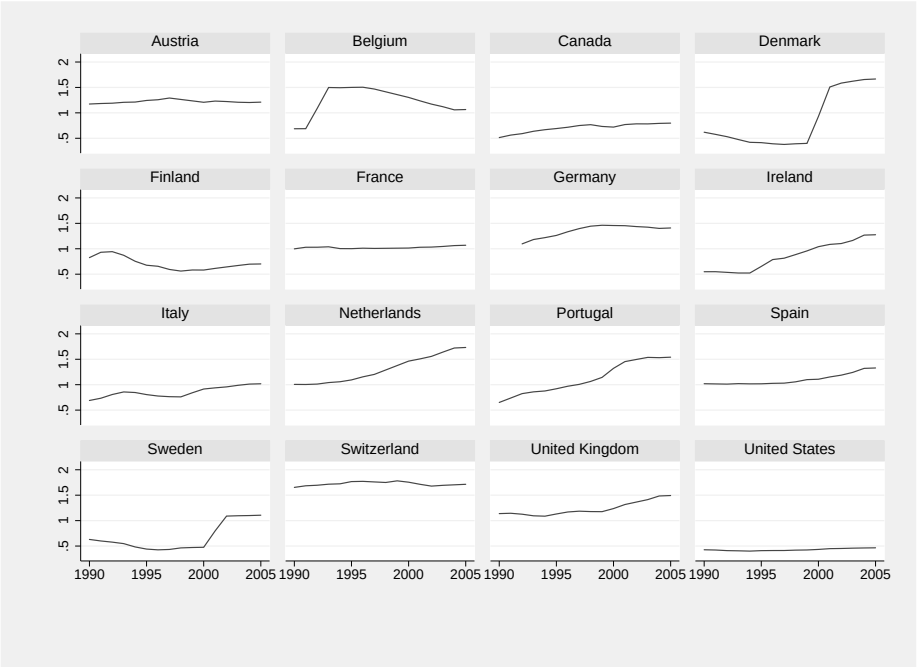
The integration of banking and financial services was intensified by the adoption of the First Banking Directive (1977) and was extended by the Second Banking Coordination Directive (1993).[2] With the guarantee of a single market license, all credit institutions in the EU member states have established branches and provided capital services across other EU countries without the authorization or control of the host country. Consequently, the process of deregulation removed the obstacle of entry to financial services so that it created a competitive environment for the banking sector.

According to the European Central bank (2004), the number of banks in the EU area has dropped sharply in the 1990s due to the bank deregulation process and bank mergers & acquisitions (M&A). In terms of the number of M&A in 15 European

[1]Belgium, Germany, France, Italy, Luxembourg and the Netherland participated with the start of European Union in 1957. In 1973, Denmark, Ireland and the United Kingdom, Greece in 1981, Spain and Portugal in 1986, Austria, Finland and Sweden in 1995. The final analysis exclude Greece and Luxembourg because of data availability.

[2]The Coordination of Laws, Regulations and Administrative Provisions Relating to the Taking Up and Pursuit of Credit institution set up home country control to provide equal regulatory treatment among member states (Directive 77/780/EEC).

Figure 1: Deposit Bank Assets per GDP



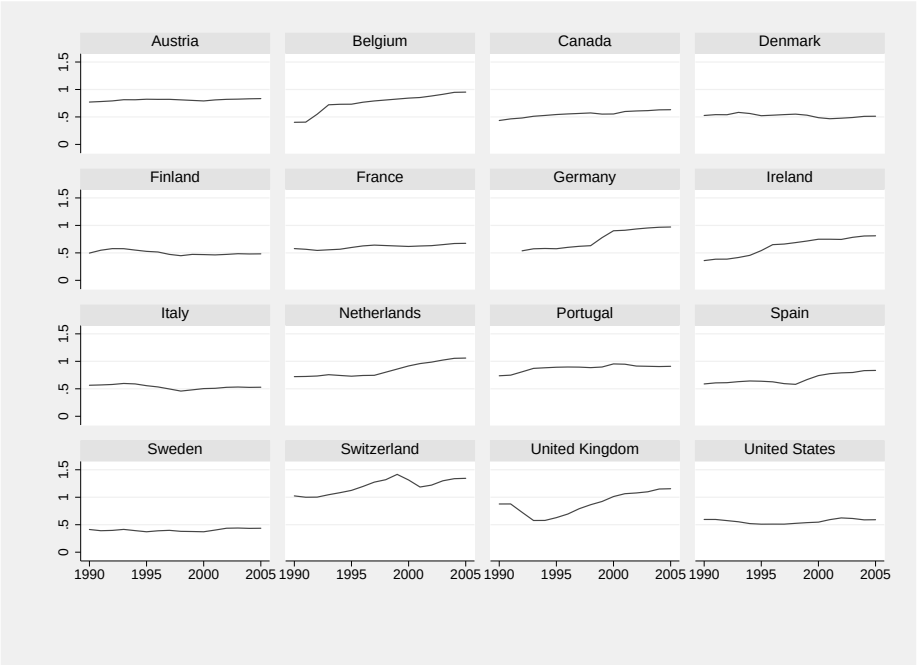
Source: IFS, Canada and United States for the comparison.

countries over 1997 to 2004, 47% are domestic, 24 % are intra-European and 29% are outside transactions. If we compare transactions in real value terms, total value of domestic acquisitions is 76% out of a total 581.1 billion. Even though we observe a drastic drop in the number of banks in European countries, the penetration by foreign banks is quite small, and the foreign-ownership rate in the banking system is about or less than 10% in the EU area.[3] In addition, most European countries have higher a reliance on the banking sector compared to the U.S.

Figure 1 and 2 present the evidence of changes in the European banking industry and the relative importance of the banking sector for firms in European countries compared to the U.S. As we mentioned above, this step is crucial to understanding

[3]The measure of the share of foreign banks from Stijin Claessens et al (2001) and Belaisch (2001), who report the descriptive statistics for the European banking sector and the number of M&A within-border, intra and outside European countries from Dermine (2005).

Figure 2: Bank Deposit per GDP



Source: IFS, Canada and United States for the comparison.

firm access to capital markets such that changes in the European banking and financial industry can alter the response of non-financial firm level investment to bank concentration and integration. Figure 1 shows the banking asset to GDP ratio from 1990 to 2005. Contrary to the United States, the banking asset to GDP ratio in most European countries shows a drastic increase at a double digit rate over the sample period, except for Belgium and Finland. In Denmark and Sweden, for instance, the ratio shows a notable increase compared to other countries since early 2000. Figure 2 shows the liabilities side of the banking sector. The ratio of bank deposit to GDP in most countries is also higher than in the U.S. From the above facts, it is clear that the banking sector in the European area plays a dominant role in the financial system and provides an ideal setting to investigate the effect of bank integration and concentration on real activity. A single market system will be beneficial to borrow-

ers provided that banking competition from deregulation boosts efficiency and lowers costs for the private banking sector.[4]

From a policy point of view, higher reliance on bank finance in most European countries compared to the U.S and the exogenous of bank integration and concentration to investment decisions of firms guarantee the relationship of regulation and real activity under the constrained environment. For example, the unequal effect on the different size of firms across countries. Thus, bank integration across countries is followed by loosening regulation, reducing financial constraints for firms and providing more credit supply at a low price.

Ceterelli (2001, 2004) summarizes two conflicting predictions on the effect of market concentration on credit availability for borrowers. Traditional banking literature has pointed out the negative impact of market power in the banking sector on borrowers by increasing net margin where the difference between the lending rate and lower returns to depositors. However, recent literature suggests that a possible positive effect of bank concentration alleviates firm financial constraints under higher bank credit and a well-developed financial system.

We use the measure of the bank concentration for the 'Concentration Index' constructed by Demirgüç-Kunt and Levine (2001). The deregulation of entry to the cross-border decision will significantly reduce financial constraints faced by firms, and its effect is expected to pervade to financially constrained firms. With regard to the

[4]The Riegle-Neal Interstate Banking and Branching Efficiency Act effectively removes barriers to create competitive environment for the banking sector in the U.S. Several papers have examined the economic roles of deregulation in real activities with the U.S example, state level income growth, Jayaratne and Strahan (1996), the number of new firm, Black and Strahan (2002).

measure of bank integration for the European countries, we follow Adam et al (2002) to construct variables from International Finance Statistics.[5] In addition, we take two more measures of banking integration from the Bank of International Settlement (i.e BIS locational and consolidated statistics). The main difference between BIS locational and consolidated statistics is the residency of the reporting bank.

This paper extends well-established literature on firm investment to explain the role of bank market power on financial constraints of firms' investment decisions, especially focusing on European Union countries.[6] Therefore, understanding the structural change of the banking sector across European countries is important to study the costs and benefits of deregulation policy for the commercial banking sector. The sensitivity of internal funds to investment is generally strong for financially constrained firms due to the higher cost of external finance, and we expect that this effect will be reduced by bank integration and regulation.

This study contributes to the literature by extending well-documented investment behavior of European countries and by explaining the possible effect of bank concentration and integration from deregulation on investment across countries. Our paper is closely related with Correa (2006), who studies the effects of inter-state banking regulation on firm level investment in the U.S. The general argument of this paper is that bank concentration due to deregulation and M&A has a potential effect on investment for the firm utilizing firm-level data.

[5]The total assets share of the three largest banks in each country spans from 0 to 1(1 for highest concentration) from the bank-level database. Adam et al (2002) used the share of foreign claims relative to domestic claims as the measure of bank integration.

[6]For a recent survey of financial friction and firm investment, refer to Hubbard (1998), Stein (2003) and Bond and Reenen (2006)

The empirical results show that heterogeneous firms in countries with a highly concentrated banking sector are less financially constrained than in those with a low concentrated banking sector due to the higher external finance premium. In other words, the estimated coefficients on cash flow suggest that high concentration in the banking sector creates less information costs than low concentration, and the magnitude of these effects is stronger for the small firms, suggesting the structural intensity in the banking sector creates less severe information or agency costs for those who rely more on banks to finance their investment. Our findings are consistent with those in several recent papers, Cetorelli (2004), Peterson and Rajan (1995), and Demirüç-Kunt and Maksimovic (2004). For example, Demirüç-Kunt and Maksimovic (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.

The rest of paper is structured as follows: In section 3, we present literature reviews. In section 4, we reproduce the dynamic investment model to investigate the role of banking structure on firms' access to capital markets. In section 5, we provide several empirical issues to estimate the dynamic panel model. In section 6, we describe the panel data structure for firm level variables and the cross-country database used in estimation. In section 7, we report the main empirical finding associated with our hypothesis. Finally, conclusion remarks are provided in the last section in this paper.

2 Literature Review

2.1 Bank Integration, Concentration and Real Activity

In this subsection, we review the recent literature on the role of bank integration and deregulation on real activity. Strahan (2003) reports the relationship between bank deregulation and real economic indicators at state level in the U.S. His estimated results for removing branching restrictions across states suggest that bank deregulation fosters state growth and employment. Demyanyk et al (2005) document that bank competition decreases the correlation of personal income and state-specific shock. In addition, Morgan, Rime and Strahan(2004) provide evidence that geographical bank integration reduces total employment volatility and employment of Small and medium enterprises in states. Suggested findings give a general idea about the link between bank concentration and real indicators. Finally, Dick (2006) not only provides the beneficial effect of bank deregulation but also its effect on market structure and bank performance. These U.S findings suggest clear evidence of the structural change of the banking sector for additional countries.

Most studies use on the U.S as an example whilst international evidence is still limited. Recently, Cetorelli (2004) uses industry data, UNIDO (United Nations Industrial Development Organization), to analyze the effect of banking concentration and deregulation on the market structure of manufacturing industries, and he concludes that banking deregulation and concentration reduce the average size of firms in EU member countries more than those in non-member countries. Claessens and

Leaven (2004) report the significant effect of bank integration through foreign bank entry on bank competition, but that there is no positive evidence between bank competition and concentration in the banking sector using bank level database. In addition, Cetorelli and Gambera (2001) use various country samples to find that industries with more external finance grow faster in a concentrated banking sector, and they argue that bank concentration in each country has a positive effect on industry growth. In a cross-country study on banking concentration on the effect of efficiency, Demirgüç, Leaven and Levine (2003) find that the market power of the banking system has a negative effect on efficiency, as measured by overhead costs and the net income margin for developing countries.[7]

From the perspective of borrower, Demirgüç-Kunt and Maksimovic (2003) use the world bank survey and bank level database to estimate the effect of bank concentration on the availability of bank finance, and they conclude that monopolistic power in the banking sector increases financial constraint for firms, especially for developing countries. In a similar line of study, Demirüç-Kunt, Leaven and Levine (2004) study the relationship between the cost of financial intermediation and market structure across 72 countries using the bank level database. They use bank margin and overhead cost to represent the cost of financial intermediation with various measure of banking structure such as bank concentration, bank specific control variables and institutional characteristics. Peterson and Rajan (1995) focus on the role of cap-

[7]We use the same database with Demirgüç, Leaven and Levine (2003) and Cetorelli (2004) as indicators of the concentration in the banking sector. However, they use the average value over 1995 to 1999 in the empirical estimation, but we think that the time-varying measure is more appropriate to isolate transitory countries. In addition, the averaged measure cannot capture drastic changes in the banking sector for most European countries from the 1990s

ital markets in financing small firms and report small firms in a highly concentrated banking sector have more bank credit than in a lower concentrated banking sector as shown by the national survey of small business financial data in the U.S. On the other hand, Larrain (2006) studies the role of bank credit on industrial volatility using industry and firm level data with the measure of bank credit. He concludes that countries with higher bank credit have lower volatility in industrial output. Correa (2006) studies the effects of inter-state banking regulation on firm level investment in U.S.

This paper combines two pieces of the literature to investigate the investment behavior of an individual firm under different banking structures. The expected effect of bank concentration and integration will be stronger for the firm with higher external dependence and more constraints. We specifically seek to analyze the role of the banking structure as measured by a concentration ratio and other indicators for the national banking sector.

2.2 Financial Development and Economic Growth

In this subsection, we review more broad literature concerning 'finance and growth'. A growing body of studies has focused on the relationship between financial markets and the real side of the economy since King and Levine (1993), who use a cross-country setting with various indicators for financial sectors to present a clear empirical picture and guidelines for the role of financial development. With a more detailed cross-sectional database, Demirgüç-Kunt and Maksimovic (1998) and and

Beck, Levine, and Loayza (2000) Levin and Sarah Zeros (1998) not only provide a robust empirical link between finance and growth, but also address the causality issue of the economic mechanism from financial development and finance. Rajan and Zingales (1998) show that industries with high dependence on external finance grow faster with a developed financial system and argue that financial development has a causal effect on economic growth by alleviating the cost of external finance. They calculate industry level dependence of external finance from the Compustat database for U.S firms to correct within industry and country variations.

In the study of law and finance, many papers focus on the relationship between legal structure and finance followed by La prota, Lopez-de-silanes, Shleifer and Vishny (1997, 1998) (hereafter, LLSV). For instance, Demirgüç and Maksimovic (1998) not only report the importance of financial systems but also of legal circumstances for the growth of the firm. They calculate the growth rate of the firm and find a strong positive relationship between the firm's growth and financial development, as measured by the ratio of stock market development and the size of the banking sector. In addition, LLSV (1998) find evidence of a strong and positive relationship between finance and legal circumstances. They construct important institutional indicators from several sources and conclude that firms in countries with a more developed financial legal system grow faster than countries without a comparable legal system. They also introduce the important role of legal origin, the efficiency of the legal system, the rule of law, and the risk of expropriation and corruption to finance.

2.3 Financial Friction and Firm Level Investment

In this subsection, we review firm investment literature with financial friction to test the effect of market structure of the banking sector on firm access to the capital market in the empirical section.

There is a large amount of literature concerning corporate investment behavior under an imperfect capital market following the seminal work of Modigliani-Miller (1958). They contribute the theoretical basis for corporate finance behavior and state that firms' financial decisions concerning stock, debt and dividend policy have no effect on firm value in an efficient capital market. Later studies focus on the role of the financial market to understand the deviation from the Modigliani-Miller theorem with more sophisticated theoretical and empirical research. For instance, Myers and Majluf (1984) document that firms face a wedge between internal and external finance under an imperfect credit market. Financial friction gives firms the preference of internal funds over external finance to build up 'financial slack' for the expected investment opportunities.

The bulk of the empirical studies are followed by Fazzari, Hubbard and Petterson(1988) (hereafter, FHP), who provide more concrete empirical framework to illustrate the relationship between financial friction and investment behavior. After estimating an investment regression with 421 manufacturing firms, they categorize three types of constrained firms by dividend income ratio and they conclude that financially constrained firms' sensitivity of cash flow to investment is more severe than for unconstrained firms.

Even though there is a common agreement about the importance of financial variables such as cash flow and cash stock for investment decisions, there is a debate between Kaplan and Zingales (1997, 2000) (hereafter, KZ) and FHP regarding the sensitivity of internal funds to investment.[8] The identification problem for classifying financially constrained firms by FHP has been challenged by KZ (1997, 2000). They set up a simple one period model to compare the results from FHP with the same low dividend ratio sample. The main debate between FHP and KZ is the financial constraint on firms' investment behavior, especially concerning the sensitivity of cash flow to investment.

The debate has been expanded and developed by Alti (2003), Gomes (2001) in theoretical base and Cleary (1999, 2005) and Allayannis and Mozumar (2004) in empirical base. For example, Allayannis and Mozumar (2004) re-estimated results used by KZ (1997, 2000) and Cleary (1999), who argue the irrelevance of investment cash sensitivity to financial constraints. They conclude the opposite results derived by KZ (1997, 2000) and Cleary (1999) are due to the extreme sample selection and the strong outlier effect from negative cash flows.

On the other hand, Gilchrist and Himmelberg (1998) provide a useful illustration to identify fundamental Q and financial Q with careful consideration of the marginal profit of capital and show 'excess sensitivity' of internal finance to investment under the costly environment of the external finance model. Meanwhile, Whited (1992) extend FHP, concentrating on the debt market rather than the equity market after

[8]The empirical debate between cash flow sensitivity and financial constraints has been explained by sample selection criteria and the use of extreme negative cash flow measure to account the financial friction.

carefully examining the external market situation. She splits sample data such as bond rating, debt ratio and coverage ratio and estimates the Euler equation for investment-cash flow sensitivity.

Gertler and Gilchrist (1994) provide evidence on credit market friction and monetary policy by estimating an inventory regression with quarterly aggregate data for small and large firms from 1974 to 1989. Their main finding is that a monetary contraction creates a higher response of sales and inventories for small firms than for large firms. Later studies by Bernanke, Gertler and Gilchrist (1996) and Oliner and Rudebusch (1996) provide more supportive evidence of the differential effect of monetary contraction on small versus large firms.

The relationship between financial friction and the business cycle is well-documented by Bernanke and Blinder (1988), Bernanke and Gertler (1989) and Kiyotaki and Moore (1997). The main argument of this literature is that an imperfect capital market can explain the propagate effects of monetary policy and the business cycle on aggregate fluctuations. Bernanke, Gertler and Gilchrist (1999) put together these ideas with a general equilibrium model to explain the cyclical movement of investment and output. The presence of asymmetric information between internal and external finance creates an external finance premium, thus the propagation effect to real activities.

With large agreement on the role of financial friction, one can expect differential effects of exogenous shocks to borrowers across countries. If the primary method of financing for one firm is internal instead of external funds, a negative shock will accelerate a larger reduction of capital expenditure, provided the given investment

opportunity. Furthermore, good times with higher profit and a healthy balance sheet induce better bank rationing for the firms, which could raise the possibility for external finance that is impossible or restricted in bad times.

Meanwhile, most studies of corporate investment decision under an imperfect capital market have focused on the U.S. A brief summary of the issues involved is provided in Hubbard (1998) and Stein (2003). Evidence of firm investment behavior with imperfect market conditions for European countries has been provided by Guariglia (1999), Chratelain et al (2003), Bond, Elston, Maairesse and Mulkay (2003) and Vermeulen (2002). For example, Guariglia (1999) provides evidence on the sensitivity of the growth rate of inventories by estimating a panel of 994 U.K manufacturing firms form DataStream under three different measures of financial constraint such as coverage ratio, short-term debt to sales ratio, and leverage ratio. With Bank for the Accounts of Companies Harmonies (BACH) database, Vermeulen (2002) documents additional evidence of the financial accelerator theory with four large countries, Germany, France, Italy and Spain.[9] Chratelain et al (2003) combine the results from Eurosystem Monetary Transmission Network and present comparative results on investment by European countries. Bond et al (2003) utilize the individual database of each country to compare three different investment equations for the four largest EU countries in EU and conclude less excess sensitivity of cash flow in the market oriented system of the U.K than in the three other European continental countries. Mizen and Yalcin (2006) find a significant response of corporate debt composition

[9]BASH database held at European Commission is semi-aggregated in industry level and provides an aggregated balance sheet and profit loss account for three different sizes of firms and industries.

regarding the firm specific characteristics with a panel of 16,000 U.K firms from 1990 to 1999. More recently, Cleary (2005) reports the behavior of firm investment to cash flows measured by capital flow of the seven largest OECD countries.

In this paper, we use the dynamic investment model with an imperfect capital market to address different conditions for individual firms in 14 European Countries. Furthermore, following Cetorelli (2004) and Correa (2006), we regress the measure of bank integration and concentration on firm-level financial variables to calculate the different responses of investment under the structural changes in the banking sector.

3 Investment Model

In this chapter, we describe the details of a dynamics model for firm value optimization under an imperfect capital market that is similar to the model in the literature of Gilchrist and Himmelberg (1998), Love (2003) and Correa (2006). We consider managers or shareholders, who choose investment and debt, to maximize the present value of dividends subject to capital accumulation (3) and external financing constraints. The objective function (1) is given by:

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

subject to

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

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

$$D_t \geqslant 0 \tag{4}$$

where $E_t[.]$ is the expectations operator conditional on information available on time t, and D_t, defined as the sum of the net predetermined profits plus net financial liabilities in equation (2), is the dividend payment to shareholders. β_{t+s} is the firm's discount factor. The capital accumulation constraint is given by equation (3). I_t is investment expenditure, δ is the rate of capital depreciation, K_t is the beginning of capital stock and ξ_t is a productivity shock. The firm's revenue function is given by

$\Pi(K_t, \xi_t)$ and B_t is the firm's net financial liabilities. As in Gilchrist and Himmelberg (1998), financial frictions are incorporated with the assumptions of non-negative binding constraints and the additional cost for the external finance, $\eta(B_t, K_t, \xi_t)$, which depends on the set of state variables and is an increasing function of the level of borrowing. Let λ_t denote the Lagrangian with the constraint of (4), which is the shadow cost of internal funds due to information and agency cost. The gross required rate of return on debt is $(1 + r_t)(1 + \eta(B_t, K_t, \xi_t))B_t$, where r_t is the risk-free rate of return.[10]

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

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

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. The intertemporal substitution of investment in equation (7) states that the marginal cost of investing at time t is equal to the discounted marginal cost of investing at time $t + 1$. Under the M-M theorem, the stochastic discount factor, $\frac{1+\lambda_{t+1}}{1+\lambda_t}$ in the right-hand side of equation (7) is the same for firms over the time. However, in an imperfect capital market, we have $\lambda_t = 0$ and $\lambda_{t+1} > 0$, showing that the relative shadow cost of an intertemporal investment decision will be higher tomorrow.

[10]We assume that investment will be productive in the next period with restricted profit function and also no tax consideration in the structural model, and the price of the investment good is normalized to unity.

The first order condition for debt is described by:

$$E_t\left[\left(\frac{1+\lambda_{t+1}}{1+\lambda_t}\right)\left(1+\eta_{t+1}+\frac{\partial\eta_{t+1}}{\partial B_{t+1}}B_{t+1}\right)\right]=1 \tag{6}$$

(6) does not relate to the investment Euler equation directly so we deal with debt problems separately in the empirical model. Let MPK_t denote the marginal profit function. Assuming the discount rate in (7) is constant over time and firms, then the first order condition becomes:

$$1+\frac{\partial C(I_t,K_t)}{\partial I_t}=E_t\left[\sum_{s=1}^{\infty}\beta^s(1-\delta)^s\left(\prod_{k=1}^{s}\left(\frac{1+\lambda_{t+k}}{1+\lambda_{t+k-1}}\right)\right)\mathrm{MPK}_{t+s}\right] \tag{7}$$

where the discount factor is the product of deterministic, $\beta^s(1-\delta)^s$ and time varying stochastic factor $\frac{1+\lambda_{t+1}}{1+\lambda_t}$. Let $\Phi_{t,t+s}$ denote the stochastic discount factor and the first order Taylor approximation allows us linearize the product of the discount factor in (7) to get:[11]

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

We assume that, as did Love (2003) and Correa(2006), the stochastic discount factor is the linear approximation for the stock of liquid assets. In a sense, internal funds allow firms to make additional investments provided positive investment opportuni-

[11]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 $E(\Phi_{t+s})\simeq 1$ and $E(MPK_{t+s})\simeq\gamma$ due to the range of the mean of the stochastic discount factor. Therefore, $\Phi_{t+s}MPK_{t+s}\simeq\gamma_0+\gamma\Phi_{t+s}+MPK_{t+s}$

ties are present otherwise they postpone this project until next period. Thus, the presence of an external financial premium guarantee a positive correlation between cash stock and investment. In our empirical work, we use the interaction term of cash stock or cash flow with bank integration and concentration.

$$\Phi_{i,t+s} \simeq \sigma_{0i} + \sum_{k=1}^{s} \sigma Cash_{i,t+k-1} \tag{9}$$

The main hypothesis of this paper is that bank integration and bank concentration due to the deregulation process in European countries reduces financial constraint. For this hypothesis, we extend (9) to incorporate bank concentration and bank deregulation.

$$\Phi_{t+s} \simeq \sigma_{0i} + \sum_{k=1}^{s} \left(\sigma_{1i} + \sigma_{2i}\mathrm{Con}_{ct}\right) \mathrm{Cash}_{i,t} \tag{10}$$

MPK_{it} is parameterized using a sales-based measure derived from the profit maximization problem with a Cobb-Douglas production function.[12]

$$MPK_{it} = \theta_i \frac{S_{it}}{K_{it}} \tag{11}$$

We incorporate a standard convex-adjustment cost function into the system. It includes the lagged investment to capital ratio to capture the strong persistence observed in the data.[13]

[12]In the empirical framework, $MPK_{it} \approx \text{const} + \theta_i + \overline{\theta}\frac{S}{K}_{it}$ and firm specific parameter θ is captured by fixed effect.

[13]The marginal adjustment cost is equal to $C(I_{it}, K_{it}) = \alpha\left(\frac{I_{it}}{K_{it}} - \rho\frac{I_{it-1}}{K_{it-1}} - v_i\right)$ and we can estimate the parameter value of ρ to check persistency in the data.

$$C(I_{it}, K_{it}) = \frac{\alpha}{2}\left(\frac{I_{it}}{K_{it}} - \rho\frac{I_{it-1}}{K_{it-1}} - v_i\right)^2 K_{it} \tag{12}$$

where α and v_t denote cost of capital and a firm-specific level of investment, respectively. Substituting (10) into (8) to get:

$$1+\frac{\partial C(I_t, K_t)}{\partial I_t} = c+E_t\left[\sum_{s=1}^{\infty}\beta^s(1-\delta)^{s-1}MPK_{t+s}\right]+\sigma_1\gamma E_t\left[\sum_{s=1}^{\infty}\sum_{k=1}^{s}\beta^s(1-\delta)^{s-1}\left(Cash\right)_{i,t+k}\right] \tag{13}$$

$$\sigma_2\gamma E_t\left[\sum_{s=1}^{\infty}\sum_{k=1}^{s}\beta^s(1-\delta)^{s-1}\left(Cash * Con\right)_{i,t+k}\right]$$

The linearization based on the assumption about the variables in the right-hand side by vector autoregressive process of order one and the rational expectations assumption make the final empirical model:

$$\frac{I}{K}_{it} = \beta_1\frac{I}{K}_{i,t-1} + \beta_2\frac{S}{K}_{i,t} + \beta_3 Cash_{i,t} + \beta_4 Cash_{i,t}Con_c + f_i + d_{c,t} + u_{i,t} \tag{14}$$

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 (14) 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:

$$Ho : \beta_3 \geqslant 0 \text{ and } \beta_4 < 0. \tag{15}$$

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 high sensitivity of cash stock to concentration. In other words, financial constraint decreases with high concentration followed by M&A, enhancing firm level investment.

The notation for the investment model.

I_t : investment expenditure.

K_t is the beginning of capital stock.

D_t : dividend payment to shareholders.

β_{t+s} : discount factor from $t+s$ to t

B_t is the firm's net financial liabilities.

δ is the rate of capital depreciation.

ξ_t is a productivity shock.

$\eta(\cdot)$: External finance premium.

r_t is the risk-free rate of return.

λ_t : the Lagrangian multiplier on Non-negativity constraint.

$\Pi(K_t, \xi_t)$: The firm's profit function.

$(1 + r_t)(1 + \eta(B_t, K_t, \xi_t))B_t$: The gross required rate of return.

v_i : Firm's specific effect in adjustment cost function.

$E_t[.]$: the expectations operator condition on time t.

4 Data

In this section, we describe the data used in this paper and provide more detail of construction on the data specification in Table A-1 and A-2. Our sample contains 14European countries: Austria, Belgium, Finland, France, Germany, Ireland, Italy, Netherland, Portugal, Spain, Sweden, Switzerland and United Kingdom.

4.1 Firm Level Data

All observations for our firm-level data are taken from the Compustat® Global database, held at the WRDS between 1992 and 2005, which contains financial and income statements for publicly traded companies in more than 80 countries, including coverage of over 96% of European market capitalization. Compustat Global consists of four distinct files in comparable form. We start with unbalanced panel data from 1992 to 2005 for 14 European countries. Most countries in our sample have had a single currency regime since 1999 except for Denmark, Switzerland, Sweden and U.K which allows us to test for an important structural change in 1999. We focus on total assets, capital expenditures, sales, cash stock and debt.[14] All financial variables are rescaled by the scale factor and converted by the appropriate exchange rates from the Compustat Global currency file. More details of construction and calculation of financial variables are given in Table A-1 and A-2.

Table 1 and 2 provide the full sample coverage across European countries and the

[14]This paper uses cash stock as a measure of firms' internal funds instead of cash flow since cash flow sensitivity of investment is criticized by several recent papers, Alti (2003), Gomes(2001), Erickson and Whtied (2000) and Kaplan and Zingales (1997, 2000).

Table 1: Sample Coverage across Countries

Country	Code	No. of Obs	Percent of Obs	No. of firms
Austria	AUT	367	2.54	51
Belgium	BEL	304	2.10	43
Switzerland	CHE	988	6.83	125
Germany	DEU	2,041	14.11	280
Denmark	DNK	697	4.82	86
Spain	ESP	452	3.12	66
Finland	FIN	461	3.19	64
France	FRA	1,267	8.76	200
United Kingdom	GBR	5,712	39.48	701
Ireland	IRE	209	1.44	23
Italy	ITA	395	2.73	71
Netherlands	NLD	870	6.01	101
Portugal	PRT	86	0.59	14
Sweden	SWE	618	4.27	97
Total		14467	100	1922
Average years of firms				7.53
Average numbers of firms per country				137

Source : Compustat Global.

descriptive statistics for firms' key financial variables in each country. As revealed in Table 1, the number of observations vary widely across countries. For example, the U.K has the largest sample observation at 39.5% of the total sample, and Germany and France have 14.1% and 8.8%, respectively. The total number of firms in the full sample is 1922, and the average number of firms is 137 for each country. The difference can create skewed results for big countries, such as U.K, Germany and France in the pooled sample, in terms of the number of observations. We use a rank-based and the weighting regression approach to correct the over-representive sample in big countries. The reasoning behind a rank-based approach is that one

Table 2: Descriptive Statistics for Financial Variables across Countries

Country	Code	TA[1]	IK	SK	CF	Cash	TQ	Debt
Austria	AUT	1288	0.188	3.306	0.097	0.253	1.123	0.254
Belgium	BEL	2456	0.222	4.460	0.105	0.395	1.454	0.261
Switzerland	CHE	2775	0.161	3.668	0.314	0.135	1.609	0.253
Germany	DEU	5782	0.241	5.091	0.331	0.089	1.509	0.197
Denmark	DNK	929	0.232	4.536	0.321	0.118	1.358	0.278
Spain	ESP	5280	0.186	3.175	0.269	0.068	1.360	0.234
Finland	FIN	2267	0.225	4.246	0.371	0.085	1.232	0.291
France	FRA	5696	0.252	6.294	0.411	0.118	1.285	0.242
United Kingdom	GBR	1944	0.202	4.554	0.303	0.093	1.549	0.195
Ireland	IRE	1342	0.189	4.257	0.322	0.132	1.421	0.291
Italy	ITA	8231	0.200	3.946	0.336	0.117	1.213	0.242
Netherlands	NLD	2912	0.219	5.906	0.376	0.074	1.445	0.244
Portugal	PRT	2519	0.231	2.798	0.192	0.069	1.169	0.251
Sweden	SWE	2152	0.216	4.905	0.372	0.093	1.479	0.235
Mean		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

Source : Compustat Global.
[1]Units : One million U.S dollars.

needs to make the criteria similar for firms in order to correctly infer the differences in the banking sector. The weighting regression approach places the more weight on a country with a small number of observations to equalize the country's influence in terms of observations.[15]

We tabulate the descriptive statistics per country in Table 2, and the first thing to notice is that the distribution of firm size in terms of total assets varies widely across countries. For example, Italian firms in the sample show a greater size of 8231

[15]The previous research on international investment uses single country regression approach to check the difference of the important financial variable such as cash flow and leverage ratio(i.e Bond et al(2003) and Cleary (2005).)

contrary to Danish firms, whose mean of total assets is equal to 929 U.S dollars. We also notice that Austrian and Belgium firms hold on average more that 5 times the cash that Spanish and Finnish firms hold. However, we cannot find any significant differences between Germany and the U.K as a polar example of bank-based and market-oriented financial systems. To better understand the panel structure of the sample, we further divide the sample into industries and years. Table 3 and 4 show descriptive statistics by industry and year. Tabacco and leather industries have higher internal funds compared to other industries, as expected. We have a relatively small number of observations in the starting and ending periods. For data consistency, we compare the descriptive statistics with the recent study by Cleary(2005) who used the same data set with a different period.

4.2 Country Level Data

The sensitivity of internal funds to investment is strong for financially constrained firms due to the higher cost of external finance, and we expect this effect will be reduced by bank integration and regulation. The cross-country database for bank concentration is given by Demirgüç-Kunt and Levine (2001) from 1990 to 2005. They calculate the bank concentration index as the sum of market shares of the three largest banks in each country from Fitch's BankScope database. Table 5 presents the descriptive statistics for the cross-country institutional characteristics and the structure of the banking sector in our sample. Figure 3 shows bank concentration indexes for each country, and indexes tend to decrease with fluctuations except for

Table 3: Descriptive Statistics by Industry

SIC	Industry name	IK	SK	Cash	CF	TQ	Debt	No. of obs	Percent of obs
0	Agriculture, forestry and fishing	0.151	2.347	0.138	0.224	1.912	0.205	104	0.74
1	Mining	0.217	1.906	0.105	0.244	1.304	0.214	228	1.61
2	Construction	0.240	6.848	0.127	0.322	1.176	0.174	621	4.39
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	Wholesale trade and retail trade	0.231	6.329	0.090	0.329	1.473	0.212	2,232	15.79
20	Food and kindred products	0.193	4.139	0.080	0.286	1.355	0.252	1,118	7.91
21	Tobacco manufactures	0.172	3.609	0.179	0.576	1.712	0.347	23	0.16
22	Textile mill products	0.188	4.557	0.069	0.249	2.245	0.235	315	2.23
23	Apparel and fabrics-based products	0.199	6.501	0.085	0.339	1.250	0.218	296	2.09
24	Lumber and wood products	0.203	4.479	0.090	0.204	1.164	0.270	98	0.69
25	Furniture and fixtures	0.202	4.525	0.092	0.258	1.258	0.229	200	1.42
26	Paper and allied products	0.175	2.640	0.072	0.217	1.109	0.259	444	3.14
27	Printing and publishing	0.227	5.143	0.098	0.510	1.698	0.222	429	3.04
28	Chemicals and allied products	0.212	3.803	0.109	0.357	1.708	0.207	1,019	7.21
29	Petroleum refining	0.172	4.429	0.051	0.257	1.257	0.235	88	0.62
30	Rubber and plastics products	0.210	3.980	0.069	0.311	1.346	0.242	327	2.31
31	Leather and leather products	0.210	7.463	0.153	0.383	1.564	0.112	55	0.39
32	Stone, clay, glass, and concrete	0.183	2.945	0.078	0.253	1.184	0.220	682	4.83
33	Primary metal industries	0.198	3.888	0.075	0.282	1.185	0.220	462	3.27
34	Fabricated metal products	0.219	5.087	0.084	0.329	1.264	0.222	494	3.5
35	Machinery, except electrical	0.209	5.739	0.113	0.375	1.535	0.203	1,240	8.77
36	Electrical and electronic machinery, equipment and supplies	0.243	5.638	0.122	0.378	1.583	0.200	811	5.74
37	Transportation equipment	0.252	5.208	0.115	0.360	1.261	0.233	545	3.86
38	Instruments; Photographic, medical and optical goods; Clocks	0.255	5.327	0.132	0.542	2.137	0.199	510	3.61
39	Miscellaneous manufacturing industries	0.251	5.638	0.110	0.448	1.440	0.210	183	1.29

Source : Compustat Global.

Table 4: Descriptive Statistics by Year

Year	IK	SK	Cash	CF	TQ	Debt	No. of obs	Percent 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							14467	100

Source : Compustat Global.

Switzerland and Spain. The deregulation of entry to the cross-border decision will significantly reduce financial constraints faced by firms, and its effect is expected to pervade to financially constrained firms. With regard to the measure of bank integration for European countries, we will use the share of foreign assets held, scaled by domestic total assets in the banking sector. To check the comparability of the integration measure, we will use two more measures, the ratio of foreign claims to domestic claims held in the banking sector from BIS locational banking statistics and the bilateral cross-border claims from BIS consolidated statistics.

As revealed in Table 5, U.K and Spain have the highest and Belgium, Switzerland, Italy and France have lowest investor protection indexes. The net income margin of

Table 5: Descriptive Statistics of Cross-Country Variables

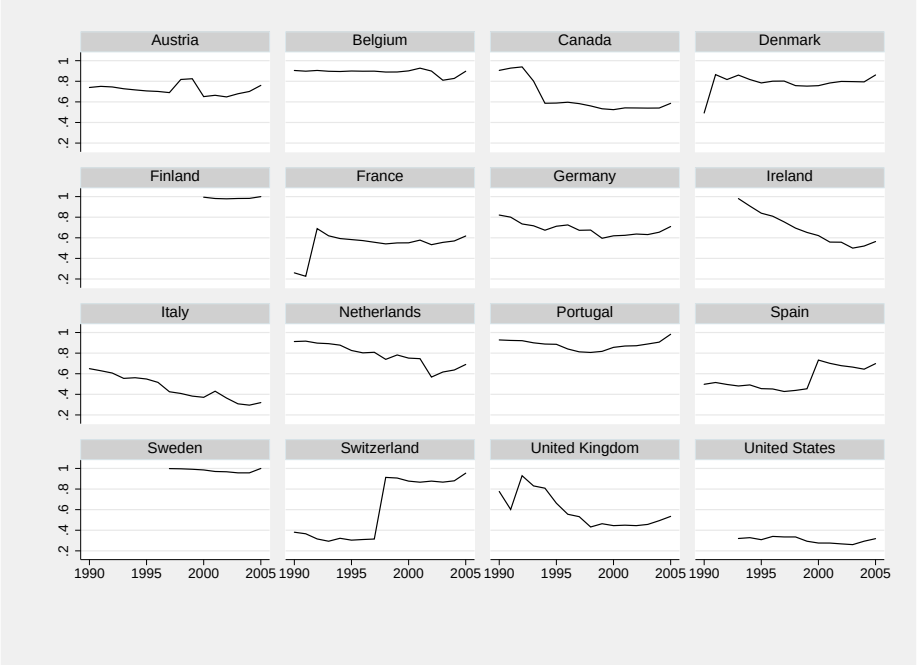
Country	GDPgr	Creditor's Rights[1]	Shareholder's Rights[1]	Stock Mrk Dev	Prv.Bond Mrk Dev	Pub.Bond Dev	Bank Power	Con[2]	Net income margin	Integration Int1	Int2	Int3
AUT	1.47%	3	2	0.16	0.32	0.33	1.23	0.71	0.02	0.03	0.24	0.26
BEL	1.91%	2	0	0.65	0.47	1.01	1.30	0.88	0.02	0.07	0.36	0.41
CHE	5.61%	1	2	2.08	0.43	0.23	1.73	0.72	0.02	0.60	0.52	0.17
DEU	2.04%	3	1	0.36	0.50	0.30	1.35	0.68	0.03	0.03	0.18	0.28
DNK	2.10%	3	2	0.51	1.09	0.55	0.97	0.79	0.04	0.83	0.34	0.53
ESP	3.21%	2	4	0.50	0.18	0.44	1.10	0.53	0.04	0.03	0.14	0.31
FIN	3.50%	1	3	1.09	0.26	0.35	0.66	0.99	0.03	0.00	0.26	0.49
FRA	1.68%	0	3	0.60	0.45	0.43	1.03	0.57	0.03	0.04	0.28	0.27
GBR	2.78%	4	5	1.39	0.16	0.31	1.23	0.57	0.03	0.26	1.01	0.14
IRL	8.32%	1	4	0.60	0.08	0.30	0.88	0.70	0.01	0.00	0.54	0.39
ITA	1.50%	2	1	0.34	0.38	0.92	0.89	0.41	0.03	0.50	0.11	0.35
NLD	2.52%	2	2	1.05	0.41	0.46	1.35	0.75	0.02	0.15	0.29	0.29
PRT	2.21%	1	3	0.32	0.21	0.42	1.23	0.87	0.03	0.03	0.20	0.64
SWE	2.79%	2	3	0.99	0.45	0.45	0.76	0.98	0.03	0.79	0.32	0.53
Mean	2.71%	1.93	2.50	0.76	0.38	0.46	1.12	0.72	0.03	0.24	0.34	0.38
Quartiles:												
25%	0.019	1.000	2.000	0.398	0.224	0.315	0.907	0.597	0.021	0.029	0.210	0.278
50%	0.024	2.000	2.500	0.598	0.394	0.428	1.166	0.715	0.028	0.056	0.286	0.346
75%	0.031	2.750	3.000	1.034	0.449	0.461	1.284	0.849	0.031	0.442	0.358	0.489

Source : IFS and WDI.

[1]Units : Indexes do not vary by year.

[2] Con refers to bank concentration.

Figure 3: Bank Concentration



Source: WDI, Canada and United States for the comparison.

commercial banks in Denmark and Spain is the highest at 4%, and Ireland has the lowest value at 1%. In order to test the financial accelerator theory for the firms' level investment, which is stronger in contraction, we need to identify the business cycle from real GDP growth. We define the recession dummies for each European country as the deviation from mean value to trend.

5 Econometric Issue

5.1 GMM-IV Estimation

Several difficulties arise in estimating the responsiveness of firm level investment to the change in banking structure for each country. Two main empirical concerns are the treatment of fixed effects and the possible endogenous problem to obtain consistent estimators. For the first problem, the 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.[16] 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 (14) is estimated after forward-mean differences and country-time differences to remove an unobserved firm-specific effect, f_i and country-time dummies, $d_{c,t}$.[17] The orthogonality condition for the model is given by $E[\varepsilon_t|Z_{t-s}] = 0$ for $s \geqslant 1$, here x are our instrumental variables. The instrument

[16] More specifically, if we take the mean differencing, the transformed investment capital ratio is $IK^*_{i,t-1} = IK_{i,t-1} - \frac{1}{T-1}(IK_{i,1} + \cdots + IK_{i,t} + \cdots + IK_{i,T-1})$ and The transformed error term is $u^*_{i,t} = u_{i,t} - \frac{1}{T-1}(u_{i,2} + \cdots + u_{i,t-1} + \cdots + u_{i,T})$. $-\frac{IK_{i,t}}{T-1}$ is necessarily correlated with $u_{i,t}$.

[17] Forward-mean differencing or "Orthogonal deviation" are proposed by Arellano and Bover(1995), which removes only the mean of all future observations by $u^*_{it} = c_t \left[u_{it} - \frac{1}{T-t}\left(u_{it+1} + ... + u_{iT}\right)\right], t = 1, ..., T-1$,where $c^2_t = \frac{T-t}{T-t-1}$ 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) used this transformation to remove the individual effect.

variables are $t-1$ and $t-2$ lags of all the variables in equation (14) and 2-digit industry dummies. The GMM-IV estimator with an optimal weight matrix can solve efficiency and possible simultaneity issues. This paper also provides 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 count the difference in the number of observations per country and the over-representative role of the large countries, such as the U.K, Sweden and France in our sample, 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 valuse. Due to the unknown properties of the sample distribution for the weighting regression, we apply the GMM bootstrap method proposed by Hall and Horowitz (1996). We report not only the bootstrapped p-value for the weighting regression model, but also the rank-based model to compare the p value from the asymptotic and bootstrapped distribution.[18] In the next section, we explain a more detailed procedure for implementing GMM bootstrap of Hansen test statistics.

[18]Hall and Horowitz (1996) argue that asymptotic theory "often provides poor approximations to the distributions of test statistics from GMM estimator".(p.p 891). We explain more detail procedure to implement GMM bootstrap.

5.2 GMM Bootstrap

In this subsection, we apply the GMM bootstrap methodology proposed by Hall and Horowitz (1996) to check the large sample properties of the Hansen test for the overidentification of instrumental variables in the dynamic panel data and also to obtain 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 Hansen-test statistics,

$$\tilde{g}_N^b = \frac{1}{N}\sum_{i=1}^{N} g\left(z_i^b, \beta\right) - \frac{1}{N}\sum_{i=1}^{N} g\left(z_i, \hat{\beta}\right) \tag{16}$$

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, 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:

$$\tilde{g}_N^b = Z^{b'}\left(y^b - x^b\beta\right) - Z'\hat{u} \tag{17}$$

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,

$$J^b(\beta) = \tilde{g}_N^b(\beta)' W \tilde{g}_N^b(\beta) \tag{18}$$

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

$$\tilde{\beta} = \left[x^{b'} Z^b W Z^{b'} x^b\right]^{-1} \left[x^{b'} Z^b W \left[Z^{b'} y^b - Z' \hat{u}\right]\right] \tag{19}$$

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

$$J^b(\tilde{\beta}) = \tilde{g}_N^b(\tilde{\beta})' \left(\tilde{V}^b\right)^{-1} \tilde{g}_N^b(\tilde{\beta}) \tag{20}$$

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

6 Empirical Results

6.1 International Investment Behavior

This section presents a basic regression of investment on internal cash stock. We start with the benchmark specification of the investment model without characteristics of the banking structure in European countries. Table 6 summarizes single country regression results using GMM estimation. According to Bond at el (2003), who compare the investment behavior of the four largest countries in Europe, the cash flow sensitivity to investment is more severe in the U.K than the three continental countries, Belgium, France and Germany.[19] They suggest that the degree of estimated cash flow may reflect the differences between market-based and relationship-based financial systems. However, we should be cautious in analyzing the results on the estimated coefficient for cash stock to investment directly as noted by Bond (2003).

It is worthwhile to note several basic results from single country regressions. First of all, the lagged term of investment shows statistical significance and strong persistence in all regressions, single country, industry and pooled sample. The estimated coefficient from the reduced form model ranges from 0.17 to 0.47, which indicates our appropriate choice for the adjustment cost function. Second, the response of investment to marginal productivity of capital as measured by the sales to capital ratio explains the small fraction of investment whilst the financial factor measured

[19]We have two advantages over the results in Bond et al (2003). First, they use accounting and income statement databases from different sources in each country. Second, they estimate a single country regression and then compare the sensitivity of cash flow to investment while we use a pooled sample across countries with country- and industry-specific control.

Table 6: Single Country Regression : GMM-IV

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

Variable definitions are in Tables A-2 and A-3. The estimation is by GMM, Time and fixed effects are removed prior to estimation. Instruments are first and second lags of IK, SK, Cash, CF, COGS, 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	Number
	Coeff	St.err		Coeff	St.err		Coeff	St.err		p-value	of Obs.
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

by internal cash stock explains a large part of investment in our sample. The results are consistent with Cleary (2005). Most countries have a positive response of cash stock to investment except for Belgium, Netherlands Italy and Sweden. Among these countries, only Italy has a significant negative sign on the cash stock on investment variables, and other countries have small coefficients or statistically insignificant results, which reflect the existence of financial constraints. Finally, the Hansen test statistics for over-identifying restrictions and the corresponding p-value indicates that most single country regressions are under satisfactory except for Spain and the U.K. The distribution of the estimated coefficients across countries on sales to capital ratio and cash stock are reported in Figures 5 and 6. Figure 5 shows that Denmark and Italy have the lowest cash flow coefficient; on the other hand, Denmark, Italy, Portugal and Austria have the highest coefficients.[20] In other words, the degree of capital market imperfection is much lower in Italy and Denmark than in Portugal and Austria so that firms in the former countries need to accumulate financial slack for future investment.[21] The structural differences of the commercial banking sector in terms of concentration measures affect individual firm investment decisions via an external finance premium.

The next section of this paper presents the main empirical results in accessing how the structural change in the banking sector mitigates firms' use of internal funds.

[20]For example, the median value of banking concentration across countries, the highest country is Finland(et 0.99) and the lowest country is Italy(et 0.41)

[21]The term, "financial slack" introduced by Myers and Majluf (1984), has effects on investment with financial friction so that firms with not enough cash in hand with an asymmetric environment of external finance need to postpone their investment in the future.

6.2 Main Results: Bank concentration and Integration

The main results are based on equation (14) and are reported in Table 7. The models 1 through 4 are rank-based, and model 5 is a weighting regression, where weights are equal to one divided by the number of observations per country. All coefficients are of the expected sign and significant at 1% and 5%. The time-varying market structure in the banking sector has a significant role on firm-level investment through the stochastic discount factor. The main coefficients are cash and its interaction with the market structure of the banking sector. The cash coefficient enters with a positive sign and significance in all models, which is consistent with the existence of credit constraints. Most importantly, the interaction between cash stock and 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. The highly concentrated banking sector due to the deregulation process in European countries relaxes financial constraints on firms. Hansen J statistics for over-identification in Table 7 show the tradeoff between efficiency gains from more observations and poor Hansen p-values due to more unbalanced data in the estimation. 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 0.026. Finally, the partial effect of an one standard deviation of cash

Table 7: Bank Concentration and Financing Constraints

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

Variable definitions are in Table A-1 and A-2. The 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 IK, SK, Cash, CF, COGS, interactions of Con with IK, SK and Cash, and industry dummies. The firms are ranked based on the size of total assets. 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 Top 25		2 Top 50		3 Top 100		4 Top 150		5 All	
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)	
$Cash_{it} \times Con_{ct}$	-1.706	**	-1.909	**	-2.912	***	-4.266	***	-2.746	***
	(0.709)		(0.792)		(0.900)		(1.092)		(0.895)	
Const	-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	
P-value for Hansen Over-identification.										
Chi-square	0.207		0.212		0.082		0.767		N/A	
Bootstrap	0.938		0.873		0.518		0.933		0.422	

stock innovation on investment is equal to five cents.[22]

When we include a leverage ratio as measured by the sum of debt in current liabilities and long-term debt in the main regression, the coefficients on the leverage ratio is significant only in weighting regression while the sign on leverage coefficients are all correct to some degree in Table 8.

Another way to explain these differences is to split the sample according to the median level of bank concentration to not include an interaction term in the model. We divide the sample into high and low concentration measures and further separate it by firm ranking according to total assets in each country, which gauges different effects on small firms versus large firms.

It is worthwhile to note that sample split results are relatively weak tests compared to the interaction term specification with the pooled sample because sample spilt cannot capture transitory countries between each region over the sample period.[23] The estimated coefficients on cash flow are 0.061 in a high concentration sample and .169 in a low concentration sample space (i.e. model 1 and 4), which suggests that high concentration in the banking sector creates a less severe external finance premium than low concentration regions. These effects are stronger for small firms. If we compare model 1 and 4 with the same cutoff point (i.e top 25), the cash coefficients on the high concentrated sample are insignificant or smaller than

[22]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.

[23]The existing literature for banking concentration across countries usually uses the average of concentration measure instead of the time-varying one. However, most European countries show the drastic change during 1990's so that the median measure for bank concentration will inadequately assign country's market power in the banking sector.

Table 8: Banking Concentration and Financing Constraints with Leverage

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

Variable definitions are in Table A-1 and A-2. The estimation is by GMM, country-time and fixed effects are removed by country-time and forward mean differecing prior to estimation. Instruments are first and second lags of IK, SK, Cash, CF, COGS, leverage, interactions of Con with IK, SK, Cash and leverage ratio, and industry dummies. The firms are ranked based on the size of total assets. 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 Top 25		2 Top 50		3 Top 100		3 Top 150		5 All	
I/K_{it-1}	0.301	***	0.300	***	0.279	***	0.236	***	0.223	***
	(0.034)		(0.030)		(0.026)		(0.025)		(0.017)	
S/K_{it}	0.029	***	0.032	***	0.035	***	0.032	***	0.039	***
	(0.006)		(0.005)		(0.005)		(0.005)		(0.005)	
$Cash_{it}$	1.348	***	1.283	**	1.743	***	2.657	***	2.623	***
	(0.463)		(0.504)		(0.531)		(0.608)		(0.566)	
$Cash_{it} \times Con_{ct}$	-1.813		-1.711	**	-2.300	***	-3.662	***	-3.340	***
	(0.674)		(0.718)		(0.752)		(0.882)		(0.783)	
Leverage	-0.091		-0.097		-0.043		-0.025		-0.112	***
	(0.062)		(0.063)		(0.057)		(0.055)		(0.041)	
Const	-0.006	***	-0.003		-0.002		-0.003		-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	
P-value for Hansen Overid:										
Chi-square	0.254		0.311		0.076		0.686		N/A	
Bootstrap	0.943		0.933		0.473		0.863		0.478	

Table 9: Sample Splits

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

Variable definitions are in Table A-1 and A-2. The 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 IK, SK, Cash, CF, COGS, and industry dummies. The firms are ranked based on the size of total assets. 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.

	High Concentration						Low Concentration					
Model:	1		2		3		4		5		6	
	Top 25		Top 125		All		Top 25		Top 125		All	
I/K_{it-1}	0.290	***	0.237	***	0.230	***	0.368	***	0.287	***	0.265	***
	(0.038)		(0.026)		(0.023)		(0.036)		(0.045)		(0.024)	
S/K_{it}	0.036	***	0.032	***	0.038	***	0.018	***	0.023	***	0.032	***
	(0.006)		(0.005)		(0.006)		(0.004)		(0.003)		(0.004)	
$Cash_{it}$	0.061		0.033		0.140	***	0.169	**	0.134	**	0.223	***
	(0.069)		(0.062)		(0.071)		(0.070)		(0.063)		(0.062)	
Const	-0.004	*	-0.001		-0.002		-0.006	***	-0.007	***	-0.001	
	(0.002)		(0.002)		(0.002)		(0.002)		(0.002)		(0.002)	
No. of obs	1154		2822		3257		333		1245		3915	
No. of firms	208		646		791		80		318		922	
P-value for J-stat:												
χ^2	0.092		0.060		N/A		0.450		0.125		N/A	
Bootstrap	0.787		0.238		0.238		0.328		0.853		0.848	

Table 10: Bank Integration and Financial Constraints

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

Variable definitions are in Table A-1 and A-2. The estimation is by GMM, country-time and fixed effects are removed prior to estimation. Instruments are first and second lags of IK, SK, Cash, CF, COGS and its interaction with IK, SK, Cash, interaction with Intg with IK, SK, Cash and industry dummies. P-values for J -statistic(test of over-identifying restrictions) are obtained using χ^2 distribution or Bootstrap simulation with 200 repetitions. Heteroskedasticity adjusted standard errors in parentheses; ***,**,and * represent significance at 1%, 5% and 10% respectively. For the integration measures, IFS, BIS locational and BIS consolidated represent Model 1, 2 and 3, respectively.

	Integration					
Model:	1		2		3	
I/K_{it-1}	0.230	***	0.223	***	0.215	***
	(0.016)		(0.017)		(0.018)	
S/K_{it}	0.004	***	0.042	***	0.051	***
	(0.005)		(0.003)		(0.004)	
$Cash_{it}$	0.137	**	0.060		0.156	***
	(0.067)		(0.109)		(0.220)	
$Cash_{it}$*$Intg_{ct}$	-0.028		-0.063	***	0.108	
	(0.087)		(0.023)		(0.164)	
Constant	-0.001		0.011	***	-0.001	
	(0.001)		(0.002)		(0.001)	
No. of obs	7172		7144		7144	
No. of firms	1713		1707		1707	
Bootstrap	0.277		0.838		0.463	

that on the low concentrated sample, telling us the same results obtained from Table 9. The results we obtain from the borrowers' point of view are consistent with Beck, Demirüç-Kunt and Maksimovic (2004), who find a negative relationship between market power in the banking sector and financial constraints for developing countries in general. They also suggest that market concentration reduces financial obstacles in countries with a well developed financial system. When we include the commonly used financial integration measure in our estimation, the results are economically meaningful but statistically insignificant (Table 10).

6.3 Size Effect

In this subsection, we introduce firm size consideration into the baseline model. The sample of firms from each country might differ according to size, and in turn we need to control size effects from the effect of banking sector. Most papers in investment literature have used size as one important criterion for external finance. If countries with high bank power have the most sizable firm in the sample, then the estimated effect from the previous section can be explained not by the structural difference in banking sector but by firm size. In order to test the effect of firm size, we consider an additional term in the basic model, which is an interaction term with size.

$$\begin{aligned} \frac{I}{K}_{it} &= \beta_1 \frac{I}{K}_{i,t-1} + \beta_2 \frac{S}{K}_{it} + \beta_3 Cash_{it} + \beta_4 Cash_{i,t} Con_{c,t} \\ &\quad + \beta_5 Cash_{i,t} Size_{i,t} + f_i + d_{c,t} + u_{it} \end{aligned} \tag{21}$$

The test is model (2) in Table 11. The instruments now include size and interaction of size with investment, cash and sales. Model 1 in Table 11 presents significant size effects in the sample without the banking structure. For instance, the cash coefficient on a firm with mean size is equal to 0.113 while the cash coefficient on a firm with one standard deviation below the mean is equal to 0.308. The different size effect approximately increases by three times.[24] Next, in addition to size effect, we include our main interaction term as expressed in (21). Both coefficients are negative and significant, indicating the effect of cross-country differences in banking sectors has explanatory power even though we control for the size of the firms. Finally, we include the triple interaction term in (21) to question the different size effects across countries. Model 3 in Table 11 provides the final result.

$$\begin{aligned} \frac{I}{K}_{it} &= \beta_1 \frac{I}{K}_{i,t-1} + \beta_2 \frac{S}{K}_{it} + \beta_3 Cash_{it} + \beta_4 Cash_{i,t} Con_{c,t} \\ &\quad + \beta_5 Cash_{i,t} Size_{i,t} + \beta_6 Cash_{i,t} Size_{i,t} Con_{ct} + f_i + d_{c,t} + u_{it} \end{aligned} \tag{22}$$

The test is now focused on the triple interaction term in (22). The expected sign on β_6 is positive holding the sign of the remaining coefficients constant. We start with the base line regression with size interaction to capture informational asymmetries between firms. The results are presented in Table 11 (column 1, 2 and 3). Model 1 in Table 11 presents the basic specification of our model for size effect. The inclusion of the interaction of size as measured by the log of total assets in U.S dollars does

[24]The mean of the log of total assets in U.S dollars is equal to 6.121 and one standard deviation below mean is equal to 4.236

Table 11: Robustness : Size and Business Cycle

The dependent variable is IK_t. The size is equal to the (log of) total assets in US dollars, Rec is Recession dummy from country-year real GDP growth rate. The estimation is by GMM, country-time and fixed effects are removed prior to estimation by country-time differencing and orthogonal transformation . Instruments are first and second lags of IK, SK, Cash, CF, COGS, size (Recession dummies) and its interactions with Cash, IK and SK, interactions of Conc with IK, SK, Cash, size, 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 ***	0.231 ***	0.228 ***	0.223 ***
	(0.017)	(0.008)	(0.017)	(0.017)	(0.017)	(0.017)
S/K_{it}	0.048 ***	0.018 ***	0.047 ***	0.048 ***	0.040 ***	0.038 ***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.005)	(0.005)
$Cash_{it}$	0.744 ***	3.472 ***	4.919 **	0.291 ***	2.806 ***	3.245 ***
	(0.187)	(0.860)	(1.722)	(0.047)	(0.702)	(0.696)
$Cash_{it} \times Size_{it}$	-0.103 ***	-0.186 ***	-0.578 ***			
	(0.029)	(0.051)	(0.247)			
$Cash_{it} \times Con_{ct}$		-2.862 ***	-6.192 ***		-3.624 ***	-4.318 ***
		(0.963)	(2.377)		(0.987)	(0.968)
$Cash_{it} \times Con_{ct} \times Size_{it}$			0.343 **			
			(0.162)			
$Cash_{it} \times Rec_{ct}$				0.143 **	0.648 **	3.441 ***
				(0.069)	(0.292)	(0.865)
$Cash_{it} \times Rec_{ct} \times Size_{it}$						-0.449 ***
						(0.125)
Const	0.015 **	-0.001 **	0.000	-0.001	-0.003	-0.003 *
	(0.002)	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)
N obs	7003	7003	7003	7003	7003	7003
N firms	1700	1700	1700	1700	1700	1700
Bootstraped P-value for J-statistic:	0.427	0.532	0.257	0.397	0.552	0.667

not alter our results (Model 2). Finally, when we include the triple interaction of cash, size and bank concentration, the coefficient on the triple interaction term is positive and statistically significant. That is, bank concentration reduces more financial constraints for big firms than small firms.

6.4 Business Cycles

In this subsection, we investigate whether investment rate differed in response based on the stages of the business cycle. The relationship between financial friction and the business cycle is well-documented by Bernanke and Blinder (1988), Bernanke and Gertler (1989) and Kiyotaki and Moore (1997). Their main theorem states that an imperfect capital market can explain the propagate effects of monetary policy and the business cycle on aggregate fluctuation. In other words, more financially constrained or distressed firms are hit harder in a recession. Recent evidence is from Bernanke, Gertler and Gilchrist (1999) for the U.S and Vermeulen (2002) for the four largest European countries. We define a dummy variable, which is equal to one if the real GDP growth rate is below the median trend, Models 4,5 and 6 in Table 11. We find a significant effect of a recession on financial constraints when we run pooled GMM regression. We find that coefficients on the financial term expressed as cash stock are of expected sign and significant.

6.5 Institutional Indicator and Firm Level Investment

In this subsection, we introduce institutional differences across countries and test whether indicators of institutional difference are correlated with cash-investment sensitivity in European countries. In the study of law and finance, many papers focus on the relationship between legal structure and finance followed by LLSV (1998). They make the important distinction of legal origin, which comes from English, French, German and Scandinavian. Demirgüç and Maksimovic (1998) report the importance of the legal and financial system for the growth rate of a firm. The difference of the legal and financial systems can be explained by the rights of shareholders and also anti-director rights. The effect of banking structure on firm-level investment will be different depending on institutional characteristics. It is straightforward to tell there is higher efficiency in the banking sector with better legal protection. We use several legal indicators in this paper borrowing from LLSV (1998). We have 2 models for each legal indicator starting from accounting standard to the shareholder rights in Table 12. This is done by replacing the interaction term for the indicator variables. Table 12 shows the effect of legal structure on the sensitivity of cash stock to investment. Most legal indicators have a negative sign and are significant as expected except creditor rights and English origin. The results indicate that firms' financial constraints are reduced by an efficient legal structure. When we put the bank concentration measure with legal environment, some of the indicators become insignificant, which indicates those legal indicators have a minor effect on firm-level investment compared to the market power of the banking sector. Accounting stan-

Table 12: Robustness : Legal System Indicator and Financial Constraint

The dependent variable is IK_t, the model is given in (14) with Con interactions replaced with each of the indicator variable interactions. The estimation is by GMM, country-time and fixed effects are removed prior to estimation. Instruments are first and second lags of IK, SK, Cash, CF, COGS, interactions of Con and appropriate Indicator with IK, SK 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}	$Cash_{it}$	$Cash_{it} \times Ind_c$	$Cash_{it} \times Con_{ct}$	P-value J-stat.
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	Corruption	0.211 ***	0.052 ***	2.723 ***	-0.275 ***		0.443
		(0.015)	(0.005)	(0.473)	(0.051)		
II-2	Corruption	0.231 ***	0.048 ***	2.681 ***	-0.210 ***	-0.623	0.292
		(0.016)	(0.005)	(0.586)	(0.051)	(0.467)	
IV-1	Efficiency	0.231 ***	0.053 ***	3.137 ***	-0.318 ***		0.603
		(0.014)	(0.004)	(0.380)	(0.041)		
IV-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)	
V-1	Rule of Law	0.229 ***	0.047 ***	3.371 ***	-0.341 ***		0.392
		(0.016)	(0.004)	(0.599)	(0.063)		
V-2	Rule of Law	0.228 ***	0.046 ***	3.700 ***	-0.229 ***	-1.771 ***	0.373
		(0.016)	(0.004)	(0.695)	(0.065)	(0.554)	
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)	

dards and English origin are insignificant and of positive sign, telling us the two indicators have a smaller or opposite effect. Our results consistent with Love (2003) and Demirgüç and Maksimovic (1998).

6.6 Pre and Post EMU period

In this subsection, we examine the economic role of the introduction of a common currency and the rapid expansion of the capital market since the European Monetary Union. To illustrate the economic impact of the adoption of a single currency regime on the sensitivity of internal funds. We divide the sample into two regimes, namely pre-EMU and post-EMU period. Without serious consideration of the beneficial aspect of a rapid European integration process in the financial system, most firms in European countries since 1999 have insignificant sensitivity of internal funds to investment.

It is clear to see the difference between pre- and post-EMU periods. Columns (1) to (3) in Table 13 present a rank-based regression with cutoff value from top 25 to top 150. Cash coefficients go up with cutoff values and also are quantitatively large and significant while the cash coefficients in the post-EMU sample are insignificant or negative. The negative coefficient on cash stock with post-sample tells us financial constraints are not severe for the whole firm, but still we have a size effect quite similar to pre-sample. The results based on the sample splits between periods are somewhat surprising and similar with sample splits by high versus low concentrated banking sectors. This is a particularly interesting set of results and quite consistent

Table 13: The Differential Behavior of Investment in Pre- and Post-EMU periods

The dependent variable is IK_t; variable definitions are in Table A-1 and A-2. Pre- and Post-EMU periods are 1992-1998 and 1999-2005. The estimation is by GMM, country-time and fixed effects are removed prior to estimation. Instruments are first and second lags of IK, SK, Cash, CF, COGS and industry dummies. The firms are ranked based on the size of the total assets. P-values for J -statistic (test of over-identifying restrictions) are obtained using χ^2 distribution or Bootstrap simulation with 200 repetitions. Heteroskedasticity adjusted standard errors in parentheses; ***,**,and * represent significance at 1%, 5% and 10% respectively.

	Pre - EMU								Post - EMU							
Model	1		2		3		4		5		6		7		8	
	Top 25		Top 50		Top 150		All		Top 25		Top 50		Top 150		All	
I/K_{it-1}	0.340	***	0.334	***	0.328	***	0.263	***	0.158	***	0.174	***	0.176	***	0.131	***
	(0.044)		(0.040)		(0.034)		(0.022)		(0.054)		(0.049)		(0.039)		(0.030)	
S/K_{it}	0.035	***	0.040	***	0.033	***	0.043	***	0.031	***	0.031	***	0.025	***	0.039	**
	(0.008)		(0.007)		(0.007)		(0.006)		(0.005)		(0.005)		(0.005)		(0.006)	
$Cash_{it}$	0.243	***	0.250	***	0.171	***	0.354	***	-0.229	***	-0.186		0.023		-0.039	
	(0.074)		(0.071)		(0.063)		(0.064)		(0.103)		(0.115)		(0.113)		(0.105)	
Const	-0.008	**	-0.00		-0.003		-0.002		0.001		-0.003		-0.002		-0.004	***
	(0.003)		(0.003)		(0.002)		(0.002)		(0.002)		(0.002)		(0.002)		(0.002)	
No. of obs	741		1168		1750		3380		505		858		1346		2492	
No. of firms	205		344		540		1705		194		343		562		1039	
P-value for J-stat :																
χ^2	0.442		0.192		0.019		N/A		0.162		0.047		0.015		N/A	
Bootstrap	0.927		0.843		0.368		0.558		0.958		0.782		0.402		0.478	

Table 14: The Differential Behavior of Investment in Pre- and Post-EMU periods with EU 10

The dependent variable is IK_t; variable definitions are in Table A-1 and A-2. Pre- and Post-EMU periods are 1992-1998 and 1999-2005. The estimation is by GMM, country-time and fixed effects are removed prior to estimation. Instruments are first and second lags of IK, SK, Cash, CF, COGS and industry dummies. The firms are ranked based on the size of the total assets. P-values for J -statistic (test of over-identifying restrictions) are obtained using χ^2 distribution or Bootstrap simulation with 200 repetitions. Heteroskedasticity adjusted standard errors in parentheses; ***,**,and * represent significance at 1%, 5% and 10% respectively. We exclude Denmark, Sweden, Switzerland and U.K sample.

	Pre - EMU								Post - EMU							
Model	1		2		3		4		5		6		7		8	
	Top 25		Top 50		Top 150		All		Top 25		Top 50		Top 150		All	
I/K_{it-1}	0.340	***	0.354	***	0.291	***	0.272	***	0.110	**	0.172	***	0.213	***	0.158	***
	(0.045)		(0.039)		(0.035)		(0.042)		(0.046)		(0.053)		(0.047)		(0.043)	
S/K_{it}	0.032	***	0.033	***	0.030	***	0.034	***	0.038	***	0.036	***	0.023	***	0.032	***
	(0.009)		(0.007)		(0.005)		(0.005)		(0.006)		(0.005)		(0.005)		(0.008)	
$Cash_{it}$	0.236	***	0.244	***	0.190	**	0.200	***	-0.242	**	-0.151		0.203		-0.023	
	(0.088)		(0.089)		(0.088)		(0.049)		(0.122)		(0.159)		(0.164)		(0.183)	
Const	-0.006	**	-0.004		-0.001		-0.004		0.001		0.000		-0.001		-0.006	**
	(0.003)		(0.003)		(0.003)		(0.002)		(0.002)		(0.002)		(0.002)		(0.002)	
No. of obs	536		813		1383		1685		305		462		689		817	
No. of firms	153		241		430		529		127		208		336		415	
P-value for J-stat :																
χ^2	0.230		0.113		0.002		N/A		0.760		0.811		0.284		N/A	
Bootstrap	0.883		0.787		0.407		0.968		0.993		0.993		0.813		0.843	

with traditional investment literature of financial friction under different periods.

We estimate several specifications of the investment model given in the equation (14). The results we obtain from Table 13 can be summarized by sample split exercise pre-EMU sample shows the general behavior of investment which is quite similar with other literature but the coefficient are on cash stock in post EMU sample is negative and highly significant.

6.7 Bank Credit and Size of the Banking Sector

Two traditional measures for the development of the private banking sector are bank credit to private sectors and the size of the banking sector scaled by GDP. Larrain (2006) studies the role of bank credit on industrial volatility. Using industry and firm level data with the measure of bank credit, he conclude that countries with higher bank credit have lower volatility in industrial output. The European countries with higher banking credit increase the probability of firm access to capital markets. In other words, bank credit reduces financial constraints for firms. The results for bank credit are presented in (column 1, 2 and 3) and the size of private banking sector (column 4 and 5) in Table 17. When we estimate the benchmark model with bank credit, we have a significantly negative sign on the interaction term. If we include the interaction term with size effect to check the robustness of the bank credit effect, the main coefficient becomes insignificant, indicating the size effect is dominant to the bank credit and the size of banking sector.

Table 15: Robustness : Bank credit and Bank power

The dependent variable is IK_t; Bank credit and power are defined in Table A-2. The estimation is by GMM, country-time and fixed effects are removed prior to estimation. 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 6790 observations (1685 firms). Instruments are first and second lags of IK, SK, Cash, CFK, COGS, Banking sector characteristics(bank credit and Bank Power) and its interaction with IK, SK, Cash and industry dummies. The firms are ranked based on the size of the capital stock. P-values for J-statistic (test of over-identifying restrictions) are obtained using χ^2 distribution or Bootstrap simulation with 200 repetitions. Heteroskedasticity adjusted standard errors in parentheses; ***,**,and * represent significance at 1%, 5% and 10% respectively.

	Bank Credit						Bank Power			
Model:	I		II		III		IV		V	
I/K_{it-1}	0.229	***	0.245	***	0.226	***	0.229	***	0.221	***
	(0.017)		(0.016)		(0.015)		(0.016)		(0.016)	
S/K_{it}	0.038	***	0.037	***	0.052	***	0.043	***	0.044	***
	(0.005)		(0.005)		(0.004)		(0.005)		(0.005)	
$Cash_{it}$	0.864	***	0.897	***	0.915	***	0.873	***	0.297	
	(0.182)		(0.190)		(0.197)		(0.199)		(0.352)	
$Cash_{it} \times Size_{it}$	-0.118	***	-0.107	***	-0.097	***	-0.110	***	-0.014	
	(0.028)		(0.029)		(0.031)		(0.031)		(0.056)	
$Cash_{it} \times Banking_{ct}$			-0.061		-0.198		-0.017		0.850	
			(0.087)		(0.136)		(0.083)		(0.315)	
$Cash_{it} \times Banking_{ct} \times Size_{it}$					0.048				-0.117	
					(0.323)				(0.049)	
Const	-0.001		-0.001		0.000		-0.001		-0.001	
	(0.001)		(0.001)		(0.001)		(0.001)		(0.001)	
No. of obs	6790		6790		6790		6790		6790	
No. of firms	1685		1685		1685		1685		1685	
Bootstraped P-value for J-statistic:	0.277		0.257		0.542		0.233		0.328	

7 Conclusion

Using 2286 listed firms in 14 European countries for the period 1992 to 2005, we investigate a dynamic investment model to study the existence of financial constraints provided by the structural change of the private banking structure. We further consider size, business cycle and institutional differences across countries to check the robustness of our estimator as a possible alternative explanation for the cost of external finance. Out empirical findings are summarized as following: First of all, the empirical results show that the highly concentrated banking sector in European countries followed by a deregulation process helps to relax financial constraints on firm-level investment in general. The magnitude of this effect is bigger for big firms compared to small ones by both the interaction and sample splits specifications. In other words, the estimated coefficients on cash flow suggest that high concentration in the banking sector creates less information costs than low concentration, which suggests the structural intensity of the banking sector creates a higher external finance premium for small firms, which have high reliance on banks to finance their investment.

Second, along with bank concentration and integration, when we consider the difference in legal structure into the basic model, most legal indicators have negative signs and significant, as expected, except for creditor rights and English origin. The results indicate that firms' financial constraints are reduced by nice legal structure, but when we include the bank concentration measure, some indicators have an insignificant and minor effect on firm-level investment. Accounting standards and

English origin are insignificant and have positive signs, which tell suggest the two indicators have a smaller effect or relatively opposite effect with banking characteristics.

Finally, the adoption of a single currency among 10 EU countries significantly reduces financial obstacles for firms. Overall, our empirical results show that the banking structure of each country has an effect on firm-level investment through the stochastic discount factor, which affects intertemporal decision for managers. Bank concentration has different effect for different sized groups.

Appendix 1. Sample Selection

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 I deleted the following:

- 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;

Love (2003) : Sample Selection.

- Observations with IK>2.5;

- Observations with SK>20;

- Observations with cash/totol 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 2005): Sample Selection.

- Observations with IK>2(-2);

- Observations with MTB>10;

- Observations with cash flow/K>5(-5);

Appendix 2. Mathematical Derivation for Euler Equation

The dynamic optimization problem in discrete time (1) can be rewritten in a Bellman equation form, which substitutes infinite maximization with a one-period problem:

$$V_t(K_t, B_t, \xi_t) = \max_{I_t,\, B_{t+1}} D_t + \beta_{t+1} E_t \left[V_{t+1}(K_{t+1}, B_{t+1}, \xi_{t+1}) \right] + \lambda_t D_t \tag{A-1}$$

Here, λ_t is a Lagrangian multiplier on non-negativity of the dividend constraint (4). The first order condition with respect to investment of the problem in (A-1) is:

$$(1 + \lambda_t) \left(\frac{\partial D}{\partial I} \right)_t + \beta_{t+1} E_t \left[q_{t+1} \right] = 0 \tag{A-2}$$

Rearrange (A-2),

$$\beta_{t+1} E_t \left[q_{t+1} \right] = - \left(\frac{\partial D}{\partial I}_t \right) (1 + \lambda_t) \tag{A-3}$$

Here, $q_{t+1} = \left(\frac{\partial V}{\partial K} \right)_{t+1}$, the first derivative of the value function with respect to investment in $t+1$ is the 'marginal q', meaning that the shadow value of capital equal to managers or shareholders expectations of the marginal contribution of new capital goods to the value of the firm. In order to solve this FOC, we need to know q_t. We do this by taking the derivative with respect to the state variable, K_t. By using the envelope theorem, we can ignore the impact of changing state variable on

our choice variable in calculating the derivatives to derive, $q_t = \left(\frac{\partial V}{\partial K}\right)_t$:

$$q_t = \left(\frac{\partial V}{\partial K}\right)_t = (1+\lambda_t)\left(\frac{\partial D}{\partial K}\right)_t + \beta_{t+1} E_t\left[q_{t+1}\right](1-\delta) \tag{A-4}$$

Plugging FOC (A-3) to the envelope condition (A-4), then:

$$q_t = \left(\frac{\partial V}{\partial K}\right)_t = (1+\lambda_t)\left(\frac{\partial D}{\partial K}\right)_t - \left(\frac{\partial D}{\partial I}_t\right)(1+\lambda_t)(1-\delta) \tag{A-5}$$

Updating one period and substituting in FOC to eliminate $q_t$and q_{t+1}, we obtain

$$-\left(\frac{\partial D}{\partial I}\right)_t = \beta_{t+1} E_t\left[\left(\frac{1+\lambda_{t+1}}{1+\lambda_t}\right)\left(\frac{\partial D}{\partial K}\right)_{t+1} - (1-\delta)\left(\frac{\partial D}{\partial I}\right)_{t+1}\right] \tag{A-6}$$

The derivatives are:

$$\left(\frac{\partial D}{\partial I}\right)_t = -\left(\frac{\partial C}{\partial I}\right)_t - 1 \tag{A-7}$$

$$\left(\frac{\partial D}{\partial K}\right)_t = \left(\frac{\partial \Pi}{\partial K}\right)_t - \left(\frac{\partial C}{\partial K}\right)_t \tag{A-8}$$

For simplicity, I ignore the derivative of the adjustment cost function with respect to capital stock, $\frac{\partial C}{\partial K}_t$, because it is a second order effect equal to the difference in squared $\frac{I}{K}$ ratios. The mean of $\frac{I}{K}$ in the data is around 0.212, the squared term is approximately equal to 0.04 and since $\frac{\partial C}{\partial K}_t = \alpha\left(\left(\frac{I}{K}\right)_t^2 - \left(\frac{I}{K}\right)_t\left(\frac{I}{K}\right)_{t-1}\right)$ its effect is immaterial. Substituting the derivatives (A-7 and A-8) into (A-6), we obtain the

Euler equation (5) in text.

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

The Euler equation for debt can be derived by the same procedure with investment.

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Table A-1: The Construction of Financial Variables

Variable	Abb	Definition and Compustat Number
Total 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/current liabilities (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 Capital stock (Data4/data76)
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)/Data89
Interest coverage	COV	Operating income/interest and related expenses (Data14/data15)
Cash flow	CF	Income before extraordinary items + depreciation and amortization (data32+data11)
Net sales	SK	Net sales at the end of period $t-1$ scaled by capital (data1/data76)
Investment	IK	Net capital expenditure Annual change of K + DA or Data145 scaled by capital stock
Tobin$'$ 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)[1]/data89

Source : Compustat Global industrial/commercial and issue files.

[1]PRCCI is the close-price and SHOI is the shares outstanding from the Global issue file

Table A-2: The Construction of Country Level Variables

Variable	Definition	Source
Bank concentration	Assets of three largest banks as a share of assets of all commercial banks	WDI, World Bank
Integration	I. The share of foreign assets held in banking sector	IFS
	i) Banking Inst : Foreign Asset	21ZF and since 1999, 21... ZW
	ii) Banking Inst : Claims on General Government	22aZF and since 1999, 22a... ZW
	iii) Banking Inst : Claims on private Sector	22dZF and since 1999, 22d... ZW
	II. The ratio of foreign claims to domestic claims in the banking sector	BIS locational database
	III. Cross-Border claims	BIS Consolidated database by Nationality of reporting Bank
Bank credit	Bank credit to private sector/GDP	IFS
Bank power(size)	Domestic money bank domestic assets/GDP	IFS
Creditor right	Sum of four different types of creditor rights	LLDV(1998)
Shareholder right	Sum of six different types of shareholder rights.	LLDV(1998)
Legal Origin(Dummies)	1 (English Common law) 2 (French commercial code) 3 (German commercial code) 4 (Scandinavian civil law)	LLDV(1998)
Accounting standard		LLDV(1998)
Efficiency of judicial system	The measure of quality of law enforcement(zero to ten)	LLDV(1998)
Rule of law	The measure of quality of law enforcement(zero to ten)	LLDV(1998)
Risk of expropriation	The risk of outright confiscation or forced nationalization	LLDV(1998)
Corruption	The corruption measure in government range from zero to ten (lower measure means higher corruption)	LLDV(1998)
Industrial production		..6CZF, Seasonally Adjusted, IFS
GDP growth	Anuual real GDP growth rate	IFS

Table A-3: Correlations of Country-level Institutional Characteristics and Bank Concentration

	Concentration	Efficiency	Rule of Law	Expropriation	Corruption	Shareholder Rights	Creditor Rights
Efficiency	0.198						
	(0.000)						
Rule of Law	0.585	0.335					
	(0.000)	(0.000)					
Expropriation	0.051	0.424	0.332				
	(0.000)	(0.000)	(0.000)				
Corruption	0.427	0.756	0.654	0.483			
	(0.000)	(0.000)	(0.000)	(0.000)			
Shareholder Rights	-0.347	0.308	-0.650	-0.266	0.012		
	(0.000)	(0.000)	(0.000)	(0.000)	(0.160)		
Creditor Rights	-0.237	0.491	-0.416	0.052	-0.074	0.516	
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	
Accounting	-0.157	0.523	-0.366	-0.162	0.272	0.799	0.3956
	0.000	0.000	0.000	0.000	0.000	0.000	0

Figure 4: Investment, Cash Stock and Cash flow

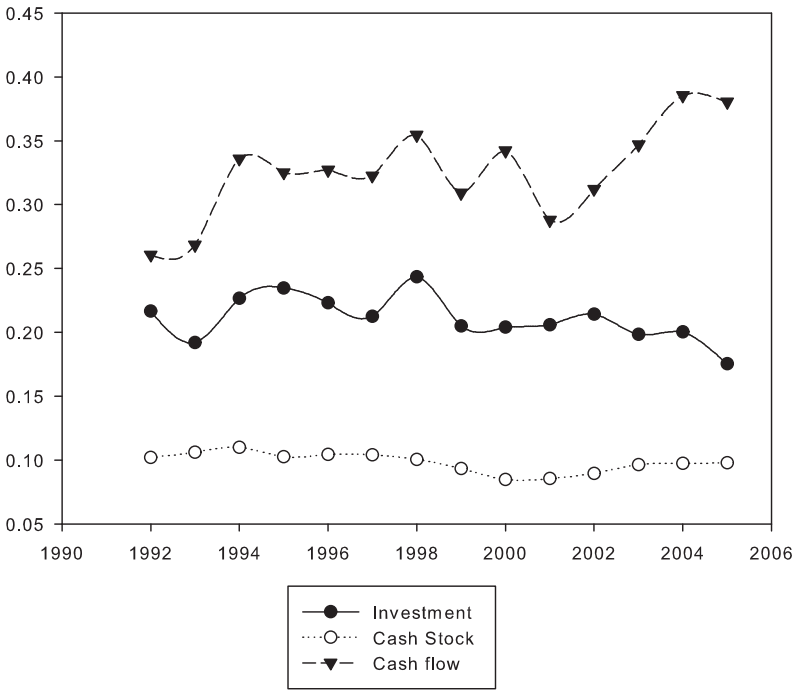


Figure 5: The Distribution of Coeff. on Cash Stock

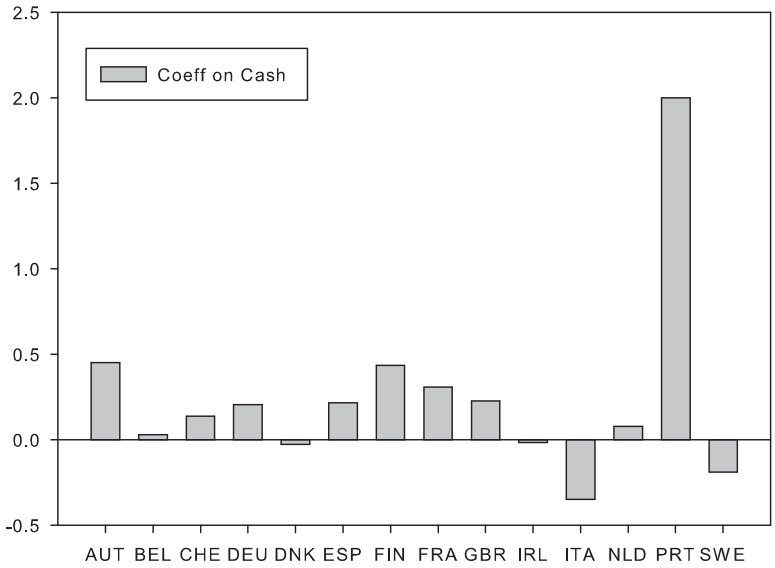


Figure 6: The Distribution of Coeff. on Sales Capital Ratio

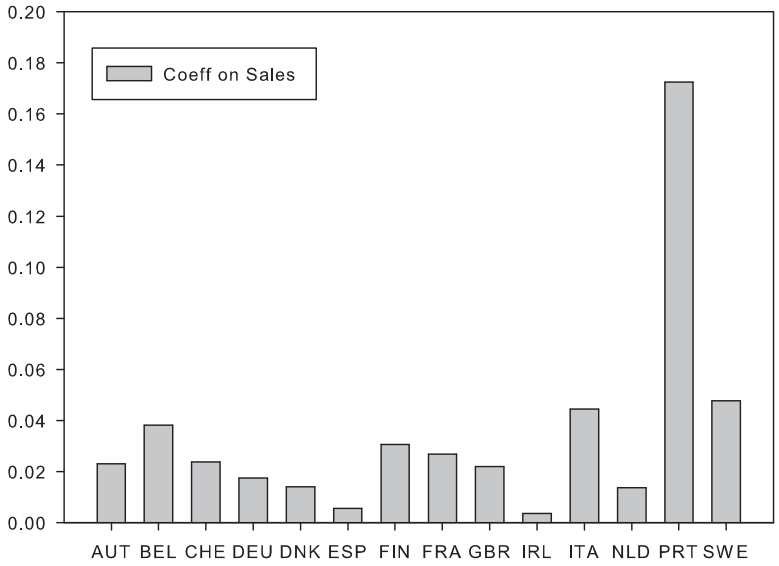


Table A-4: Banking Concentration and Financing Constraints: Cleary's Sample Selection

The dependent variable is IK_t, the model is given in (14); variable definitions are in Table A-1 and A-2. The 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 IK, SK, Cash, CF, COGS, interactions of Con with IK, SK and Cash, and industry dummies. The firms are ranked based on the size of total assets. 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 Top 25		2 Top 75		3 Top 125		4 Top 150		5 All	
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)	
$Cash_{it} \times Con_{ct}$	-1.499	***	-1.951	***	-1.766	**	-1.922	***	-2.352	***
	(0.586)		(0.734)		(0.735)		(0.775)		(0.885)	
Const	-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 Over-identification.										
Chi-square	0.113		0.014		0.001		0.000		N/A	
Bootstrap	0.963		0.498		0.228		0.252		0.833	

Table A-5: Robustness : Size and Business Cycle : Cleary's Sample Selection

The dependent variable is IK_t. The size is equal to the (log of) total assets in US dollars, Rec is Recession dummy from country-year real GDP growth rate. The estimation is by GMM, country-time and fixed effects are removed prior to estimation by country-time differencing and orthogonal transformation . Instruments are first and second lags of IK, SK, Cash, CF, COGS, size (Recession dummies) and its interactions with Cash, IK and SK, interactions of Conc with IK, SK, Cash, and size, 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	
I/K_{it-1}	0.236	***	0.200	***	0.254	***	0.194	***
	(0.015)		(0.008)		(0.016)		(0.015)	
S/K_{it}	0.026	***	0.029	***	0.015	***	0.057	***
	(0.006)		(0.004)		(0.006)		(0.005)	
$Cash_{it}$	0.478	***	0.493	***	0.088	*	1.589	***
	(0.148)		(0.107)		(0.048)		(0.616)	
$Cash_{it} \times Size_i$	-0.075	***	-0.059	***				
	(0.023)		(0.018)					
$Cash_{it} \times Con_{ct}$			-0.172	***			-0.488	**
			(0.024)				(0.188)	
$Cash_{it} \times Rec_{ct}$					-0.435	***	-2.032	***
					(0.162)		(0.852)	
Constant	-0.003	**	-0.002	***	0.162	***	-0.003	
	(0.001)		(0.001)		(0.001)		(0.002)	
No. of obs	8766		8766		8766		8766	
No. of firms	2078		2078		2078		2078	
Bootstraped P-value for J-statistic:								
	0.808		0.938		0.863		0.897	

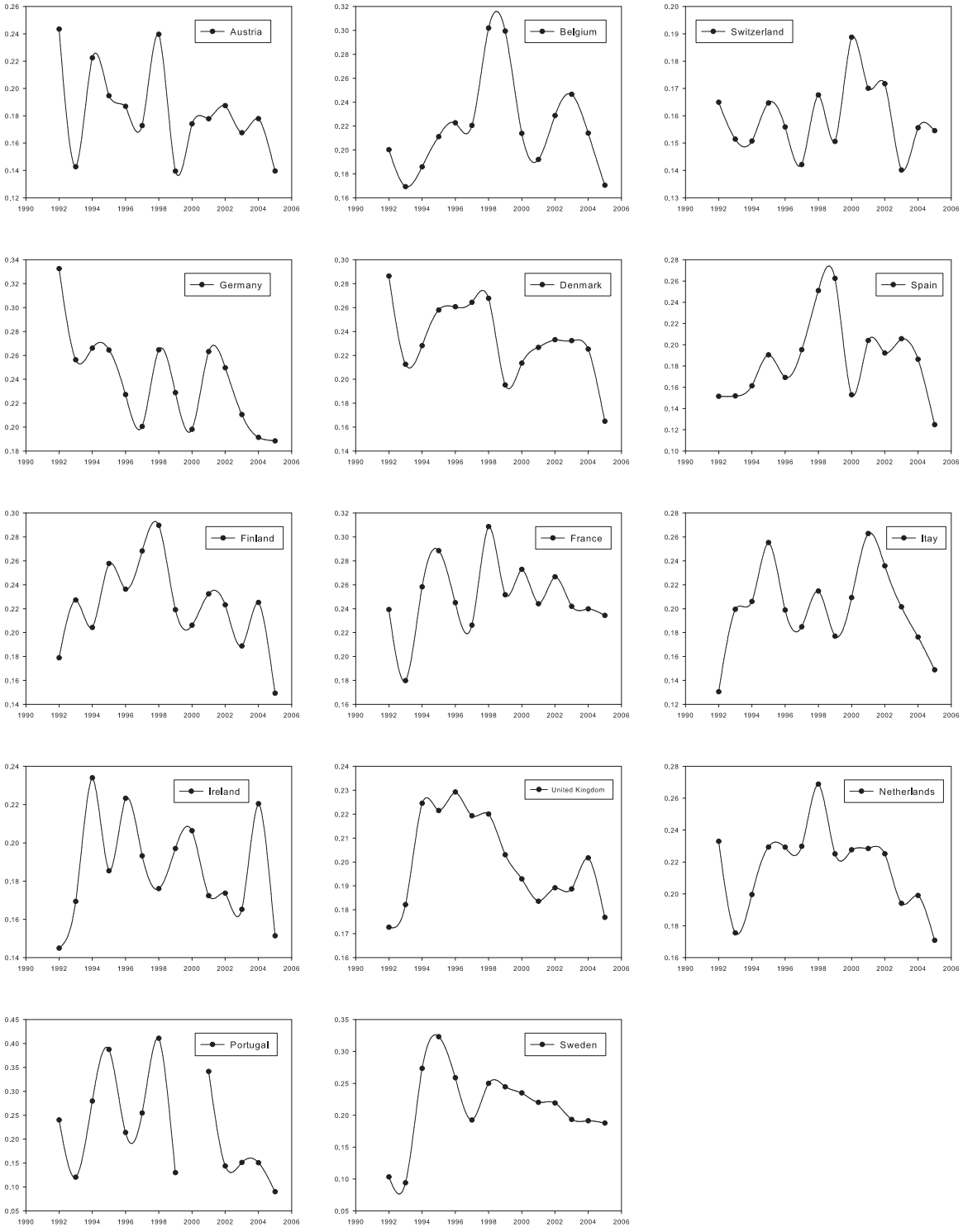
Table A-6: The Differential Behavior of Investment in Pre- and Post-EMU periods

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

The dependent variable is IK_t; variable definitions are in Table A-1 and A-2. Pre- and Post-EMU periods are 1992-1998 and 1999-2005. The estimation is by GMM, country-time and fixed effects are removed prior to estimation. Instruments are first and second lags of IK, SK, Cash, CF, COGS and its interaction with IK, SK, Cash and industry dummies. The firms are ranked based on the size of the Total assets(U.S dollars) P-values for J -statistic (test of over-identifying restrictions) are obtained using χ^2 distribution or Bootstrap simulation with 200 repetitions. Heteroskedasticity adjusted standard errors in parentheses; ***,**,and * represent significance at 1%, 5% and 10% respectively.

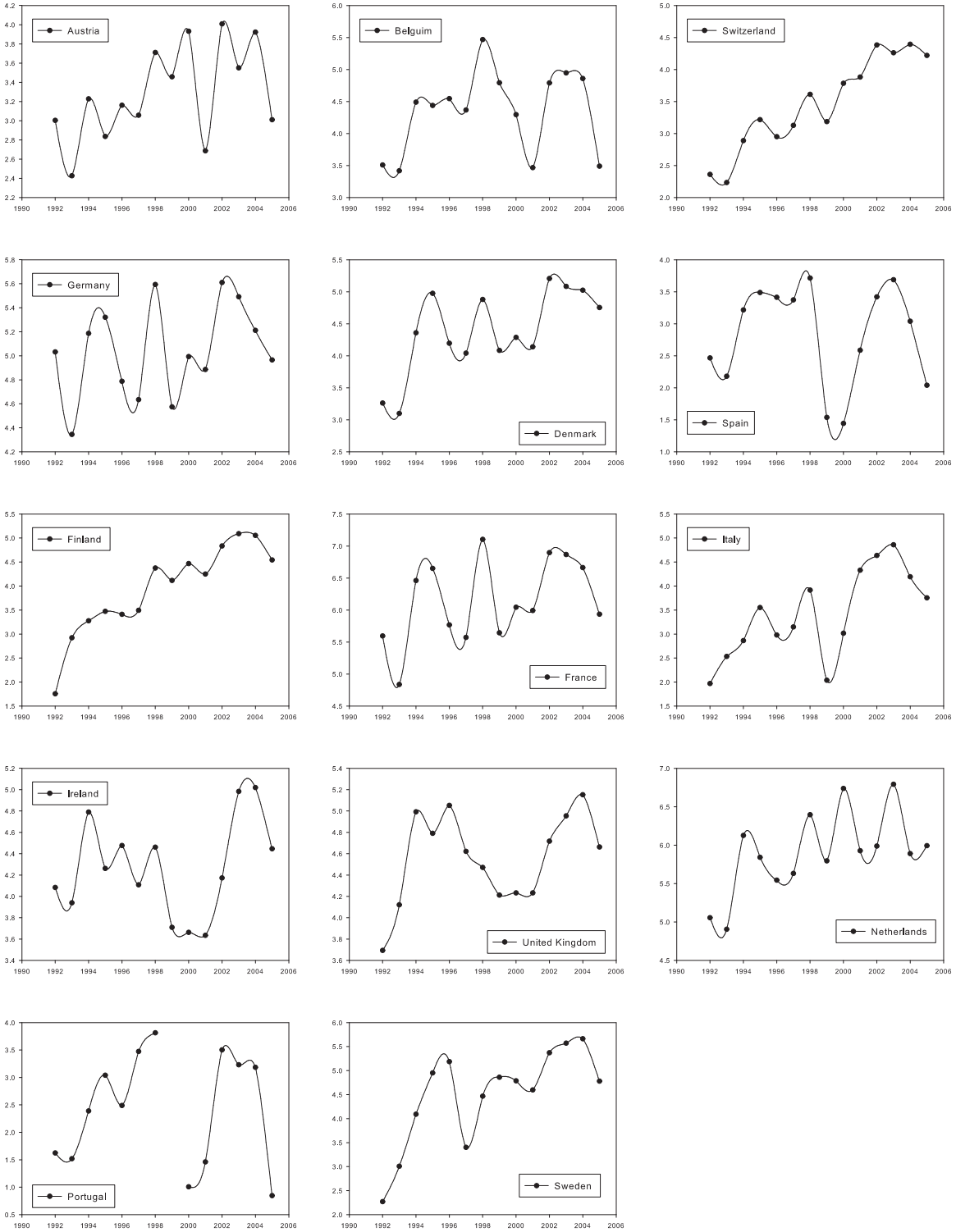
	Pre-EMU			Post-EMU		
Model:	1	2	3	4	5	6
	Top 50	Top 100	All	Top 50	Top 100	All
I/K_{it-1}	0.322 ***	0.330 ***	0.236 ***	0.262 ***	0.190 ***	0.124 ***
	(0.035)	(0.033)	(0.022)	(0.046)	(0.041)	(0.031)
S/K_{it}	0.036 ***	0.032 ***	0.049 ***	0.032 ***	0.024 ***	0.038 ***
	(0.006)	(0.005)	(0.006)	(0.004)	(0.005)	(0.005)
$Cash_{it}$	0.398 **	0.917 ***	1.490 ***	-1.742 ***	-0.586	1.209 *
	(0.172)	(0.282)	(0.367)	(0.282)	(0.479)	(0.721)
$Cash_{it} \times Con_{ct}$	-0.286	-1.065 **	-1.505 ***	2.423 ***	0.997	-1.371
	(0.253)	(0.421)	(0.520)	(0.391)	(0.614)	(0.929)
Constant	-0.005 **	-0.003	-0.002	-0.001	-0.003	-0.004
	(0.002)	(0.002)	(0.002)	(0.001)	(0.002)	(0.002) **
No. of obs	1168	1647	3277	839	1323	2469
No. of firms	344	519	1047	339	558	1035
P-value for J-stat.						
χ^2	0.287	0.090	N/A	0.122	0.016	N/A
Bootstrap	0.973	0.647	0.722	0.917	0.518	0.493

Figure 7: Investment Ratio across Country



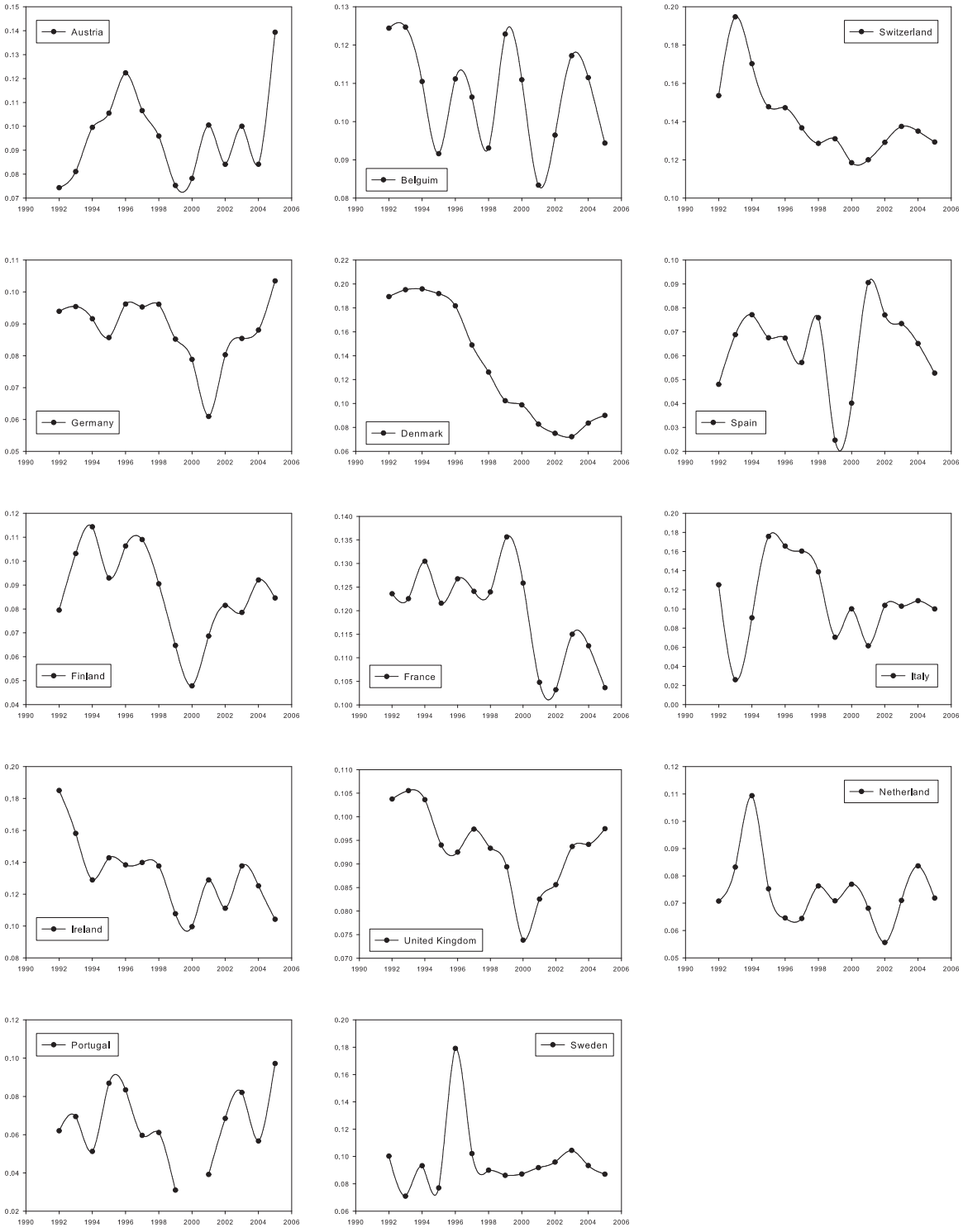
Source : Compustat Global.

Figure 8: Sales Capital Ratio across Country



Source : Compustat Global.

Figure 9: Cash Stock across Country



Source : Compustat Global.

VITA

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