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Corporate investment in a low interest rate euro zone environment

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Abstract

This thesis analyzes the effect of unconventional monetary policy (UMP) measures on the real economy in euro member countries, namely corporate investment. ECB's UMP and newly formed governmental instruments (European Stability Mechanism, ESM) were implemented to counteract the negative results of the global financial crisis of 2008 / 2009. Building on existing U.S. American research that studies the connection between general business environment, corporate financing conditions, and investment activities (McLean and Zhao, 2014), this relationship is studied in a European context. Further and again building on the vast literature on financially dependent firms, different corporate traits known to negatively affect access to external finance are compared. Given the unique ESM instrument, a subset of (financially dependent) firms from recipient countries (Spain, Portugal, and Greece) is analyzed in more detail. These results are then compared to British and Swiss firms, which operate in Europe but not in euro.

The results show that European firms possessing certain corporate traits (young, private, small, and highly indebted) show an increased financial dependence, just as their U.S. American peers. Further there is no clear indication that corporate investment has increased after ESM assistance was set in place – both because financing frictions prevailed and because investment opportunities (as measured by a q-like variable) were not seized. The comparison to Swiss and British companies shows no clear picture.

1. Introduction

In response to the 2008 / 2009 financial crisis, central banks in all leading industrialized nations have engaged in extreme and unprecedented monetary expansion. The Federal Reserve (Fed), the European Central Bank (ECB), the Bank of England (BoE), and the Bank of Japan (BoJ) have increased their holdings of treasury and corporate bonds, thereby infusing immense amounts of liquidity into the financial systems around the world.

By doing so, long- and short term interest rates have even been lowered to subzero values over the past 10 years. The theoretical grounds for expanding central banks' balance sheets and effectively cancelling the price of liquidity are threefold: First, highly indebted countries, especially in the European periphery, were provided with the means to fund necessary reforms. Second, financial institutions were de-facto unburdened by their holdings of lower grade sovereign bonds. The latter reconstruction of bank balance sheets was in turn implemented to ease the workings of the (bank) lending channel to corporations and households. Third, improved financing conditions (i.e. lower interest rates but, more importantly, the general availability of credit from financial institutions) were expected to ignite corporate investments. By creating a quasi-perpetual motion machine, the newly stimulated national and international economic growth should then translate into positive effects on tax revenue and thus public budgets.

As pointed out by Burriel and Galesi (2018), a vast amount of empirical research has demonstrated the effectiveness of policies in targeting lower interest rates. Their subsequent impact on the real economy has however not been established yet. This thesis therefore focuses on the following question: Has corporate investment in the euro zone positively responded to expansionary monetary policy? A wide range of tools has been used by the ECB and other newly created funds (e.g. European Stability Mechanism, ESM) to stabilize the economic situation in the euro zone after the financial and sovereign debt crisis of 2008 / 2009. The effectiveness of these tools in creating a sustainably stable economic environment

and providing troubled economies with the means for renewed growth is still subject to discussion: There exists, however, an imbalance between the unlimited availability of low-cost debt and the observed value of investment activity. This discrepancy forms the basis of the analysis of corporate investment across all euro zone countries, as well as neighboring non-euro countries Great Britain and Switzerland.

The OECD's 2017 Economic Outlook confirms the unhealthy state of increased indebtedness in nonfinancial corporations and the lack of corporate investment. The report names three possible explanations for the low level of investment: First, newly raised debt is solely used for share buy backs ("financial engineering"); second, there are simply no attractive investment opportunities for firms to engage in; and third, firms are actively changing their financing structure from equity to debt to take advantage of lower costs. Further, the OECD cautions the reader of the rise of zombie firms, which are too indebted to raise additional funds to finance necessary investments. These firms, however, cease to exist, as the current low interest rate environment allows them to survive even with high levels of debt. Next to the fact that these firms lose competitiveness by not investing, their mere existence blocks other market participants from gaining market shares.

The methodology used in this thesis relies on a long-lasting strand in literature that studies the determinants of business fixed investment. This empirical literature dates back to the 1950s (Meyer and Kuh, 1957) and extends to more modern approaches¹. More specifically, the methodological approach of McLean and Zhao (2014) is applied, which employs two sets of tests to analyze the sensitivity of investment to both Tobin's q (Tobin, 1969) and the availability of internally generated cash flows. McLean and Zhao's (2014) propositions are twofold: Firstly, investment becomes more sensitive to lagged values of q during expansions and times of high investor sentiment. Secondly, and at the same time, investment becomes less sensitive to cash flow. External finance costs decrease in expansionary environments,

¹ For surveys of this early literature, see Chirinko (1993), Schiantarelli (1996)

reducing the dependence on internally generated funds. The authors analyze the effect of (time-varying) external finance costs on investment, employment, share- and debt issues by U.S. American firms in the period from 1965 to 2010.

This dissertation applies the methodology employed by McLean and Zhao to European firm-level data. As described earlier, governments and firms across Europe faced liquidity, if not solvency problems during the recent financial crisis. In response, EU governments launched various assistance programs, as the European Stability Mechanism (ESM) and its predecessor the European Financial Stability Facility (EFSF). These facilities have re-established market access for troubled euro area countries, facing a sovereign debt crisis. Investment equations before and after the onset of ESM assistance are compared, using country-specific start dates. Further, different corporate traits known to have an effect on firm financing (size, age, status of incorporation) serve as a means to cluster firms across countries and industries. Also, firms operating in R&D and fixed asset intensive industries are investigated. This perspective originates from the investment definition used in this thesis: Investment encompasses CAPEX and R&D costs. The majority of empirical studies focus on CAPEX only. This may however be a limited perspective in light of the growing importance of knowledge-based industries in industrialized nations. Lastly, euro zone results are compared to those of other European, but non-euro countries, namely Switzerland and Great Britain.

The above-mentioned U.S. findings are partly confirmed for Europe, despite the fact that a union of 18 fundamentally different economies with respect to size, level of industrialization, and corporate culture can never completely compare to a homogeneous currency block as the United States. Still, both economic unions have been hit by the aforementioned financial crisis and have reacted with (partly coordinated) central bank measures.

2. Literature review

2.1. Corporate finance

2.1.1. Financing theories

This section provides an overview of the most important corporate financing theories. Literature focusing on the differences between theoretical and actual firm financial structures will be discussed in the subsequent section.

a) Irrelevance theory

According to Myers (2001), the study of (corporate) capital structure is concerned with analyzing the mix of financial instruments used to fund investment. Modigliani and Miller's (1958) work is often regarded as the founding stone of corporate finance literature and is sometimes referred to as the irrelevance theory. In their work, Modigliani and Miller (1958) derive two propositions: Proposition 1 postulates that firm market value is independent of the capital structure employed and Proposition 2 notes that "the expected yield of a share of stock is equal to the appropriate capitalization rate p_k for a pure equity stream in the class, plus a premium related to financial risk equal to the debt-to-equity ratio times the spread between p_k and r ".

The authors thus argue that a company's market value (V_j) is simply the sum of all shares outstanding (S_j) plus debt (D_j) or, put another way, all future profits (\bar{X}_j ; expected returns) discounted at rate p_k (average cost of capital; i.e. WACC):

$$\text{Proposition 1: } V_j = (S_j + D_j) = \frac{\bar{X}_j}{p_k} \quad (1)$$

The average cost of capital is in turn equal to all future expected returns divided by firm market value. The market value of the firm is assumed to be regulated by the market, so that rate p_k becomes a result rather than a driver of firm valuation, making the actual financing structure irrelevant to firm value:

$$\text{Proposition 2: } \frac{\bar{X}_j}{(S_j + D_j)} = \frac{\bar{X}_j}{V_j} = p_k \quad (2)$$

The two propositions hold only in the presence of perfect market conditions. These conditions assume that the market is perfectly competitive, provides all market participants with the same borrowing costs, consists of agents all possessing the same information, is free of distorting taxes, and rules out the possibility of bankruptcy.

As a response to Modigliani and Miller's theory, researchers have subsequently developed financing models that place great importance on the debt / equity mix employed by managers interested in maximizing firm value. The ultimate goal of all these different financing theories lies in the maximization of firm value; the means by which the maximization is achieved however differs.

b) Trade-off theory

The trade-off theory (Kraus and Litzenberger, 1973) focuses on finding the optimal corporate debt level in which (distress) costs and (tax-) benefits are balanced out. The authors include the tax-deductibility of debt financing costs into their model. The excess use of debt can nevertheless lead to distress costs, namely those associated with bankruptcy, reorganization, and agency conflicts (Myers, 2001). It can be inferred from this theory, that any tax-paying firm will use moderate debt levels in their financing structure.

The above-mentioned agency costs between managers and financiers, as well as debt and equity holders are the focal point of Jensen and Meckling's (1976) agency cost theory. Jensen and Meckling describe how agency costs arise whenever there is a separation of operational control (management) and ownership (equity holders). Management's interest should lie in the maximization of equity holders' value, but in reality may differ (managerial hubris, personal enrichment, etc.). These agency conflicts can be reduced by monitoring and control, i.e. through a board of director's overseeing management's decisions, takeovers from competing firms if the value-decreasing agency conflicts become public, adequate

compensation packages aligning management's and owners' interests, or the use of debt instruments to finance firm operations. The latter means leads to additional monitoring by debt holders, mostly financial institutions like banks.

The use of debt in turn leads to a new strand of agency conflicts, namely the one between debt and equity holders (*agency costs of debt*). Myers (2001) points out, that conflicts between these two parties only arise in situations where firms are threatened by default. This is explained by the super ordinate nature of debt vs. equity in the case of firm default. A firm can default on its debt obligation, making the claims of debt holders worthless, thereby increasing the relative and absolute value of equity holders' shares. Assuming that managers act in the interest of share- rather than debt holders, investment decisions may become riskier in nature. Equity would benefit from highly levered and risky investments without bearing the related financing (default) risk. Also, debt may be raised to start or increase dividend payments, which again favors equity over debt holders. Another problem is the possibility of underinvestment (*debt overhang*): Whenever a profitable (debt-financed) investment is undertaken, existing creditors will profit disproportionately high from this. The value of debt outstanding increases due to the subordinated nature of equity, so that holders of debt benefit first. Holding firm value constant, equity holders' value share shrinks. This may lead management to cut back on investment, despite possessing the necessary financial means and investment options (given that valuable investment opportunities in fact exist!).

The described agency problem between debt and equity holders has risen in importance since the onset of the global financial crisis: Management (acting in the interest of shareholders) may have engaged in window-dressing, avoiding the communication of a negative firm situation to outside investors. In the case of irrevocable operational problems, debt holders would be interested the most in filing for bankruptcy and saving as much of their funds as possible. Shareholders and management would however be more interested in postponing such a procedure, consequently having to write-off (subordinated) equity value.

Jensen (1986) has extended the agency cost theory by introducing the concept of *agency costs of equity*. He describes the agency problems between managers and equity holders, which may be summarized as the urge of management to “waste” excess cash for overly risky or non-value enhancing projects. Jensen refers to the disciplining nature of debt, in that the use of debt forces managers to use liquidity partly to honor debt commitments. The author further introduces *agency costs of free cash flow*, which may either lead to over retention or over investment. The idea behind over investment is easily understood, while over retention is not: Managers may enjoy presiding over high amounts of liquid assets. At the same time, over-liquidity increases the chances of hostile takeovers.

Free cash flow may be a breeding ground for agency problems; at the same time it may alleviate financing problems in times of market turmoil and liquidity pullbacks by financial intermediaries. It can sometimes be the only means to fund investments and keeping the competitive edge.

c) Pecking order theory

The third major financing theory is the pecking order theory introduced by Myers and Majluf (1984). The authors’ main point is neither taxation nor the controlling nature of debt, but the informational aspect of different financing instruments. Managers who possess all inside information want to keep the amount of information transferred to the market to a minimum. It follows that they will prefer internal funds (cash and cash equivalents) to external funds (debt and equity). In the case where external financing is necessary, they will prefer debt over equity instruments. The intuition behind this is as follows: Managers are assumed to be acting in the interest of existing shareholders, thus they will maximize firm, or at least equity value. Whenever a firm issues shares, the share price will drop. Investors know about management’s interest and infer that shares will only be issued if the current stock price is (too) high. A firm will clearly never raise the maximum of capital at a sub-optimal share price. As a

consequence, the market will adjust the share price, and the value of existing equity drops. The signaling or information-revealing risk is lower when debt is used. Managers will try to avoid equity issues as long as possible. The amount of debt used by a firm thus reflects the total external financing need of a corporation.

d) Empirical evidence

The above-described theories have had a great impact on empirical corporate finance research. Up until today, researchers empirically relate the theories described above to observed financing structures and try to develop hypotheses explaining differences and similarities found in actual corporate data. In what follows, a few of those studies will be outlined.

Mayer (1990) compares the financial structures of corporations in eight developed countries (France, Germany, Italy, Finland, UK, USA, Canada, Japan) in the period from 1970 to 1985 and deduces ten observations. These observations will be explained in what follows; the observations' order does however not follow the one presented by Mayer (1990), so as to present an alternative interrelation. *Observation 1* identifies retentions as the dominant financing source in all countries and *Observation 4* finds banks to be the most important external source of financing in all countries. These two observations are in-line with *Observation 7* ("There is a strong inverse relationship between the proportion of expenditure financed from retentions and bank credit"). *Observation 7* can further be differentiated by country: Self-financing ratios observed in different countries vary markedly (*Observation 2*) and bank finance is a dominant source of funding in France, Italy, and Japan, but "surprisingly" small for Germany (*Observation 5*). From *Observation 7* follows *Observation 3*, which states that securities markets are of subordinated importance to corporate funding across all countries. *Observations 6, 8, and 10* are U.K.-focused: The majority of firm investment is funded by retentions (*Observation 6*) and the importance of

securities markets as a source of financing has decreased (*Observation 8*), while “ bank (and short-term) finance accounts for approximately two-thirds of U.K. companies' total debt but more than five-sixth of small companies' total debt” (*Observation 10*). SMEs are more dependent on external finance than large firms, while raising a smaller share of funds in securities markets (*Observation 9*). This, in turn, underlines the importance of a close banking relationship for SMEs.

Taken together, the above findings are not consistent with the irrelevance propositions described by Modigliani and Miller (1958), but lend support to the pecking order theory (internal finance is preferred over external finance) and the agency costs theory (the use of debt and banks as management control mechanisms). Mayer (1990) concludes that control theories serve as a universal explanation for all ten observations, in which banks serve as cost-efficient monitors of firm clients' activities. In the author's view, the observed bank dominance cannot be explained solely by the pecking order theory which focuses on information asymmetries. According to Mayer (1990), these informational deficiencies could also be eliminated by other, non-bank agents.

The empirical research of observed capital structures often revolves around U.S. American firms. Rajan and Zingales (1995) compare these well-documented U.S. firm results to those of other industrialized (G7) countries. Their findings are twofold: First, firm debt levels are very similar across G7 countries. While the countries display similar levels of economic development, their institutional environments (tax and bankruptcy regulations, role of banks vs. bond- and securities markets) differ markedly. The source of firm debt may be different (banks vs. bond markets), but the amount of leverage raised is very similar across firms from these countries. Second, the authors conclude that leverage is indeed determined by the same firm factors (fixed assets / total assets share, market-to-book ratio, size, profitability) across countries.

In contrast, the influence of the just-described institutional differences on firm capital structures and debt maturity choices is confirmed by Fan et al. (2012), using a sample of firms from 39 developed and developing countries. The legal and tax system, corruption level, and capital supplier preferences are important determinants of observed variations in firm leverage and debt maturity composition. Firms incorporated in countries with bankruptcy codes, deposit insurance, and higher tax-advantages use more debt and debt with longer maturities. More corrupt economies are associated with an increased use of short-term debt and low levels of equity. The opposite is true for more legally stable environments. Further, the existence of developed sovereign bond markets reduces the use of bond-financing; these securities seem to crowd each other out. From the supplier side, banks prefer short-term debt, which in turn is a dominant source of finance in countries with a highly developed banking sector. Given deposit insurance, debt maturities increase. The former therefore seems to influence the lending behavior of banks. The authors conclude that the country of incorporation is a greater determinant of firm capital structure than its industry affiliation.

Another important finding regarding firm financial structures is introduced by Lemmon et al. (2008), who find that observed capital structures are stable over a long period of time (1965-2003). The authors state that “the majority of variation in leverage is driven by an unobserved time-invariant effect that generates surprisingly stable capital structures”. According to the authors, debt ratios have both transitory and permanent features. The transitory feature is expressed by the fact that debt ratios tend to converge to moderate debt levels over time (highly indebted firms de-lever and vice versa). At the same time, leverage ratios are stable over time for firms with relatively high or low debt levels. Lemmon et al. (2008) conclude that the observed capital structure variation is mainly shaped by factors of long term persistence.

The findings of Lemmon et al. (2008) are challenged by the work of DeAngelo and Roll (2015), who ask “How stable are corporate capital structures?” The authors start by criticizing

existing research noting that “(...) a consensus has apparently formed around leverage stability as a “fact””. DeAngelo and Roll come to a different conclusion analyzing U.S. firms from 1950-2008. The authors observe frequent and significant increases / reductions in firm leverage. It is argued that “significant firm fixed effects in leverage panels do not establish stability of the cross-section. They only indicate reliable differences across firms in their time-series average leverage ratios calculated overall years in a panel. Such differences do not rule out large changes in the relative leverage positions of firms in cross-sections that prevail at different times.” DeAngelo and Roll (2015) find support for the pecking order theory applied to the funding of certain investment projects.

The aggregate leverage of unregulated U.S. American firms has increased significantly since the end of WWII, as outlined by Graham et al. (2015). According to the authors, this development cannot be explained by changes in firm characteristics, but rather by changes in sovereign debt levels, sentiment, and financial sector importance. Graham et al. (2015) point out that the use of leverage (measured by debt-to-capital) has increased by more than three times from 1945 to 1970 (11% vs. 35%). A negative relationship between government debt and corporate debt leads the authors to the conclusion that corporate debt financing has accelerated due to the reduction of U.S.- government borrowing: Since investors can choose to invest in either government or corporate bonds, a reduction in the amount of treasuries outstanding becomes a competitive advantage for businesses. The second explanation brought forward is the positive relation between corporate financial policy and the output of the financial sector: Financial intermediaries’ monitoring and information gathering abilities may have led to an increased use of debt by corporations. The second explanation seems more plausible than inferring a relation from post-WWII sovereign debt levels to recent corporate financing structures. Both the agency costs theory and the pecking order theory are in-line with the growing importance of bank financing.

Without anticipating the part on macroeconomic literature, the expansive nature of banks and other financial intermediaries is discussed by Cecchetti and Kharroubi (2015). The authors argue that there is a tipping point at which increased financial development impairs economic growth, a trend which can be observed in the data from 15 advanced OECD countries.

Another recent paper sheds light on the choice between debt / equity as well as internal / external finance, and establishes a new relationship to the degree and type of firm investment. While the preference of internal over external funds is fully confirmed (Chay et al. 2015), the superiority of debt over equity finance, as described in Myers and Majluf's pecking order theory, is more "tenuous". Chay et al. (2015) find financing decisions to vary with the degree of firm investment. At low and medium investment levels, equity financing is preferred over debt financing, which stands in contrast to the pecking order's prediction. The authors conclude that financing choices are not primarily driven by factors supporting the pecking order theory. Rather, tax aspects and costs associated with debt service and bankruptcies (supporting the trade-off theory) will also be reflected in financing decisions. Interestingly, the authors find the choice between debt and equity instruments to depend on the type of investment being financed. Organic growth (defined as capital expenditures and R&D investments) is mostly financed by internal funds, while debt instruments are used for M&A activities. A closely related finding is concerned with cash holdings (Chay et al. 2015): Firms that display high levels of investment also tend to hold large cash reserves and save a significant share of cash raised during equity issues.

At the same time, high cash holdings are also associated with the risk of management embezzlement, as described in Jensen and Meckling's (1976) agency cost theory. Officer (2011) finds firms marked by a low Tobin's q / high cash flow combination to react positively to dividend initiation announcements. The author interprets this as being consistent with the agency cost theory (i.e. overinvestment): By paying dividends to shareholders, management is

curtailed in its power to waste ample resources (high cash flow) in a situation of limited investment opportunities (low Tobin's q). The author's result supports the agency costs of free cash flow theory (Jensen, 1986) in which a high amount of free cash flow is associated with the risk of overinvestment. At the same time, Officer's results are also in-line with the cash flow signaling hypothesis, as described by Lang and Litzenberger (1989).

The research described thus far has ignored the possibility of peer firms having an effect on individual firms' financing choices. Leary and Roberts (2014) analyze this connection and infer that individual firms' financing decisions are driven by peer firms' financing decisions rather than peer firms' characteristics. The authors distinguish between exactly these two channels (financing decisions vs. firm characteristics) through which firms influence their peers. Especially smaller and financially constrained firms seem more responsive to changes in financial policies of their – larger and more successful – peers.

2.1.2. Investment theories

This section starts with a description of the most important corporate investment theories and presents related empirical evidence thereafter. The structure of the first part roughly follows the outline found in Chapter 7 of "The Corporation" (Mueller, 2006). It serves as the basis for organizing the vast amount of empirical research presented in the second part, which concludes the section on investment theories.

a) Basic investment decision

The first two concepts (basic investment decision and accelerator theory) are primarily concerned with the decisions to purchase capital equipment. According to Mueller (2006), there are two major aspects with regards to the investments decision, namely 1) the marginal return (expected from the investment) and 2) the costs of capital (necessary to finance the endeavor). The basic investment decision is thus:

$$P * \frac{\partial f(K, L)}{\partial K} = i \quad (3)$$

$P = \text{price of output}$, $K = \text{capital stock}$, $L = \text{labor quantity}$, $i = \text{firm cost of capital}$

The left hand side describes the marginal contribution of a unit of capital to revenue. The numerator is a function of the (marginal) input factors capital and labor. The denominator describes the marginal amount of capital employed. Thus, firm profits are maximized whenever marginal returns (on capital) equal (right hand side) cost of capital (Mueller, 2006).

b) Accelerator theory

The accelerator theory's focus lies within the left hand side of the basic investment decision, namely the marginal return of investment. The basic idea of the accelerator theory is that capital addition can only occur over time, since its purchase and installation do not take place instantaneously. Thus, investment displays the difference between the desired level of capital stock (K_t^D) and the actual stock level (K_{t-1}) presently installed in the firm. The accelerator theory can be formulated as follows:

$$I_t = K_t - K_{t-1} = \alpha(K_t^D - K_{t-1}) \quad (3)$$

$I_t = \text{investment at time } t$, $K_t = \text{capital stock at time } t$, $K_{t-1} = \text{capital stock at time } t - 1$,
 $\alpha = \text{rate of adjustment}$, $K_t^D = \text{desired level of capital at time } t$

Put differently, α measures the accelerator effect, namely the change from and K_{t-1} to K_t^D , which again is equal to investment in a given period.

$$I_t = \alpha b Q_t - \alpha K_{t-1} \quad (4)$$

$I_t = \text{investment at time } t$, $\alpha = \text{rate of adjustment}$, $Q_t = \text{quantity of output at time } t$,
 $b = \frac{K_t^D}{Q_t} = \text{ratio of desired capital } K_t^D \text{ to future output } Q_t$, $K_{t-1} = \text{capital stock at time } t - 1$

Output (Q_t) will be a multiple / fraction (b) of the input factor K_t^D . In other words, if a firm wants to increase output, it needs to increase the necessary capital stock proportionally (i.e. it has to invest so as to reach the desired stock level).

c) Cash flow models

The cash flow model's focus lies within the right hand side of the basic investment decision, namely the cost of capital. Mueller (2006) argues that management is interested in implementing a desired investment flow rather than achieving a certain capital stock. Investment is thus concerned with the difference between the desired and actual investment level. Current investment is the sum of (the dedicated proportion of) cash flow (necessary to reach the desired investment level, i.e. $b_{cash} * F_t$), and lagged investment.

The cash flow theory can be described as follows:

$$I_t - I_{t-1} = \alpha(I_t^D - I_{t-1}) \quad (5)$$

$$I_t = \alpha b_{cash} F_t + (1 - \alpha) I_{t-1} \quad (6)$$

I_t = investment at time t I_{t-1} = investment at time $t - 1$, α = rate of adjustment, I_t^D = desired investment at time t , b_{cash} = proportion of cash flow, F_t = cash flow at time t

When internal resources do not suffice to fund investment, external funds need to be raised. The second underlying assumption thus refers to the costs of external finance being higher than those of internal cash flows. According to Mueller (2006), there are three possible explanations for increased costs of external finance: 1) transaction costs of raising external capital, 2) asymmetric information, and following 3) managerial discretion or agency problems. The transaction costs explanation introduced by Duesenberry (1958) states that actions associated with raising debt or issuing shares will lead to additional costs. It follows that equity is the most expensive form of funding, followed by debt, and then by internal cash flow. The asymmetric information explanation refers to the work of Myers and Majluf (1984), which has been outlined earlier (2.1.1.c). The third explanation, namely managerial discretion (Marris, 1963, 1964, 1998), is concerned with a situation in which "(...) managers wish to expand the growth rate of their company beyond the level which maximizes shareholder wealth, while maintaining the company's share price at a sufficiently high level to avoid

takeover by outsiders (...)" (Mueller, 2006). A company's value of equity is calculated by the product of the average share price and the number of shares outstanding, or by the discounted value of all future dividend payments. If available cash flow is either used for dividend payments or investment, an increase in investment will decrease dividend payments and thus company equity value (c.p.). Management will thus invest up to a level, at which the marginal utility from increasing (growth-generating) investment is in balance with the disutility of increasing the probability of an outside takeover (by lowering the share price).

d) Neoclassical theory

The neoclassical theory resembles the accelerator model in that investment is the difference between desired (K^D) and current capital stock level (K_{t-1}). This follows from substituting K^D by output:

$$K^D = a \frac{P_t Q_t}{i_t} \quad (7)$$

It thus contrasts in that investment becomes a function of firm-specific costs of capital (i_t) and the price (P_t) of its output (Q_t):

$$I_t = \alpha a \frac{P_t Q_t}{i_t} - \alpha K_{t-1} \quad (8)$$

I_t = investment at time t , α = rate of adjustment, a = adjustment cost, P_t = price of output at time t , Q_t = quantity of output at time t , i_t = firm cost of capital at time t , K_{t-1} = capital stock at time $t - 1$

The price of capital services (unit rental of capital, i_t) depends on the costs of capital, the price of investment goods, the tax structure, and the rate of change of the price of investment goods, i.e. inflation. (The neoclassical model version 1 incorporates inflation in i_t , while the neoclassical model version 2 ignores inflation, Jorgenson and Siebert, 1968a).

With perfect foresight, the actual and desired levels of capital would always be in equilibrium. Jorgenson and Siebert (1968b), who are proponents of the neoclassical theory,

relax the “perfect foresight” assumption so that desired and actual levels may differ at time t . Further, as put by the authors, if the desired level of capital is equal to the actual level of capital, then investment is the sum of the change in desired capital and replacement investment.

“For maximization of the market value of the firm subject to the production function and the constraint relating investment to change in capital, the necessary conditions are identical to conditions for maximization of profit before taxes at each point in time” (Jorgenson and Siebert, 1968b):

$$Y = PQ - sL - iK \quad (9)$$

Y = yield / profit before taxes; P = price of output, Q = quantity of output, s = wage costs, L = quantity of labor, i = costs of capital, K = quantity of capital

e) Expectations theories of investment

The just described accelerator and neoclassical theories establish a relationship between I_t and Q_t . Assuming that current investment is undertaken with the aim to increase future output, Mueller (2006) notes that this consideration “(...) led Yehuda Grunfeld (1960) to propose that investment should depend on a variable that captures expected future growth rate in the demand for capital”. Firm market value (which implicitly captures expectations of future growth rates of output), is often represented by Tobin’s q .

Tobin’s q is defined as the ratio between firm market value to firm book value. If the ratio exceeds the value of 1, market participants regard the firm as possessing good investment opportunities. The idea behind this is again rooted in the definition of firm market value: all future cash flows discounted by the applicable cost of capital. If a firm is assumed to be having good investment opportunities, the sum of all future cash flows increases and so will market value.

The q theory of investment resembles the neoclassical theory (see 2.1.2. d), except for the substitution by Tobin's q (q), which measures the desired level of capital stock.

$$I_t = \alpha q K_t - \alpha K_{t-1} \quad (10)$$

$I_t =$ investment at time t , $\alpha =$ rate of adjustment, $q =$ Tobin's q , $K_t =$ capital stock at time t , $K_{t-1} =$ capital stock at time $t - 1$

Chirinko (1993) has categorized the above-described models into two groups – models with implicit and explicit dynamics. Both groups are defined as follows: “Models are included in the latter (explicit) category if dynamic elements appear explicitly in the optimization problem and if the estimated coefficients are linked explicitly to the underlying technology and expectation parameters. The implicit category contains those investment models that do not meet these criteria.” (Chirinko, 1993). The neoclassical model is an example of the implicit category, while the expectations (q -theory) model includes explicit dynamics. Chirinko (1993) establishes benchmark models for both categories, which serve as the basis for discussing differences.

The benchmark implicit model is defined as:

$$K_t^D = f[\text{prices, quantities, shocks}] \quad (11)$$

The desired level of capital stock (K_t^D) is here achieved instantaneously and without considering any dynamics. Dynamics are introduced by the flow of investments (necessary to obtain K_t^D) and are introduced implicitly, meaning that they are not “derived as an implication of a particular hypotheses”. According to Chirinko, there are two types of dynamics: First, those related to “the translation from a stock demand to a flow demand” and second, those concerning the linkage of unobservable expectations to observable variables. The first set of dynamics includes delivery lags, adjustment costs, vintage effects, and replacement investment. The second set tries to incorporate (unobservable) firm expectations to the

investment model through “regressive or extrapolative schemes represented by distributed lags”.

The benchmark explicit empirical model is defined as:

$$I_t^D / K_t^D = (1 - \alpha)(E_t \{\lambda_t\} - p_t^I) + u_t \quad (12)$$

where I_t^D / K_t^D = desired investment / capital stock at time t , α = adjustment factor, E_t = expectations operator at time t , λ_t = discounted sum of the spot marginal revenue products = shadow price of capital at time t , p_t^I = relative price of investment at time t , u_t = error term = technology shock at time t

Models with explicit dynamics thus account for technology and expectations inherent in the investment process. Technology is incorporated through adjustment cost (e.g., lost output during installation of new technology); firm expectations are included as the expected future revenue streams less investment costs.

f) Empirical evidence

The neoclassical theory was first empirically tested and compared to other investment theories by Jorgenson and Siebert (1968a). The authors classify the neoclassical theory as superior to the accelerator, expected profits, and liquidity models (in this order). Each of the four investment theories is applied to the flexible accelerator framework and the underlying firm data set. The theories are then ranked according to residual sizes (with the smallest residual constituting the best result). Jorgenson and Siebert distinguish between two versions of the neoclassical theory - 1 and 2. The only difference lies in the measurement of the costs of equity: version 2 excludes capital gains (i.e. inflation), while version 1 does not. In the same year, the authors published another article where they analyze the implications of including and excluding capital gains (Jorgenson and Siebert, 1968b). They find empirical support for the importance of inflation in the corporate investment process. In another comparison of

investment models, Jorgenson (1971) notes that the financial endowment of a firm needs to be taken into account. In his view, this can either be implemented by incorporating the availability of internal funds or the costs of external finance. Jorgenson (1971) concludes that - consistent with the Modigliani-Miller theory – internal resources (cash flow) are not the driving force behind corporate investment. More recent work on cash flow (McLean and Zhao 2014) and cash holdings (Opler et al. 1999; Harford et al. 2003; Ang and Smedema 2011) clearly contradicts this argumentation (detailed discussion of articles in subsequent sections).

The ranking proposed by Jorgenson and Siebert (1968a) has been criticized shortly after by Elliott (1973), who uses a longer time dimension and includes cross-sectional observations before ranking the aforementioned four models. Elliott is not able to confirm the explanatory superiority of the neoclassical model, but finds the cash flow theory to perform best, followed by the accelerator and the expectations / neoclassical theories.

Chamberlain and Gordon (1989) are also critics of the neoclassical theory. The authors base their argumentation on Jensen and Meckling's (1976) agency cost theory: Under the neoclassical theory, management will invest so as to maximize firm value. Chamberlain and Gordon loosen this assumption by connecting it to the concept of *probability of the corporation's long-run survival* (PLRS) (Gordon, 1983). Under this concept, management will choose financing and investment as to maximize the probability of long-run survival (Chamberlain and Gordon, 1989). At the same time, the company's investment may vary with the amount of internal liquidity at hand and the availability of profitable investment options. This aspect emphasizes one of the main drawbacks of the neoclassical theory – the absence of imperfections such as liquidity constraints, the risk of bankruptcy, and agency problems.

The above-described critique is extended by Hay and Louri (1995). The authors note that previous research treats all future investment decisions as being independent of those taken before. They introduce a model that takes into account an “interdependence of decisions” and management's risk aversion. The authors thus introduce a hierarchy of decisions:

Fundamental decisions - steering the investment and financing future of the firm - will be taken before those with a short-term horizon. Long-term decisions will however also influence the direction of short-term decisions.

Expectations theories of investment have been the basis for in-depth research and discussion. Ciccolo and Fromm (1979) are strong proponents of the q theory and evaluate it as being superior to the neoclassical theory in describing corporate investment behavior. They argue that the financing structure of a firm does in fact influence its market value. Potential financiers will assess both the investment plans of the corporation and the debt / equity ratio when calculating the applicable costs of capital. The authors conclude that real investment and financing decisions need to be seen as working interactively.

In order for the q theory of investment to be an accurate predictor of future investment prospects, market's firm valuation needs to be accurate. As pointed out by Schiantarelli (1996), if investment opportunities are not measured adequately by q , cash flow's significance will be overstated. Cash flow, instead of q , will contain information about future performance. Morck et al. (1990) challenge the content and quality of the information conveyed in stock prices. According to the authors, firm market values are strongly influenced by sentiment and are therefore not solely driven by firm fundamentals. Four different views of the market's role are discussed: 1) the passive informant hypothesis, 2) the active informant hypothesis, 3) the financing hypothesis, and 4) the stock market pressure hypothesis.

The first hypothesis states that management possesses more information than market participants, so that market information is not guiding management's investment decisions. The second hypothesis is the opposite of the first one and predicts managers to rely on information conveyed in market prices when deciding on investment. The third hypothesis is not concerned with the informational content of market prices, but rather with the impact of market participants on financing costs (equity and debt instruments). According to the last hypothesis, the stock market exerts pressure on management: By investing or disinvesting in

company shares, market participants exert pressure on management; thereby influencing the latter's investment decisions. Morck et al. (1990) find slight support for the passive informant and the active informant hypothesis. Overall, however, they conclude that “the stock market is sometimes a faulty predictor of the future, which does not receive much attention and does not influence aggregate investment”. It follows that the value of Tobin's q will also be “faulty” and should not be used as a predictor for investment opportunities.

Asker et al. (2014) identify public firms to be investing less than their private peers and thus to be less responsive to investment opportunities (as predicted by measured q). They attribute this finding to the fact that managers of public firms may be suffering from managerial myopia, a certain type of agency cost that arises between managers and stock holders. Management will shy away from investment that distorts short-term company profitability. According to Asker et al. (2014), it even seems as if firms were not investing despite high q 's; a development that started in the early 2000s.

Gutierrez and Philippon (2016) confirm the just described short-termism, adding industry concentration as a second explanation: Industries with less competition (i.e. more concentration) and more common ownership are associated with using their free cash flow for share buybacks rather than (productive) investments. Although not explicitly pointed out by Asker et al. (2014) and Gutierrez and Philippon (2016) the results are consistent with the stock market pressure hypothesis described by Morck et al. (1990). Managers cater to shareholders by bypassing investment opportunities in favor of sound financial KPIs or by increasing shareholder wealth by “engineering” higher stock prices via buybacks. In either case, shareholders' interests are top priority, trumping growth-enhancing (present) investment.

A third aspect is brought forward by Frank and Shen (2016). The authors analyze the implied negative relationship between corporate investment and cost of capital. Increased cost of capital would reduce the sum of all future cash flows by applying a higher rate of discount.

This would lead to a smaller market value and consequently a reduced q ratio. Their research is only partly consistent with the q theory of investment: If costs of equity are derived using the standard CAPM, higher costs of equity lead to increased investment. When the implied cost of capital (ICC) model is applied, the expected negative relation between costs of equity and investment is derived. ICC proxies the internal rate of return (which is only known to management) from current stock prices and the flow of expected future dividends. The authors conclude that CAPM captures noise effects, while implied ICC does not and caution future researchers to consider these effects in their work. The distorting effect of accounting techniques in comparing different investment hypothesis has also been discussed by Nair (1979).

The cash flow theory of investment has been extensively tested and advanced by Fazzari et al. (FHPBP thereafter, 1988). The authors have tested the asymmetric information hypothesis presented earlier. Their central point is concerned with the ability (or inability) of firms to react instantaneously to changes in capital market prices. FHPBP (1988) underline the importance of financial capacity to fund investments. In accordance with the pecking order theory of financing, they assign special attention to the availability of internal funds, i.e. cash flow. They study differences in financing and investment by forming groups of firms with different characteristics. The authors argue that observed retention practices provide a useful a priori criterion for identifying firms that are likely to face high costs of external finance. If the cost disadvantage of external finance is large, it should have the greatest effect on firms that retain most of their income. If the cost disadvantage is low, then retention practices should not correlate with financing practices, Tobin's q , or investment behavior. They classify firms into three groups. Class 1 firms have a ratio of dividends to income less than 0.1 for at least 10 years. Class 2 firms have a dividend-income ratio between 0.1 and 0.2 for at least 10 years. Class 3 includes all other firms. Analyzing a large panel spanning 1970-1984, they report large estimated cash flow coefficients (0.461) for firms in class 1. The cash

flow coefficient for firms in class 2 is smaller (0.363) and class 3 firms exhibit the smallest cash flow coefficient (0.230). The results suggest that financial effects are generally important for investment in all classes of firms. Moreover, the pattern in the estimated coefficients indicates a substantially higher sensitivity of investment to cash flow and liquidity in firms that retain nearly all of their income (so-called financially constrained firms).

FHPBP's (1988) work on the cash flow theory of investment has sparked an ongoing discussion between the former and Kaplan and Zingales (1995). The latter authors question the correlation between cash flow and investment. In their analysis, Kaplan and Zingales (1995) group firms into categories of financial constraint based on qualitative information collected from annual reports. They find that firms could have increased investment activity substantially, given their internal financial resources. Moreover, less financially constrained firms were found to show higher investment sensitivities than their more financially constrained peers. Their two conclusions are: Firstly, a high cash flow / investment sensitivity is not necessarily a sign of financial constraints and secondly, governmental policies aimed at easing access to credit will not automatically lead to an increase in corporate investment of financially constrained firms. Kaplan and Zingales extended their critique in a subsequent paper (1997). They explain that cash flow may be capturing additional investment opportunities not incorporated in q . Also, FHPBP's results might have been driven by outliers. An interesting concept proposed by Kaplan and Zingales is the question of whether financial constraints can be regarded as being equal to financial distress. If this were to be true, financially distressed firms would show smaller cash flow-investment sensitivities, since they would use all internal resources to meet financial obligations. Kaplan and Zingales find no evidence for this theory in their dataset. Kaplan and Zingales' results are supported by Cleary (1999), who states that less creditworthy firms (i.e. more financially constrained) exhibit lower cash flow-investment sensitivities.

The problems associated with sample splitting based on measures of financial dependence have been discussed by Schiantarelli (1996). He points out three main issues: First, companies tend to be assigned to the constrained / unconstrained group in a fixed manner over the whole sample period. Second, the sample splitting may lead to endogeneity: “Some, if not most, of the criteria used to split the sample are likely to be correlated with both the firm-specific and time-invariant component of the error term”. Third, the splitting is commonly based on one firm characteristic, opposed to a set of characteristics. This may prove to be insufficient to classify a firm as being constrained / unconstrained.

FHPBP’s (1988) results have further been tested and challenged by Alti (2003). The author analyzes the investment / cash flow sensitivities for a benchmark of firms where financing is frictionless. Alti’s (2003) results indicate that “the frictionless benchmark is able to account for the observed magnitudes of the investment-cash flow sensitivity, and the patterns it exhibits”. This sensitivity is also present when Tobin’s q is additionally inserted as an explanatory variable. The highest sensitivities are found for low dividend payout (i.e. financially constrained) / high q (i.e. high investment opportunities) firms. Alti (2003) stresses the noisiness of Tobin’s q as a measure of investment opportunities. q is not only a measure of short-term investment plans, but also of long-term growth opportunities; cash flow may be a better predictor of near-term investment opportunities than Tobin’s for younger, smaller, low dividend payout firms. Financing constraints faced by these types of firms may thus not be the driving force between increased cash flow / investment sensitivities, but the existence of viable investment endeavors proxied by cash flow.

Indirect support for FHPBP (1988) is described by Lang et al. (1995). A negative relation between leverage and growth is found for low- q , but not for high- q firms. The liquidity (cash flow) reducing effect of debt service also leads to impairment in raising external funds in the future. Low q firms may be wrongly judged by the market as not having investment opportunities or might in fact lack growth prospects. In the latter case, debt might exert a

disciplinary effect on management, as proposed by the theory of agency costs. Lang et al. (1995) sum up by declaring that “leverage matters more than operating cash flow.”

Lamont (1997) finds support for FHPBP’s theory and the managerial discretion hypothesis. He uses a unique approach to test internal capital markets of diversified oil companies during the 1980’s oil price decrease. Lamont proves that investment of non-oil subsidiaries falls after the cash shortening in the oil-selling part of the company. The conclusion is thus twofold: Shortened cash resources lead to reduced investment activity and financing decisions of different parts of the same company are interdependent. Not managing free cash flow / cash holdings effectively can therefore lead to significant liquidity risks – despite the agency costs associated with holding too much liquidity. A substantial part of corporate finance literature is dedicated to corporate cash holdings, and will be presented in the following part.

Opler et al. (1999) analyze U.S. cash holdings in the period 1971-1994 and find that smaller firms, firms with viable growth opportunities, and firms with unstable cash flows tend to hold large cash holdings. Further, they find a connection between financing frictions and cash holdings: Financially independent firms (large and / or with good credit ratings) are associated with lower cash reserves. With regards to investment, the authors conclude that “(...) the propensity to use excess cash on investment and acquisitions is quite limited”.

In their 2003 paper Harford et al. identify an investment-supporting effect of cash reserves, especially in the period following a downturn (circumventing the search for external finance). Firms with cash reserves are also associated with positive (sales) performance effects. At the same time, excess cash reserves are associated with increased agency problems in non-downturn periods. In a subsequent study, Harford et al. (2014) describe the effect of shortened debt maturity observed in U.S. corporate cash holdings. Increased cash reserves can help mitigate underinvestment and refinancing risk, which is confirmed by the data analyzed.

Still, firms face a trade-off between these two risks and the agency costs of holding significant cash reserves.

A related question is therefore: do firms (actively) prepare for recessions, if the underinvestment and refinancing risks seem to be common knowledge? Ang and Smedema (2011) test the above questions and conclude that firms do not prepare for recessions. Their empirical results were however influenced by firms that were simply not able to accumulate cash reserves (i.e. financially constrained and cash poor firms).

But, as described in another study by Brown and Petersen (2011), firms that engage in high R&D investment activities seem to prepare. These firms have high adjustment costs with regards to investment and finance their activities mainly by using volatile sources (i.e. cash flow and equity issues). Brown and Petersen (2011) analyze cash management and cash holdings in high R&D firms and confirm “R&D smoothing” by accumulated cash reserves.

Subramaniam et al. (2011) base their analysis on the rationale behind Lamont’s (1997) study, namely the effect of firm diversification on financial structure and add another perspective to firm cash holdings. Diversified firms hold significantly less cash reserves than their focused peers. Subramaniam et al. (2011) attribute this firstly to the complementary growth opportunities present in a diversified firm and secondly to the existence of an internal capital market within the firm. The alternative hypotheses (diversified companies are more likely to generate cash through asset sales and diversified companies are suffering more from agency problems) could not be confirmed by the data analyzed.

The q (expectations) and cash flow theories of investment have been analyzed jointly by McLean and Zhao (2014). During recessions, U.S. investment and employment are found to be less sensitive to Tobin's q and more sensitive to CF (and vice versa). McLean and Zhao’s (2014) theoretical approach is applied to European firms to test the two investment theories both in a euro-context and in light of the recent financial crisis. The authors’ methodology is described in a later part of this thesis.

Concluding the cash flow discussion and referring to Mueller (2006), the effect of cash flow on corporate investment may either be driven by “informational asymmetries and financial constraints facing managers who seek to maximize shareholder wealth” or by “the attractiveness of internal cash flows to managers who maximize their own goals by overinvesting”. Informational asymmetries lead to (external) financial constraints in small, young, and privately held firms, while the threat of management-related agency conflicts is of major importance in larger, older, and publicly held firms. This firm-level distinction will play a major role when empirically analyzing the investment behavior of European firms in Part 5.

2.2. Macro economics

The literature presented thus far focuses on financing and investment decisions at the firm-level. The institutional and macroeconomic environment, influencing both the cost of capital and the set of investment opportunities, only plays an indirect role in this literature. The following part therefore describes how private and public financial institutions influence corporate financing and investment decisions.

2.2.1. Financial institutions

2.2.1.1. Private banks

Diamond (1984) develops a theory of financial intermediation. Financial institutions alleviate agency problems between firms and lenders by monitoring management at relatively low cost. The cost of monitoring is comparatively low due to the diversified nature of financial institutions: “It (an intermediary) has a gross cost advantage in collecting this information (monitoring) because the alternative is either duplication of effort if each lender monitors directly or a free-rider problem, in which case no lender monitors” (Diamond, 1984). The author’s model accounts for two types of diversification: Either diversification by subdividing independent risks (a large number of risk averse bankers are able to observe the

monitoring task of their colleagues) or diversification by adding independent risk of a given scale (one banker monitors an increasing number of loans, whereby diversification is increased as more loans are added). The author also distinguishes between two forms of risk tolerance by a financial intermediary: If the intermediary is risk neutral, diversification within the bank is important since it increases the probability that sufficient proceeds are raised to repay its depositors. If the intermediary is risk averse, diversification helps in increasing the intermediary's risk tolerance.

Close ties between firms and financial intermediaries improve information flows and can thereby reduce corporate refinancing risk. Hoshi et al. (1991) investigate the asymmetric information hypothesis by studying this relationship for two sets of Japanese firms: The first set consists of firms associated to a keiretsu, i.e. an industrial group in which one central institution finances the investments of member firms. The second set consists of independent firms with weaker banking ties. The authors present evidence of a weaker liquidity / investment sensitivity for keiretsu firms, which they attribute to mitigated information problems.

The closest European pendant to a keiretsu financial intermediary is the so-called house bank. The degree of cash flow / investment sensitivities is found to vary between European countries. Mizen and Vermeulen (2005) compare German and UK firms, which differ in their financing behavior. While German firms are known to work with (a single) house bank, UK firms are frequently raising funds in capital markets. UK firms exhibit greater cash flow sensitivities, with firm-level creditworthiness and not variations in financial systems being the main driving force behind the results.

Gugler et al. (2007) compare differences in cash flow/ investment sensitivities between firms in Continental Europe and in Anglo-Saxon countries. The notion behind this comparison lies in the institutional differences between both regions, i.e. publicly listed Anglo-Saxon firms vs. bank dependent Continental European companies. Asymmetric

information, as well as principal-agent conflicts, can cause stock listed firms to differ from their privately held (Continental European) counterparts. These two types of problems appear to be more severe for Continental European firms and firms with weak accounting standards. The same applies to firms that are family controlled. This leads to reduced investment by corporations with the aforementioned features – despite the existence of attractive opportunities. The authors conclude that a reform of the Continental European institutional environment could lead to increased investment activity.

The importance of good domestic financial institutions is stressed by Gennaioli et al. (2009). If institutions are perceived as trustworthy and are consequently able to attract (foreign) financial resources, both private (corporations) and public (government) sectors benefit. The “disciplining” role of financial institutions makes it possible for governments to access international capital markets. This close tie between private financial institutions and governments feeds back during a situation in which domestic government defaults: Domestic banks are often large holders of bonds and suffer substantial losses, which in turn hurts private agents (depositors, private and corporate debtors). Financial institutions are thus intrinsically motivated in disciplining the government.

The role of private banks presented so far has been limited to monitoring, financial intermediation, and supply of credit. Jakab and Kumhof, (2015) attribute a “more active” - and possibly more realistic - role to banks, namely the creation of money. Two models are compared: First, the theoretical and commonly used intermediation of loanable funds (ILF) and second, financing through money creation (FMC). In the first one, banks transform deposit to loans; in the second one, banks actually create deposits / money each time loans are granted. “(...) FMC banks that create purchasing power can technically do so instantaneously and discontinuously, because the process does not involve physical goods, but rather the creation of money through the simultaneous expansion of both sides of banks’ balance sheets”. Jakab and Kumhof (2015) advance this idea by reasoning that banks’ lending

activities are not constrained by central bank liquidity, but only by “profitability and solvency considerations”. This in turn leads to bank lending activities being pro-cyclical, marked by quantity rationing in downturns. The classical deposit multiplier model of banking, which will be detailed in section 2.2.2.1., “does not recognize that modern central banks target interest rates, and are committed to supplying as many reserves (and cash) as banks demand at that rate” (Jakab and Kumhof, 2015).

2.2.1.2. Central banks’ role

Jakab and Kumhof’s (2015) work offers a good transition to explaining the commonly held view on central banks’ role, the means by which central policy is transferred to the real economy and consequently, how money / liquidity / leverage is created.

The ECB officially states its objective as follows: “Our main aim is to maintain price stability, i.e. to safeguard the value of the euro. Price stability is essential for economic growth and job creation – two of the European Union’s objectives – and it represents the most important contribution monetary policy can make in that area.”²

This is exactly the “new” central bank objective described by Jakab and Kumhof (2015). It has also been described by Clarida et al. (1998). The monetary policy of two sets of countries is compared: G3 (Germany, Japan, and the U.S.) vs. E3 (UK, France, and Italy). The first set of central banks (Deutsche Bundesbank, Bank of Japan, and Federal Reserve) is associated with forward looking inflation targeting. Further, the German central bank’s influence on the monetary policies of E3 central banks is stressed, even before the creation of the single European Central Bank system. E3 central banks’ role has “boiled down to fighting inflation by following the Bundesbank” according to Clarida et al. (1998). The means by which the G3 central banks reach their inflation target (called “soft-hearted inflation targeting” by the authors) is described as follows: “In response to a rise in expected inflation

² <https://www.ecb.europa.eu/ecb/tasks/html/index.en.html>

relative to target, each central bank raises nominal rates sufficiently enough to push up real rates”.

Before expanding further on central bank policy, the concept of government-issued treasury bonds and the government’s role in providing liquidity support will be introduced. “Do claims on private assets provide sufficient liquidity for an effective functioning of the productive sector? Or does the state have a role in creating liquidity and regulating it either through adjustments in the stock of government securities or by other means?” summarizes Holmström and Tirole’s (1998) research questions. If there is no aggregate uncertainty, private means suffice to finance firm operations. Corporations are able to raise liquidity (defined as “instruments (...) that can be used to transfer wealth across periods”) either by holding credit lines with financial intermediaries, by issuing debt / equity, or by holding claims on other firms. If, however, there is aggregate uncertainty (as was for example the case during the recent financial crisis), governmental support may be necessary. Holding treasury bonds becomes thus a fourth source of liquidity for firms - a publicly created storage facility of liquidity, which is universally redeemable. This alleviates firms from having to hold cash reserves. Financial intermediaries play only a passive role in Holmström and Tirole’s (1998) model.

2.2.2. Monetary transmission

2.2.2.1. Lending channels: bank vs. broad

In addition to sovereign bonds, market liquidity is also influenced by central bank monetary policy, which is explicitly independent of governmental actions. As described by Clarida et al. (1998), the main central bank instrument is the (short-term) interbank lending rate for interbank loans. Based on the deposit multiplier model, banks create loans from deposits stored in the respective institution. Traditionally, private banks had to further adhere to reserve requirements set by the applicable central bank (the ECB is still holding on to a low

reserve requirement, while e.g. the BoE is not)³. Reserve requirements are however no longer a means to steer bank lending; rather, central banks influence private banks' lending activities by changing the interest rate payable on funds borrowed from the central bank (interbank lending rate).

Deutsche Bundesbank (2017) points out that the above-described money creation process should theoretically only be influenced by central banks' interest rate policy. However, Jakab and Kumhof's (2015) updated view on private banks' active role in the money creation process is supported by the German central bank. Deutsche Bundesbank's (2017) article starts by examining the striking disconnection between the rise in (euro zone) bank reserves and the stable growth rate of the monetary aggregate M3. Commercial banks grant loans and create money independently of excess reserves / deposits at hand, meaning that book money creation functions through "a set of straightforward accounting entries" (Deutsche Bundesbank, 2017). Money and credit follow from transactions between banks and non-banks, without impacting the central bank balance sheet. The amount is limited by bank profitability considerations, funding needs, and demand for credit, as well as capital and liquidity regulations and central bank interest rate policy.

The recent financial crisis made non-standard monetary policy measures necessary, including large asset purchases by the ECB. This has led to a sharp increase in reserves. In case the seller of sovereign bonds is a domestic non-bank, there will be a direct effect on the monetary aggregate. The settlement needs to occur through a domestic bank, and the central bank provides the non-bank seller's bank with reserves in the respective amount of bonds sold. Purchase programs also have an indirect effect on transmission mechanisms (portfolio rebalancing and signaling channels): Interest rates drop and lending conditions become looser.

³ This reserve requirement theoretically leads to a demand for central bank liquidity: Financial institutions are thus not allowed to transfer all of their deposits into loans, but must keep a certain share as reserves, in case depositors want to withdraw funds. To maintain these reserve requirements, banks may need to borrow additional funds in the overnight interbank market, at the cost of the interbank lending rate. The latter is influenced by the interest rate charged by the central bank to private banks.

The demand for loans increases and banks' holdings of debt increase in value as interest rates fall.

The mechanisms of monetary transmission, i.e. the effect of monetary policy on the economy, are still subject to debate. These mechanisms can roughly be divided into three theoretical strands, according to Mishkin (2016): First, traditional interest rate channel, second, other asset price effects, and third, the credit view. The following description of theoretical transmission mechanisms of monetary policy roughly follows the structure found in Mishkin (2016).

The traditional interest rate channel describes the effect of lowered (long-term) real interest rates, which lead to lowered borrowing costs. This in turn leads to higher investment spending and increased aggregate demand. In this definition, investment encompasses both businesses' expenditures as well as consumer durable expenditures (durable goods and housing). The emphasis on real as opposed to nominal interest rates on spending becomes especially important in a situation in which nominal interest rates have been lowered to (the lower bound) zero, as seen during the recent financial crisis. Due to the fact that central banks managed to keep inflation expectations at above zero, real interest rates were actually lowered to sub-zero levels and monetary policy remained to be effective.

Mishkin (2016) lists exchange rate effects on net exports, Tobin's q theory, and wealth effects under the second theoretical strand of monetary transmission, namely effects on other asset prices. The effect of lowered interest rates on exchange rates works as follows: Domestic assets will become less attractive, as the return on investment (e.g. Treasury bonds' coupons) drops. The demand (price) for the respective domestic currency drops and domestic goods become less expensive, leading to a rise in net exports and thus in aggregate demand. Lowered interest rates are further associated with an increase in stock prices: Their returns become relatively more attractive compared to bonds. Companies thus experience a rise in market-to-book-values (Tobin's q). This improves financing and investment conditions and

leads to an increase in aggregate demand. The latter transmission mechanism is a fundamental part of McLean and Zhao's (2014) research, which forms the basis of this dissertation. Wealth effects, the third transmission mechanism related to other asset prices, describes the increase in personal wealth of consumers as stock and house prices appreciate. The improved financial situation will - at least theoretically - lead to increased consumption.

The credit view of monetary transmission can be divided into five effects: the balance sheet channel, the cash flow channel, the unanticipated price level channel, the household liquidity effects channel, and the bank lending channel.

The balance sheet channel works through borrowers' net worth. With reduced interest rates, the demand for stocks increases as described previously. Firms' net worth increases. The risk of moral hazard and adverse selection in lending falls, with collateral available and a lower propensity to engage in risky endeavors. Again, the amount borrowed and used for investments should rise. The cash flow channel is concerned with the improved difference between cash in- and outflows. Due to the fact that nominal interest rates fall as a consequence to expansionary monetary policy, short-term debt becomes less expensive, which reduces cash outflows - firms' liquidity improves. This makes them even more attractive borrowers to banks, which are afraid of moral hazard and adverse selection. A drop in interest rates is usually associated with increased inflation. This may be regarded as an "unanticipated rise in price level", which additionally improves firms' net worth. Households' liquidity will also improve as their wealth (measured by share and real estate assets) increases and the likelihood of financial distress decreases.

The fifth effect namely the credit view channel (bank lending channel), will be discussed in greater detail. As expansionary monetary policy increases the amount of bank reserves and bank deposits, there will be a higher offer of bank loans (bank lending channel). Especially bank-dependent firms (small, private, young) will react to changes in the availability of loans. The bank lending channel can itself be divided into a "money view" and a "credit view".

Bernanke (1988) describes the money view as the traditional perspective. Banks are provided with commercial bank reserves by the Fed which can be seen as the “raw material” to issue new deposits. More technically, the money view is concerned with the liability side of banks (esp. deposits), while the credit view focuses on the asset side of banks (esp. loans).

Figure 1: Outline of a bank balance sheet

Simplified bank balance sheet to illustrate the credit and money view discussed in literature.

Assets	Liabilities
• Loans	• Deposits
• Securities	• Interbank market financing
<i>“credit view”</i>	<i>“money view”</i>

Bernanke and Blinder (1992) discuss both perspectives. In case monetary policy tightens, the amount of deposits on the liability side of banks declines. Households will transform their deposits to interest-bearing instruments, which offer higher yields. The asset side of the balance sheet declines at the same rate and the *composition* of the asset-side changes over time: At first, banks will sell of securities to finance the outflow of deposits. The amount of loans stays stable, since these are long-term contractual commitments that cannot be altered instantaneously. After some time however, the share of loans drops (credit-view) and the share of securities increases proportionally. Banks cut back on lending and start rebuilding their security holdings - the *supply* of credit is falling (i.e. loans). “The microeconomic justification of this so-called credit view is the observation that, under realistic conditions of asymmetric information, loans from financial intermediaries are “special””, as banks “extend credit to customers who find it difficult or impossible to obtain credit in the open market” (Bernanke and Blinder, 1992).

Gertler and Gilchrist (1992) analyze the question of monetary transmission by comparing the response of small vs. large (manufacturing) firms to central bank monetary policy. The idea behind this experiment set up is that small firms 1) usually pay a premium on external

finance and 2) are unable to substitute (bank) financing through capital market financing. The study finds small firms to react significantly more negative (i.e. sales decline) to tight monetary policy (i.e. rising interest rates) than their larger corporate peers. Also, bank lending activities to small firms are declining, while they grow for large firms at the same time. For Gertler and Gilchrist (1992), these findings lend support to the supply-side “credit crunch” faced by small firms whenever Federal Funds rates increase. Their work is thus in support of the credit view.

The credit view (here: “loan supply channel”) is also supported by Kashyap et al. (1992). While Gertler and Gilchrist (1992) use a form of “FHPBP-type” firm financial dependency as a means to discriminate between “money” vs.” credit” view, Kashyap et al. (KSW hereafter) use firm financing. If the money view holds, a change in the Federal Funds rate will apply to both loans and e.g. commercial paper interest rates (securities). If so, banks and firms will treat both instruments as substitutes: Banks will not alter the asset-side composition of loans and securities, and firms will simply increase security issues to compensate for a tightened loan supply (without having to cut back on investment). The evidence based on aggregate data shows that shifts in monetary policy lead to a rebalancing of banks’ asset side and this in turn seems to affect firm investment. Loans and securities are not perfect substitutes and loans can indeed be regarded as “special”.

Oliner and Rudebusch (1995) are not able to replicate these findings, after shifting from aggregate to firm-level data (small vs. large firms). The authors see no special role for loans, but “do not rule out other forms of the credit channel”. Specifically, they argue for a broad credit channel, with monetary policy influencing the price of all types of debt. From analyzing firm-level (Oliner and Rudebusch, 1996a) data they conclude that tightened monetary policy leads to a financing shift from small to large firms. The aggregated data set will in turn show a decrease in loans issued, since only a small proportion of large firms relies on bank financing. In their reply, KSW (1996) remark that small firm results should not be regarded as

contradicting the loan supply channel. The authors argue that large firms partially finance small firms' accounts payable by issuing securities and extending payback periods to their smaller counterparts. Oliner and Rudebusch (1996b) further underline their view by testing the relationship between internal finance and investment. For small firms, a stronger internal funds / investment relationship is found after monetary tightening. This is assessed as evidence for the broad credit channel, as obviously all debt instruments are now too costly for SMEs. Kashyap et al. (1994) use an alternative test to validate their bank lending theory, namely the effect of monetary tightening on inventories of bank-dependent firms. The results indicate that these firms decrease their holdings of inventories by a larger degree than their non-bank dependent counterparts.

Guargilia and Mateut (2010) associate a high degree of global engagement to a significant reduction of liquidity constraints, partly because of the use of trade credit (which is however not a perfect substitute for bank loans). Yet another perspective supports the bank lending channel: By assessing the impact of monetary tightening on lending activities of banks with less liquid balance sheets. Kashyap and Stein (2000) infer that banks with lower securities-to-assets-ratios (i.e. higher shares of loans) react more strongly to changes in monetary policy.

2.2.2.2. Lending channels in Europe

The evidence presented so far has been mainly focused on U.S. firm and bank data. The empirical evidence on monetary transmission in Europe will be presented in what follows. An operative interest rate channel is confirmed for Germany, France, Italy, and Spain by Chatelain et. al. (2001), meaning that investment reacts to changes in costs of capital. A (broad) credit channel is only found for Italy. This type of credit channel is working through its effect on net cash flow (i.e. after interest payments). The definition differs from the credit channel specification discussed earlier. Due to varying levels of bank dependence (high: Italy, low: France) no single European answer emerges. Mojon et al. (2002) confirm the existence

of an interest rate channel. Again, no clear evidence on the existence of a credit channel is found: Smaller firms have to pay a credit premium, but this “SME premium” does not change after a shift in the underlying interest rate. “These findings put doubt on the possibility that accelerator phenomena might play an important role in the transmission mechanism in the largest euro area countries.” (Mojon et al., 2002).

Single country evidence for the UK (Huang, 2003) and Switzerland (Zurlinden, 2005) is in support of the “credit view” of monetary transmission. The “clear” finding of a British and a Swiss bank lending channel could be attributable to the fact that there is a 1:1 relation between a central bank and an economy (Bank of England and Schweizerische Nationalbank). This stands in contrast to the 1:18 relation of the ECB. The euro-zone has started to harmonize the policies of its different central banks under the EMU regime since the early 1990’s (see Clarida et al., 1998). Country-specific differences with regards to states of economy (recession vs. expansion), institutional environments (house bank concept vs. advanced capital markets), and industry / firm structures may not have been explicitly targeted by a “uniform” or at least coordinated euro monetary policy.

2.2.3. Currency unions

2.2.3.1. Euro zone

S.Hämäläinen (former member of the executive board of the ECB) describes the three main reasons behind the euro introduction in her 1999 presentation: 1) a *political argument* with the euro as a means to foster European integration to “reduce the risk of war and crises on the continent”; 2) a *macroeconomic argument* for price stability “to enhance political and economic stability, not only in the euro area, but also in a global context”, and 3) a *microeconomic argument* where a single European currency will “increase cross-border

competition and market integration, thereby improving the efficiency of the markets for goods, services and capital in the participating countries”.⁴

Empirical evidence attributes the introduction of the European currency union to lower interest rates for member countries. Hassan (2013) finds a reduction in the risk-free interest rate and in stock returns in the non-traded sector of euro member countries. The drop in interest rates (and thus perceived riskiness of respective bonds) is associated with the “better hedge against consumption risk”. Since bonds of the euro zone account for a relatively larger share of world wealth than their national predecessors, the country-specific consumption risk component of governmental bonds is diversified away. The “euro bond” becomes more valuable than bonds denominated in the respective 18 single currencies.

Hassan’s (2013) results offer a good explanation of the findings of Bris et al. (2014): By studying firms from 11 euro countries from 1991-2006, a significant increase in debt financing for firms from previously “weak currency” countries is uncovered. The introduction of the euro has thus improved the supply of capital by reducing the costs of external finance for many euro member countries. Especially larger firms and companies dependent on outside financing increased their debt holdings in the latter part of the post-introduction period.

2.3. Background and effects of the financial crisis (2008 – today)

The recent financial crisis casts some doubt on the productive use of increased (European) leverage. The 2008 / 2009 financial crisis has started in the U.S. American real estate sector. Many sub-prime lenders defaulted on their adjustable rate mortgages, which led to fire-sales of houses. At the same time, a securitization of mortgages had taken place: Mortgage-backed securities (MBS) were traded internationally and were held by financial institutions and private investors. The MBS market broke down as soon as it became evident that a large share of mortgage payments would not be honored and that underlying assets significantly dropped

⁴ <https://www.ecb.europa.eu/press/key/date/1999/html/sp990521.en.html>

in value. As a consequence, institutions like Fannie Mae, Freddie Mac, Bear Sterns, Merrill Lynch, and Lehman Brothers faced major liquidity problems, which resulted in the insolvency and bankruptcy of several financial intermediaries.

Due to the global nature of modern finance, MBS were also traded in other parts of the world. Firms like Lehman Brothers became financiers of firms outside the U.S. Countries like Ireland and Spain were further confronted with their own housing bubble: The introduction of the euro led to a significant drop in interest rates for sovereign and private debt. This low-cost leverage was mainly used in the construction and housing sector; simultaneously, private households were offered attractive financing conditions. As described by Cecchetti and Kharroubi (2015), financial institutions were a driving force behind the investment in low-productivity / high-collateral investments in real estate.

The liquidity and solvency of European financial institutions was / is crucial for several reasons: 1) trust in their stability is important for private households and corporations depositing their savings at banks (i.e. bank-runs have to be ruled out), 2) European firms depend on banks when engaging in global trade and financial interactions, 3) European governments are dependent on private financial institutions as holders of sovereign debt and quasi-financiers of government activities. The freezing-up of global financial markets has had severe negative effects on the financing of European countries from the euro-periphery, especially Greece, Spain, Ireland, Portugal, and Cyprus. (Lower grade) government bonds from these countries became quasi-illiquid and private banks, holding these assets, became significantly financially impaired.

Soon after, in 2010, a sovereign debt crisis had emerged and many European private banks had suffered substantially from both the U.S. and European financial turbulences, bringing them to the verge of illiquidity (if not insolvency). As described in a 2010 ECB press

release⁵, several measures to counteract the effects of financial turmoil were initiated. One of these standard monetary measures was lowering the ECB's short-term interest rates through main refinancing operations (MRO) to zero or even sub-zero levels. Another measure involved the (unconventional) set-up of a Securities Market Programme (SMP), including “interventions by the euro system in public and private debt securities markets in the euro area to ensure depth and liquidity in those market segments that are dysfunctional” to “restore an appropriate monetary policy transmission mechanism”. In 2012 Mario Draghi gave his infamous “whatever it takes” speech, announcing the OMT (outright monetary transactions) program, which terminated the SMP. Financial institutions were de-facto alleviated of their “toxic assets” holdings by the ECB (through SMP) and the liquidity of sovereign bond markets was restored. The OMT is aimed at sovereign debt securities traded in secondary markets with times-to-maturity of one to three years. In order to be eligible for the OMT program, countries selling bonds must adhere to the rules and regulations of the European Stability Mechanism (ESM, see next paragraph). So far, no country has used the OMT. Nevertheless, sovereign bond rates have significantly decreased after the announcement of the program, especially for euro-periphery countries. As described by Lenza (2015), yields of Italian and Spanish two-year government bonds decreased significantly post-announcement, while there was no significant effect for French and German bonds.

The ESM has simultaneously been established in 2012. It is a fund created by the euro-member countries and can both extend loans to governments (so far Spain, Ireland, Cyprus, Portugal, Greece) and purchase government bonds through the Secondary Market Support Facility (SMSF). As is the case with the OMT, the SMSF is theoretically eligible to purchase an unlimited amount of government securities. In 2014, the ESM's rights have been extended to directly capitalizing or subsidizing European banks, without the intermediation of the respective government being necessary (Sinn, 2016). Jäger and Grigoriadis (2017) document

⁵ <https://www.ecb.europa.eu/press/pr/date/2010/html/pr100510.en.html>

a “(...) need for additional research on the effectiveness of rescue policies – not just of the ECB, but also of other EU institutions and member states”. They argue that the simultaneous implementation of ECB measures and support packages may have led to negative effects with regards to sovereign debt reduction and fiscal consolidation.

This thesis’ focus lies in evaluating the effect of these rescue policies (i.e. ESM / EFSF), which still necessitate in-depth analysis - despite an ongoing debate about their effectiveness. It is assumed that the fundamental transmission mechanism to the banking sector and the real economy will be the same as with the ECB’s SMP. Both programs engage in bond purchases, with the aim to reduce bond yield spreads, re-establish a functioning bank lending channel, and support governments of crisis countries.

The following section presents empirical work focusing on the effects of the recent financial crisis.

2.3.1. Institutional environment

The ECB (conventionally) lowered MRO during the financial crisis. The aim was to increase bank lending, thereby stimulating economic activity, and thus raising inflation rates in the euro zone. At the same time - despite an overall improved business environment and a revaluated bond portfolio (Schwaab, 2017) - lowered key interest rates have had a negative effect on many banks’ business models. Lucas et al. (2017) find that banks grew larger, held more trading assets, possessed larger derivative portfolios, increased leverage, and were confronted with decreased funding by depositors during the crisis.

Not only did deposits by households and corporations fall, but also those from other financial intermediaries. Nyborg and Österberg (2014) describe tightness in interbank liquidity, which is a consequence of illiquidity in broader financial markets. Central bank liquidity became expensive during the onset of the crisis, leading banks to sell-off financial assets in order to raise additional liquidity. The authors advance the notion of financial

markets possessing the function of a “liquidity storage facility that players can dip into when they need liquidity (in the monetary sense)”. If financial intermediaries need liquidity, they will sell assets which leads to a value reduction. As soon as central banks start infusing liquidity, the value of high-powered money (liquidity) falls and asset prices reverse.

The effectiveness of (unconventional) asset purchases over conventional monetary policy is described by Schabert (2014). Conventional monetary policy is primarily aimed at stabilizing prices. In his model, the author describes how central bank purchases of loans at above-market prices alleviate borrowing constraints: Private agents will sell their loans and refinance at now lower interest rates, using the proceeds to extend lending activities to private borrowers. This mechanism allows central banks to directly stimulate lending, while rationing the access to money (i.e. the price and the amount of it).

Related research by Eser and Schwaab (2016) analyzes the effects of the above-described ECB’s Securities Market Programme in five sovereign bond markets (Spain, Greece, Portugal, Ireland, Italy). As stressed by the authors, the SMP’s main objective is the restoration of monetary policy transmission mechanisms through outright secondary market purchases. This stands in contrast to “normal” quantitative easing (QE), which is aimed at making “the monetary policy stance more accommodative once the main policy interest rate has reached its lower bound”. Further, SMP differs from other asset purchase programs in three dimensions: 1. SMP was implemented during a sovereign debt crisis; 2. the exact workings of the program were only disclosed after actions had been taken (e.g. amount of assets purchased); 3. the program’s introduction and the connected signaling (i.e. country yields higher than justified) have led to controversy in the Eurosystem (Eser and Schwaab, 2016). The authors confirm a reduction of 5-year bond rates, through reduced default-risk premia, default risk signaling effects, and supply effects in certain markets. Eser and Schwab (2016) acknowledge that “it cannot be argued that the introduction of the SMP was sufficient to end the euro area sovereign debt crisis”.

Nikolov and Popov (2014) describe the reinforcement of sovereign debt and banking fragility: When banks' holdings of government bonds devalue significantly, governments themselves may be forced to issue bailout guarantees to banks – which leads to another increase in interest rates and a further devaluation of bond holdings. Acharya and Mora (2015) describe how banks could only honor their firm credit lines through governmental support (U.S. government increasing insurance limits from 100k\$ to 250k\$). Due to the overall insecurity during the financial crisis, banks faced a decline in deposits which translated into a reduction in new credit issued. Similar public guarantees were granted in the euro zone.

As described by Leonello (2017), this guarantee may negatively feedback on the government announcing deposit insurance or bailout promises, as was the case in Ireland. In order for public intervention to have the desired effect, its advantages must outweigh its disadvantages. According to Leonello (2017) guarantees are beneficial “when an increase in the size of the guarantees leads to such a significant reduction in the probability of a banking crisis that, despite the increased disbursement for the government, the probability of a sovereign default also drops”.

Despite the adverse effect of government interventions, banks have chosen to increase their holdings of government bonds, due to moral hazard: “Banks make large profits if a fiscal crisis is averted and count on leaving losses to the state when it is not” (Nikolov and Popov, 2014). This has led to a wakened recovery in lending activities by European banks. Financial institutions, which are traditionally large holders of sovereign debt, were thus also beneficiaries of the SMP: Their balance sheets had been hit by the devaluation and illiquidity of lower-grade treasuries - especially those banks from the southern periphery of the European Union. The lowering of treasury spreads led to an “automatic” increase in government bonds' value and should have had a positive effect on lending activities.

Albeit drastic macroeconomic measures, European investment activity has not evolved quite as envisioned. Especially when compared to the post-crisis U.S. American development, euro area investment appears low. Vermeulen (2016) attributes this to slow aggregate consumption rather than uncertainty and the availability of credit. The euro area has been hit by a sovereign debt crisis right after the global financial crisis (“double-dip recession” Jarocinski and Mackowiak, 2017); also, U.S. construction has picked up quickly after the crisis’ peak, whereas European construction has not. Vermeulen (2016) concludes by stating “policymakers would be misguided to focus on investment exclusively. Instead, policies should aim for a broader recovery of aggregate demand and consumption in particular”.

Another dimension to monetary and fiscal policy in the single-currency euro zone is added by Jarocinski and Mackowiak (2017). Self-fulfilling expectations impact output, inflation, and government bond spreads, where “pessimistic expectations can lead to bad outcomes”. Pessimistic agents will lead government bond spreads to increase which can result in debt restructuring or even default: “In an economy with its own fiat currency, the monetary authority and the fiscal authority can ensure that public debt denominated in the national fiat currency is non-defaultable (...)”. Since this is no longer possible under the single-currency regime, the authors propose “a common euro area, non-defaultable debt instrument”. This “euro bond” could however result in moral hazard problems, including increased risk-taking by certain governments, taking advantage of the common European debt instrument.

2.3.2. Bank lending channels during the crisis

Darracq Paries et al. (2014) describe the heterogeneous transmission mechanisms (from reduced policy- to reduced bank lending rates) in the euro zone. Results for all four countries analyzed (Germany, France, Italy, and Spain) show a reduction in bank lending rates, with Spanish and Italian rates being adjusted upward due to sovereign debt risks and a depressed macroeconomic environment. The impact of frictions in the banking sector on corporate

financing and investment is investigated by Vermeulen (2012). The author describes a reduction of credit supply during the financial crisis, with firms mainly depending on bank credit exhibiting the largest reduction in investment. Vermeulen further detects asymmetric effects between northern (Belgium, Germany, France) and southern (Spain, Italy, Portugal) country results, which he attributes to a higher degree of bank dependence in the south.

In a closely related study, Ciccarelli and Maddaloni (2013) dissect the credit channel into the bank lending channel and the borrower's balance sheet channel. The authors state that the ECB's unconventional monetary liquidity provisions have de-facto neutralized the bank lending channel by "effectively substituting the interbank market". The borrower channel however remained constrained, with firm balance sheets not meeting collateral requirements – especially those of SMEs from countries in the euro-periphery.

The importance of close firm / bank ties during times of financial turmoil is demonstrated by Rosenfeld (2014). His analysis attributes firms that receive (relationship-backed) bank financing shortly before facing distress as more probable to overcoming this situation. Rosenfeld associates this to reduced information asymmetries and the fact that "when a firm maintains its viability, its creditors remain whole". Jimenez et al. (2014) analyze a unique dataset consisting of information on Spanish bank loan applications. Interestingly, a lower overnight interest rate is associated with an increase in loan granting by lowly capitalized banks to risky firms. An increase in bank-risk taking and the composition of credit committed leads to the following conclusion: expansionary monetary policy may be attributed to risk-shifting and moral hazard problems. This finding is in-line with Blattner et al. (2018). From Portuguese bank data, the authors infer that loans were primarily granted to firms facing an increased insolvency risk, thereby circumventing the inherent default risk on (bank) debt. At the same time, firms possessing viable investment opportunities are crowded out in their efforts to raise bank financing.

Unconventional monetary policy in a globalized world can also lead to effects in regions outside a central bank's scope of action. Gräb and Zochowski (2017) describe the international bank lending channel of unconventional monetary policy, in which Euro banks are associated with increased lending activities to the rest of the world as a response to ECB expansionary monetary policy. The same holds for European lending activities with respect to Fed policy adjustments. Liquidity constrained euro banks react stronger to international spillovers, as described by Gräb and Zochowski (2017): "(...) bank-specific supply effects, stemming from banks' increased ability to lend following a central bank balance sheet expansion, are a major driver of monetary policy spillovers (...)".

2.3.3. Firm financing, cash reserves, and investment

According to Kothari et al. (2014), there seems "little evidence that unusual conditions in the credit markets led to a large drop in investment over and above what would be expected given changes in the real economy (...)". This view is rather unusual given the vast amount of research studying financing frictions and subsequent investment declines. Almeida et al. (2009) attribute refinancing problems (especially for firms with debt maturing in late 2007) to investment reductions. As described by the authors, investment decisions in non-crisis times are independent of debt maturity composition. Campello et al. (2009) survey more than 1000 international CFOs to assess the level of credit constraints and the consequent reductions in investment. CFOs from credit constrained firms reduce investment activities (tech spending, employment, and capital spending). Further, cash reserves are used, lines of credit drawn "just in case", and assets sold. Also, investment opportunities are cut or postponed. As pointed out by Acharya and Mora (2015), US American credit lines could only be held up by banks though related government aid. In the case of Lehman Brothers, there was no governmental intervention to save the bank from insolvency. According to May (2014), firms that lost access to Lehman Brothers credit lines cut back on investment and built up cash reserves.

A non-linear relationship between leverage and investment is confirmed for five countries from the euro area periphery (Gebauer et al., 2017). Based on firm data from Italy, Spain, Greece, Portugal, and Slovenia, a debt-to-asset ratio beyond >80-85% is shown to be investment-decreasing. This threshold is associated with an increase in financial constraints. Further, the non-linearity threshold for crisis times seems to be even lower: “(...), during the financial crisis period even low debt seems to constitute a drag on investment (...)”. The investment activity of firms from nearly the same set of countries (Greece, Italy, Ireland, Spain, Portugal; GIIPS hereafter) is analyzed by Acharya et al. (2015). The results can be summarized as follows: The OMT program initiated by the ECB has a value-enhancing effect on bank balance sheets (GIIPS sovereign debt yields decrease, which leads to an increase of sovereign debt holdings by banks). As a result, banks increase their loan supply to private borrowers; the latter, however, use the funds to build up cash reserves with “no impact on real economic activity like employment or investment”.

Related research by Campello et al. (2010) analyzes corporate liquidity management during the recent financial crisis. A number of interesting findings are made: 1) credit constrained firms (small, private etc.) hold larger credit lines than their non-constrained peers; 2) it is significantly more expensive to access new credit lines during a crisis; 3) lines of credit are used less in firms with sufficient internal liquidity; 4) firms with cash reserves “boost” their investment by additionally drawing on lines of credit. The authors conclude “that lines of credit provide the liquidity “edge” firms need to invest during the crisis”. The importance of internal resources is supported by Bliss et al (2015). Firms decreased corporate payouts (dividends, share buy-backs) in 2008 / 09 to increase cash holdings and keep investment levels stable. Harford et al. (2003) stress the importance of cash reserves during industry downturns (even before the global financial crisis), underlining the investment-boosting effect. 10 years later, Harford et al. (2014) find a shortened debt maturity in the US for the period of 1980-2008. Cash can therefore be seen as a means to mitigate refinancing risk,

thereby supporting overall investment activities. The importance of precautionary saving during crisis times is further described by Sun and Wang (2015).

Financing frictions will not only influence the level of investment, but also its type. Firms prefer less risky investments with shorter payback periods and pledgeable underlying assets (Almeida et al. 2011). Firms use these pledgeable assets as collateral for new debt. Reduced asset values will thus negatively impact firm investment through the “collateral channel” (Chaney et al. 2010). The above-described real estate bubble in the US and in parts of Europe has therefore affected corporate financing through reducing the amount of collateral available.

Summarizing, the financial crisis that started in 2008 offers a variety of theoretical strands for future research. At the same time it clearly demonstrates the shortcomings of existing econometric models and forecasting tools. The origin, timing, and magnitude of this financial crisis came probably as a surprise to most researchers and practitioners. It should be added however, that central bank and government interventions reached an unprecedented dimension that would have been impossible to forecast.

3. Hypothesis development

McLean and Zhao (2014) base their work on previous research that assumes a relationship between business cycles / investor sentiment and cost of external finance. The authors analyze investment- and employment hampering financial constraints that might be driven by low investor sentiment and recessions. Based on this, the McLean and Zhao (2014) derive the following two hypotheses with regards to q (sales growth) and cash flow sensitivities:

Hypothesis 1: *When investor sentiment is low, investment will become more sensitive to cash flow & less sensitive to Tobin's q (and vice versa)*

Hypothesis 2: *When the economy is in recession, investment will become more sensitive to cash flow & less sensitive to Tobin's q (and vice versa)*

McLean and Zhao (2014) test these two hypotheses for US American firms. Therefore, it is interesting to test whether European firms will behave just like their US peers when it comes to cash flow / q – investment sensitivities.

Financially dependent firms may exhibit more pronounced effects to low investor sentiment / financial turmoil, as discussed by e.g. FHPBP (1988). McLean and Zhao (2014) develop the following logic to categorize firms as financially dependent (“FD”): “(...) a binary variable equal to one if in the previous year the firm did not pay a dividend, does not have an S&P credit rating or has an S&P credit rating below BBB–, and had sales that were not in the top quintile for that year among ample firms; if any of these three items is not true, the firm receives a value of zero.” The work of Mulier et al. (2016) lends additional support to an increased cash-flow / investment sensitivity for financially dependent firms. The authors develop an index that measures the level of financial constraint faced by unquoted, European SMEs. These firms are classified as financially constrained based on information asymmetries (age, size), debt repayment capacity (cash flow), and solvency considerations (debt ratio). The results indicate that the most financially constrained firms pay the highest interest rate on debt

and display the highest cash-flow / investment sensitivity. The sensitivity is driven by credit constraints and not by differences in loan demand or investment opportunities.

Due to the low market capitalization of European firms also described by Mulier et al. (2016), the financial dependence dummy definition does not incorporate official credit ratings, as seen in McLean and Zhao (2014). Instead, the alternative FD dummy includes certain firm traits described by FHPBP (1988) and Gebauer et al. (2017). By dividing the firm data sample by size (small / large firms as measured by total assets), age (old / young as measured by date of incorporation), type of incorporation (public / private as derived by the existence of shares / debt traded), and ex-ante indebtedness (low / high level of indebtedness as measured by the debt / asset ratio) various dummies of financial dependence are derived. The underlying hypothesis assumes that financially constrained firms will experience difficulties in raising external finance, leading to an increased propensity to cut back on investment.

Hypothesis 3: *Financially dependent firms will be more sensitive to cash flow and less sensitive to Tobin's q than their unconstrained peers.*

A similar logic applies to firms that operate in industries where frequent investments in either R&D or fixed assets are necessary to keep the competitive edge (e.g. pharmaceuticals, automotive). Based on previous work underlining the importance of internal cash management to stabilize R&D activities in times of increased financing frictions (Ang and Smedema, 2011; Brown and Petersen, 2011), such firms may display lower cash flow / investment sensitivities. On the other side, in times of economic and financial turmoil, cash reserves might be used for debt service (financial constraints = financial distress; Kaplan and Zingales, 1997; Lang et. al., 1995). External finance may be additionally hard to raise, since banks prefer safe-outcome, steady-income, and asset-backed loans (Cecchetti and Kharroubi, 2015). This is not the case for R&D-, while it holds for fixed asset investments.

Hypothesis 4a: *Firms from industries that rely on fixed assets investment will become more sensitive to cash flow and less sensitive to Tobin's q .*

Hypothesis 4b: *For R&D-intensive firms, results may be less pronounced with respect to cash flow, given that investment-smoothing cash reserves exist.*

The last hypothesis is linked to the numerous European programs aimed at improving either bank or government liquidity. Cash flow / q – investment sensitivities of firms from countries that received direct financial governmental support from ESM (i.e. Ireland, Spain, Greece, Portugal, Cyprus) are therefore analyzed. Based on these programs and assuming an efficient interest rate channel in recipient countries, firm investment is expected to react less strongly to the availability of internal funds (cash flow) as compared to investment opportunities (q) after the implementation of ESM programs:

Hypothesis 5: *Firms incorporated in euro zone countries that received aid through the European Stability Mechanism will become less sensitive to cash flow and more sensitive to Tobin's q .*

Based on Gebauer et al. (2017), it could also be argued that cash flow sensitivities continue to prevail (or become even stronger) after the start of financial assistance programs. According to the authors, an investment-hampering effect of debt is observed in certain Euro-periphery countries. Both the absolute debt level and the relative amount of debt service (measured in terms of EBITDA) play a role. Investment may thus become excessively dependent on the availability of cash flow. “Overall, these results suggest still substantial deleveraging needs in peripheral countries to support a stronger investment recovery.” (Gebauer et al., 2017). Further, transmission mechanisms might not have worked as envisioned, with no proven monetary transmission channel with regards to investment having been detected in the past (Chatelain et al. 2001, Mojon et al., 2002).

Hypothesis 6: *Financially dependent firms financing their operations primarily in euro will be more sensitive to cash flow and less sensitive to Tobin's q compared to their European peers not operating in euro.*

This hypothesis is concerned with the investment sensitivity of European firms that do not operate primarily in euro, namely British and Swiss firms. It is assumed that firm investment in these countries will be less sensitive to the availability of internal funds, based on the following notions: First, Great Britain and Switzerland were not confronted with a sovereign debt crisis, depressing the overall economic environment, as was the euro zone. Of course, the global financial crisis has also affected Switzerland and Great Britain, especially their banking industries. These countries were however not confronted with the threat of government insolvency and illiquid sovereign bond markets. Second, the Bank of England (BoE) and the Schweizerische Nationalbank (SNB) have to accommodate to only one economy or at least a union of very similar economies as opposed to the euro zone. British Pound and Swiss Franc have been severely affected by the global financial crisis. Especially the Swiss “safe haven currency” has appreciated immensely (against the euro), which was counteracted by unprecedented SNB intervention. The ECB, in contrast, had to define a policy (interest rate regime, OMT program etc.) that accommodates to all 18 euro economies. Compared to euro-firms, Swiss and British will be less dependent on internal resources, due to a “less complex” economic and financial environment.

4. Sample, variables, and summary statistics

4.1. Sample and firm-level variables

Sample

The sample includes annual firm-level data from the Bureau van Dijk (BvD) AMADEUS database, which cover the period from 1993 to 2016. The sample includes all large and medium sized firms excluding utilities and financial intermediaries (based on US SIC codes 490 to 499 and 600-653). The only exception from the exclusion of financial intermediaries is “financial holdings”, as many European non-financial corporations are organized as holding companies. The analysis is based on firm-level information from the 18 euro zone countries, Great Britain, and Switzerland. Thereby, it is possible to compare investment patterns of firms operating in three currencies of distinct importance. Further, BoE and SNB activities are targeted at one quite homogeneous economy respectively, while ECB policy is aimed at 18 different economies. This difference may have an effect on business environments and investment activities.

Firm level variables

The following firm level variables are used in the regressions:

Table 1: Amadeus variable abbreviations and corresponding description

Variable name as in the Amadeus database	Description
toas	Total assets
fias	Fixed assets
rd	Research & development expense
empl	Number of employees
culi	Current liabilities
ocli	Other current liabilities
ncli	Non-current liabilities
ltdb	Long-term debt
loan	Loans
enva	Enterprise value
depr	Depreciation
pl	Profit / loss
cash	Cash
turn	Turnover
astk market cap	Market capitalization based on ask price

The following general adjustments are made to the variables: First, all variables are converted to euro for the years before the introduction of the single European currency in 2002, using the conversion rates provided by BvD in the AMADEUS database. Second, all variables displaying a value of 0 are changed to no information (“.”). This adjustment applies to all firm-level variables except number of employees. Not adjusting firm level data in the described manner may lead to skewed variable values. Third, no negative variable values are accepted except for research & development, employment growth, and profit / loss. Fourth, book value (BV) of equity is introduced, using the following equation:

$$BV \text{ of Equity} = [Total \text{ Assets} - Current \text{ Liabilities} - Non \text{ Current Liabilities}]$$

Based on this new variable, only observations larger than 10m€ remain in the data set. This threshold compares to McLean and Zhao’s adjustment to the US sample. Lastly, only unconsolidated data enter the firm-level set. One firm may be reported as unconsolidated, consolidated, limited financial info etc. in the AMADEUS database. The unconsolidated form represents the closest version of a company’s true operating result.

Variables: Definitions and adjustments (investment, cash flow, and q)

Investment, the most important dependent variable, is defined according to McLean and Zhao (2014). Investment thus represents the growth in total assets plus R&D expenditures, scaled by total assets. Again, only positive values enter the final data set, as disinvestments are ignored:

$$Investment = \frac{[(Total \text{ Assets}_t - Total \text{ Assets}_{t-1}) + R\&D_t]}{[Total \text{ Assets}_t]}$$

An alternative investment definition uses fixed assets instead of total assets. As with the original investment definition, only positive values are kept.

$$Investment \text{ (alternative)} = \frac{[(Fixed \text{ Assets}_t - Fixed \text{ Assets}_{t-1}) + R\&D_t]}{[Fixed \text{ Assets}_t]}$$

Cash Flow - together with Tobin's q the key independent variable – compares to the definition of McLean and Zhao (2014). Cash Flow scales the sum of profit / loss and depreciation by total assets:

$$Cash\ Flow = \frac{[Profit_t + Depreciation_t]}{[Total\ Assets_{t-1}]}$$

Proxy for Tobin's q : The second main component of McLean and Zhao's (2014) regression framework is Tobin's q , defined as market value divided by book value. This variable is generally used to measure the market's expectations about a company's future operating performance. However, since most European companies are not listed on one of the numerous national stock exchanges, q cannot be computed for these unlisted firms. Therefore, actual ex-post sales growth is used as an ex-ante q proxy.

$$Sales_Growth_1 = \frac{[Turnover_t - Turnover_{t-1}]}{[Turnover_{t-1}]}$$

Investment, cash flow and sales growth variables are winsorized at the 1st and 99th percentile levels.

Market data

Market data stem from the AMADEUS database, using the ask price market capitalization variable. Market and firm level information are matched by company id number and year of observation. Subsequently, market capitalization values are converted to euro for the years prior to 2002. As with firm-level data, "0" values are set equal to missing ".".

4.2. Measuring economic conditions and investor sentiment

McLean and Zhao (2014) find a relationship between firm investment and economic conditions. Namely, they find that "(...) investment sensitivity to q increases with both economic conditions and investor sentiment, and that investment sensitivity to cash flow declines with both economic conditions and investor sentiment." The authors use two measures of economic conditions and investor sentiment, respectively. Economic conditions

are proxied by an expansion dummy and (increasing) industrial production dummy; investor sentiment is measured by the Baker and Wurgler (2006) sentiment index and the University of Michigan consumer sentiment index.

BIP expansion / recession

In contrast to the above measures, which apply uniformly to the United States as a whole, there is no such economic measure for the euro zone. Further, it is very unlikely that the fundamentally different economic conditions of euro zone member countries (industry composition, business cycle, level of economic development etc.) will be fully reflected in only one yearly euro zone expansion / recession measure. Thus, 18 country-individual yearly BIP expansion / recession measures are constructed. Using quarterly information from Eurostat, a country is defined as being in recession if the average growth of the four quarters amounts to less than 0% ($BIP_{ExpansionRecession} = 0$). In the opposite case, the country classification is “expansionary”.

Productivity growth

As with the measure of expansion / recession there is no uniform productivity growth measure for the euro zone. Information on productivity growth stems from Eurostat and is transformed as to generate yearly growth rates for each country analyzed in the regression framework. In contrast to the expansion / recession dummy (1 / 0), there is no defined cut-off value for building a “growth / no growth” (1 / 0) dummy. Rather, the absolute growth rate (normalized at 1.0) is used in the regressions.

Investor sentiment

The European Sentiment Indicator (ESI), published by Eurostat, has a mean value of 100, and is: “(...) the weighted average (of the industrial confidence indicator (40%), the services confidence indicator (30%), the consumer confidence indicator (20%), the construction confidence indicator (5%) and the retail trade confidence indicator (5%)). Data are seasonally

adjusted.”⁶. This index exists both jointly for the euro zone (different definitions available) and individually for all of its member countries. The ESI starts in January 1985, but includes only a number of European countries from this early on (Spain, Germany etc.). A single-country yearly average value based on monthly ESI figures is derived. (Country-individual) interaction terms consisting of the expansion / recession, productivity growth, and ESI measures and the sales growth and cash flow variables are thus constructed.

⁶ https://ec.europa.eu/info/sites/info/files/ki_13092017.pdf

Summary statistics

Table 2: Summary statistics of firm variables and measures of economic conditions and investor sentiment

This table reports the summary statistics (number of observations, mean value, variance, standard deviation) for the dependent variable (investment scaled) and the independent variables (cash flow scaled by total assets and sales growth). Further, firm variables used to dissect the sample by measures of financial dependence and measures of economic conditions and investor sentiment). All variables in absolute euro values if not stated otherwise.

Description	Variable	Number of Observations	Mean	Variance	Standard Deviation
Dependent variable	Investment / Total assets (%)	602100	.1717738	.0817829	.2859771
	Total assets	1220273	2.55e+08	6.54e+18	2.56e+09
	Research & Development	1296335	542711.5	1.11e+15	3.33e+07
Independent variables	Cash Flow scaled by total assets (%)	789285	.0723948	.007972	.0892862
	Depreciation	974702	6856691	1.37e+16	1.17e+08
	Profit / loss	1090163	8219922	2.52e+16	1.59e+08
	Sales growth (%)	778662	.133222	2.881432	1.697478
	Turnover	958708	1.75e+08	3.14e+18	1.77e+09
Sample splitting ratios	Debt ratio (%)	1069596	.5978316	.0670994	.2590355
	Current liabilities	1185182	7.58e+07	9.99e+17	9.99e+08
	Non-current liabilities	1100032	7.76e+07	3.94e+18	1.98e+09
	FARatio (%)	1205835	.461748	.1003622	.3167999
	Fixed Assets	1205847	1.64e+08	2.94e+18	1.72e+09
	R&D ratio (%)	5113	.0640574	.0084154	.0917355
Other firm variables	Market capitalization (ask price)	24763	1.79e+09	5.85e+19	7.65e+09
	Other current liabilities	1091625	3.96e+07	3.80e+17	6.17e+08
	Non-current liabilities	1100032	7.76e+07	3.94e+18	1.98e+09
	Long-term debt	733542	7.41e+07	7.54e+17	8.69e+08
	Loans	714140	3.72e+07	6.58e+19	8.11e+09
	Cash	1171478	1.65e+07	1.27e+17	3.56e+08
	Fixed assets	1205847	1.64e+08	2.94e+18	1.72e+09
	Employment	973847	570.0694	3.32e+07	5758.736
Economic conditions & investor sentiment	Expansion / recession	1041241	.7808106	.1711456	.4136974
	Productivity growth	1041229	1.018877	.0015071	.0388216
	European sentiment index	1025461	97.70987	72.48844	8.514015

5. Regression framework, hypotheses, and results

5.1. General regression framework

The focus of the following section lies in the regression framework with investment (scaled by lagged total assets) as the dependent variable $\frac{I_{i,t}}{A_{i,t-1}}$.

The first step encompasses the following regression framework, which is estimated each year for the cross section of all firms (i) in the sample:

$$\frac{I_{i,t}}{A_{i,t-1}} = \beta_1 q_{i,t-1} + \beta_2 \frac{CF_{i,t}}{A_{i,t-1}} + \varepsilon_{i,t} \quad (13)$$

$I_{i,t}$ = investment, $A_{i,t-1}$ = total assets, $q_{i,t-1}$ = Tobin's q , $CF_{i,t}$ = cash flow

Were, as rationalized before, the original formula is adjusted by introducing sales growth as the Tobin's q proxy:

$$\frac{I_{i,t}}{A_{i,t-1}} = \beta_1 \frac{Turn_{i,t} - Turn_{i,t-1}}{Turn_{i,t-1}} + \beta_2 \frac{CF_{i,t}}{A_{i,t-1}} + \varepsilon_{i,t} \quad (14)$$

$I_{i,t}$ = investment, $A_{i,t-1}$ = total assets, $Turn_{i,t-1}$ = turnover in previous year, $Turn_{i,t}$ = turnover in current year, $CF_{i,t}$ = cash flow, $\varepsilon_{i,t}$ = error term

The resulting time series of coefficients (β_1 and β_2) is then regressed on the corresponding business cycle and investor sentiment measures for each year. This is done to obtain the marginal impacts of business cycle (E_t) and investor sentiment (S_t) on the q and cash flow coefficients.

$$\beta_{1,t} = \alpha + \beta_3 E_t + \beta_5 S_t + \varepsilon_t \quad (15)$$

$$\beta_{2,t} = \alpha + \beta_4 E_t + \beta_6 S_t + \varepsilon_t \quad (16)$$

Generally speaking, the main advantage of analyzing panel data is that it is possible to "remove the impact of certain forms of omitted variables bias on regression results" (Brooks, 2008). Two important panel data regression models are the fixed effects (FE) and the random effects (RE) model: "(...) the key consideration in choosing between a random effects and a

fixed effects approach is whether c_i and $x_{i,t}$ are correlated” (Wooldridge, 2002). The FE model allows for the unobserved heterogeneity (c_i) and the independent variable ($x_{i,t}$) to be correlated, while the RE model puts the c_i into the error term.

To understand both the RE and FE model, a basic unobserved effects model is described first. The definitions of the UE, RE, and FE models follow Wooldridge (2002).

1. The basic unobserved effects model (UE) is defined as:

$$y_{i,t} = x_{i,t}\beta + c_i + u_{i,t} \quad t = 1,2,\dots,T \quad (17)$$

2. The random effects model for all T periods is defined as:

$$y_i = X_i\beta + v_i \quad (18)$$

where $v_i = c_i j_T + u_i$ and where j_T is the T x 1 vector of ones. "In modern econometric parlance, "random effect" is synonymous with zero correlation between the observed explanatory variables and the unobserved effect: $\text{Cov}(x_{i,t}, c_i) = 0, t = 1,2,\dots,T$ " and "exploits the serial correlation in the composite error $v_i = c_i + u_{i,t}$ “ (Wooldridge, 2002).

3. The fixed effects model for all T periods is defined as:

$$y_i = X_i\beta + c_i j_T + u_i \quad (19)$$

where j_T is still the Tx1 vector of ones. FE models can control both for firm fixed effects (unobserved time-invariant heterogeneity across entities) or time fixed effects (unobserved time-variant effects that apply to all entities).

McLean and Zhao (2014) included both firm (α_i) and time (also: year) (α_t) fixed effects in their regression model. By substituting (15) and (16) into equation (13), the final regression framework now only includes the interactions of E and S on the q and CF coefficients:

$$\frac{l_{i,t}}{A_{i,t-1}} = \alpha_i + \alpha_t + \beta_1 q_{i,t-1} + \beta_2 \frac{CF_{i,t}}{A_{i,t-1}} + \beta_3 q_{i,t-1} \times E_t + \beta_4 \frac{CF_{i,t}}{A_{i,t-1}} \times E_t + \beta_5 q_{i,t-1} \times S_t + \quad (20)$$

$$\beta_6 \frac{CF_{i,t}}{A_{i,t-1}} \times S_t + \varepsilon_{i,t}$$

Again, substituting sales growth for q results in:

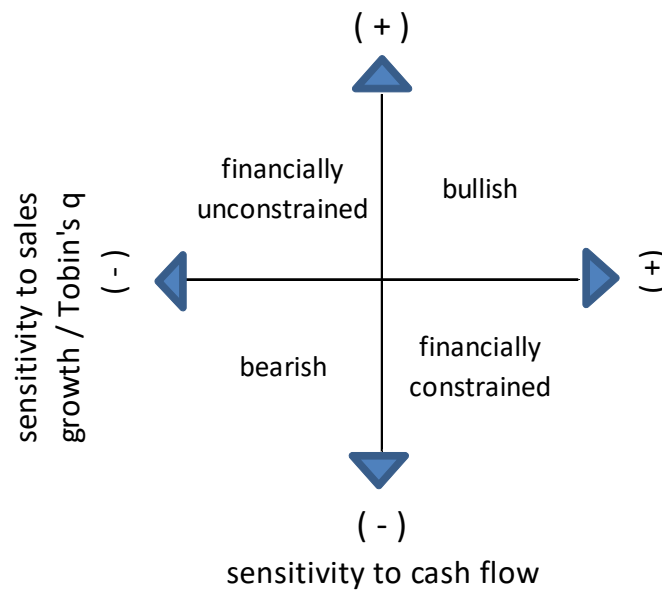
$$\frac{I_{i,t}}{A_{i,t-1}} = \alpha_i + \alpha_t + \beta_1 \frac{Turn_{i,t} - Turn_{i,t-1}}{Turn_{i,t-1}} + \beta_2 \frac{CF_{i,t}}{A_{i,t-1}} + \beta_3 \frac{Turn_{i,t} - Turn_{i,t-1}}{Turn_{i,t-1}} \times E_t + \beta_4 \frac{CF_{i,t}}{A_{i,t-1}} \times E_t + \beta_5 \frac{Turn_{i,t} - Turn_{i,t-1}}{Turn_{i,t-1}} \times S_t + \beta_6 \frac{CF_{i,t}}{A_{i,t-1}} \times S_t + \varepsilon_{i,t} \quad (21)$$

Including year fixed effects leads however to investment, q , and, cash flow variables becoming orthogonal to the yearly time-series variables E and S (thus having correlation 0). Only the interactions of E and S on investment, q , and, cash flow are therefore included and not the original time-series variables E and S .

It has to be kept in mind that a fixed firm effect in both the independent variable and the residual will lead to OLS standard errors underestimating the true standard errors (Petersen 2009). Thus, the standard errors need to be clustered both on firm and year in the given context. "The term clustered arises because these standard errors allow the regression errors to have an arbitrary correlation within a cluster, or grouping, but assume that the regression errors are uncorrelated across clusters" (Stock and Watson, 2015).

The regression results brought forward in McLean and Zhao (2014) indicate a simple relationship between cash flow and Tobin's q : In expansionary environments, firms react positively to Tobin's q (i.e. growth opportunities) and negatively to cash flow (i.e. internal resources). The reason behind this relationship is explained by the costs of external finance, which is lower during times of positive investor sentiment and economic growth and higher during recessions and in an environment marked by depressed sentiment. However, there may be two additional states of firm behavior. The following graph presents a theoretical outline of four possible states along the sensitivity to cash flow / sensitivity to Tobin's q axes:

Figure 2: Overview of theoretical firm financial states according to the investment sensitivity to cash flow / Tobin's q



The “financially unconstrained” and “constrained” quadrants correspond to McLean and Zhao’s (2014) dichotomy. The quadrant “bullish” represents a situation in which firm regressions display both a positive relationship to cash flow and Tobin’s q : Firms seize growth opportunities (captured by Tobin’s q) despite external financing frictions (i.e. lack of external resources). The opposite situation is one in which there is a low sensitivity to cash flow coupled with a low propensity to react to investment opportunities. Firms displaying both a negative relation to cash flow and Tobin’s q are bearish in a sense, in that they do not use “cheap” external finance to pursue investments. It may be hypothesized that the latter situation is a frequent result for European firms from countries having received ESM assistance. The dependence on internal resources is reduced due to favorable funding options, but firm investment will not be driven by growth opportunities. The overall economic situation and the future outlook of potential endeavors will neutralize the existence of “cheap finance”.

5.2. Econometric methodology

To decide between the possible regression models (ordinary least squares - OLS, random effects - RE, fixed effects - FE), two tests are employed on the underlying sample.

In the first step, the *Breusch and Pagan Lagrangian multiplier test (LM)* helps in choosing between OLS and RE. Under the null hypothesis, there is no panel effect in the data (homoskedasticity). OLS is thus the applicable model. If the null hypothesis is rejected, heteroskedasticity is present in at least one of the variables.

In case there is heteroskedasticity, the *Hausman test* helps in choosing between the random effects and a fixed effects specification. Under the null hypothesis, there is no correlation between the unique errors and the regressor(s). Thus, a random effects model is applicable.

Both tests are performed on a subset of regressions, namely H1.1 to H1.8 (regression results, which will be presented in part 5.3). The Breusch Pagan /Hausman test results for H1.1 to H1.8 are not presented in this dissertation but may be obtained upon request. Both the Breusch and Pagan Lagrangian multiplier test, as well as the Hausman test null hypotheses for all regressions are rejected with p -values <0.000 . Therefore, random effects should be preferred over OLS, but a fixed effects specification is more efficient than a random effects model.

Based on the above two tests, mainly FE regression results will be presented in what follows. However, all regressions are also performed under a RE specification and will be presented for selected hypotheses.

5.3. Hypotheses and results – sentiment and economic conditions

Hypothesis 1: *When investor sentiment is low, investment will become more sensitive to cash flow & less sensitive to Tobin’s q (and vice versa)*

Hypothesis 2: *When the economy is in recession, investment will become more sensitive to cash flow & less sensitive to Tobin’s q (and vice versa)*

Table 3: Results of hypotheses 1 and 2 –investment sensitivity to business cycle, productivity growth, and sentiment

This table reports the results from the fixed effects (FE) investment regressions for all euro area firms. The dependent variable is investment and the independent variables are cash flow (CF), sales growth (SGR), and the respective interaction terms with expansion (EXP), industry productivity (INDP) and sentiment (SENT). All equations include year dummies. Standard errors (in parentheses) are clustered on firm. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(4)	(5)	(6)	(8)
	H1.1	H1.2	H1.3	H1.4	H1.6	H1.8
SGR	0.0772*** (0.00270)	0.0640*** (0.0116)	0.0499 (0.133)	0.0486 (0.0737)	0.0842 (0.0955)	0.0249 (0.144)
CF (scaled)	1.034*** (0.0375)	1.005*** (0.0478)	1.107*** (0.373)	0.733*** (0.185)	0.965*** (0.213)	0.687* (0.413)
SGR*EXP		0.0127 (0.0120)			0.0155 (0.0179)	
CF *EXP		0.121*** (0.0322)			0.116*** (0.0398)	
SGR_abs*INDP			0.000254 (0.00125)			0.000238 (0.00127)
CF_abs*INDP			-8.36e-05 (0.00363)			0.000416 (0.00361)
SGR*SENT				0.000279 (0.000734)	-0.000227 (0.00107)	0.000264 (0.000743)
CF*SENT				0.00368** (0.00182)	0.000443 (0.00225)	0.00372** (0.00181)
Year dummies	yes	yes	yes	yes	yes	yes
Observations	66,804	53,197	53,197	53,197	53,197	53,197
Firms	17,971	15,826	15,826	15,826	15,826	15,826
Within R ²	0.379	0.408	0.407	0.407	0.408	0.407

The basic formulation (H1.1) regresses investment (scaled by total assets) on sales growth (proxy for McLean and Zhao’s q) and cash flow (also scaled by assets). A positive and significant effect of both independent variables is found, which compares exactly to the relationship found for U.S. firms.

H1.2 to H.4 include two additional interaction terms, respectively. H1.2 includes the interaction terms of the expansion dummy with sales growth and cash flow. Again, sales

growth and cash flow are positive and significant. The interaction terms are also positive, but only the expansion / cash flow interaction term is significant. The positive expansion / cash flow coefficient stands in contrast to McLean and Zhao's (2014) U.S. results, which display a negative coefficient. The European results thus indicate that an improvement in economic conditions leads to an increased cash flow sensitivity. The same positive and significant sales growth and cash flow relationships are found for H.4, which includes interaction terms with the sentiment dummy. U.S. results, according to McLean and Zhao (2014), indicate a negative relationship between improved sentiment and cash flow. Only H1.3, which includes interaction terms with industrial productivity growth, resembles the positive sales growth and negative cash flow relation found by McLean and Zhao. These results should however only be treated as indicative, as both coefficients are insignificant. Regressions H1.6 and H1.8 include two interaction terms, respectively. The significantly positive effect of the cash flow interaction terms on investment is confirmed. Both the sentiment / cash flow and the expansion / cash flow interaction terms remain positive and significant.

The (unexpected?) positive and significant connection between improving economic conditions / overall sentiment and cash flow may be driven by various factors. First, European financing is dominated by banks. Anglo-Saxon firms raise significant amounts of funds in capital markets. Both share issues and debt instruments play a role, as pointed out by McLean and Zhao (2014) and Gugler et.al (2007). Capital market investors place more importance on factors like investment opportunities (q) as opposed to banks, which focus on sound financial and operational aspects – independent of the economic situation or sentiment. Second, no sales growth interaction term is a (significantly) positive driver of investment. This might have to do with the type of investment undertaken by European firms. The U.S. can be regarded as the leading country for firms engaging in technological innovations (Apple, Alphabet, Microsoft etc.) while Europe is still relying on “traditional” industries like car manufacturing, chemicals, mechanical engineering etc. Investment in these industries may be

associated with less speculative, but more tangible projects. “Investment opportunities” become less important than internal resources to fund fixed-assets purchases with a (more or less) predictable payoff. Third, all dummies included – although country-specific - may lead to unexpected results when used in a cumulative “European” regression framework. None of the 18 euro countries will be in the same expansion / regression cycle or will reach the same “ESI” score at the same time.

Hypotheses 1 and 2 can thus not be confirmed for Europe. The importance of cash flow increases as economic conditions improve and sentiment improves – which stands in contrast to the expected outcome based on McLean and Zhao’s results. At the same time, sales growth is never a significant driver of firm investment.

5.4. Hypotheses and results – financial dependence and R&D activity

5.4.1. Investment of financially dependent firms

5.4.1.1. Measuring firm-level financial dependence

As outlined in section 2.1.2., a vast amount of literature focuses on analyzing corporate investment of financially dependent firms. FHPBP (1988) argue that non-dividend paying firms are financially impaired and will use their “scarce” internal resources to fund investment. Thus, these firms’ investment will display excessive cash flow sensitivity. There are four measures of financial dependence (public / private; young / old; small / large; high / low indebtedness), to capture the ease of access to external funds. Campbello et al. (2010) associate certain corporate traits with borrowing constraints, amongst others being small, private, and bank-dependent. Younger, smaller, and low dividend payout firms are further used by Altı (2003) to proxy for financial constraints. The ex-ante level of indebtedness (measured by debt / total assets), serves as an indicator for impaired access to (additional) debt. European firms are highly bank-dependent. Being highly indebted may reduce the probability of gaining access to new / extending existing bank financing.

Firm-level dummies are used to classify individual corporations as financially dependent / independent. A detailed technical explanation of these measures is provided in the following paragraphs. Year (yd*), industry (id_*), and country dummies (cd_*) are included in all random effects regressions (year dummies also in fixed effects regressions) to account for the overreaching effects included in the panel data set analyzed.

Public vs. private

The notion behind splitting the sample according to a public / private status is as follows: Private firms are financially dependent, as they are not able to raise funds (via shares or bonds) in the capital markets. These firms are therefore dependent on either internal resources or bank funding and will display a pronounced investment / cash flow sensitivity.

The public / private dummy is generated using the matching results (of the firm data and the market data information). When firm data match market data (based on the firm's ID, see above), firm observations are classified as belonging to a "public" corporation. In case there is no successful match, firm observations are treated as "private".

Firms listed on a stock exchange are often-times larger (asset wise) than their non-listed industry peers. In order to separate the public / private effect from the small / large effect, there are four additional interaction terms (public*small, public*large, private*small, private*large). The resulting private / public*small / large interaction terms are again multiplied by each year dummy.

Young vs. old

Younger firms are often classified as being financially dependent based on their missing "track record". There are no long-standing relationships with investors or financiers. Further, their business model may not have proven itself yet. Also, due to high initial investments, these firms may still be operating unprofitably.

Firms are classified as being young or old based on their date of incorporation. The threshold for being a young or an old corporation is set at 1950: Firms below this threshold are classified as “old”, while firms incorporated after 1950 are treated as “young”. Alternative thresholds (1900 and 2000) are tested, but do not lead to significant results.

Small vs. large

The financial dependence of small firms (as measured by total assets) is often rooted in their bank-dependence, their often simultaneous young age, and their limited debt capacity due to missing collateral (assets).

“Small” encompasses all firm characterized by below-median total assets, compared to all firms in their home country. “Large” firms are in turn then all firms with above-median total assets. Again, both the industry dummies and the independent variables sales growth and cash flow are interacted with the small / large dummies.

High level of indebtedness vs. low level of indebtedness

Firms with a high level of debt can be regarded as financially constrained, since a significant part of their financial resources has to be used for debt service. The underlying dataset is divided by the median debt ratio in each country. The new variable “debt ratio” is defined as follows:

$$Debt\ Ratio = \frac{[current\ liabilities_t + non\ current\ liabilities_t]}{total\ assets_t}$$

The resulting variable is winsorized at the 1st and 99th percentile level before calculating the median. A similar variable, namely debt / equity (d / e) ratio, is constructed.

$$Debt\ Equity\ Ratio = \frac{[current\ liabilities_t + non\ current\ liabilities_t]}{[total\ assets_t - current\ liabilities_t - non\ current\ liabilities_t]}$$

The results of the regressions using the d / e ratio are very similar to those using debt ratios and are thus not reported separately.

5.4.1.2. Empirical findings

In order to test the different hypotheses and taking into account firm-financial dependence, R&D- and capital intensity, as well as a distorted macroeconomic environment (ESM), a modification of the general formula employed in H1.1 to H1.8 is used.

Hypothesis 3: *Financially dependent firms will be more sensitive to cash flow and less sensitive to Tobin's q than their unconstrained peers.*

Table 4: Results of hypothesis 3.1 –investment of financially dependent firms (private vs. public)

This table reports the results from firm random effects (RE) and firm fixed effects (FE) investment regressions for private firms from the euro area. The dependent variable is investment and the independent variables are cash flow (CF), sales growth (SGR), and the respective interaction terms with the private dummy (PRIV). R² is the overall R² for RE and the within R² for FE regressions. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	(1) private RE	(2) private small RE	(3) private large RE	(4) private FE	(5) private small FE	(6) private large FE
SGR	0.154*** (0.00538)	0.209*** (0.0133)	0.144*** (0.00628)	0.131*** (0.0165)	0.136*** (0.0494)	0.128*** (0.0182)
CF	0.356*** (0.0334)	0.0860* (0.0478)	0.614*** (0.0474)	0.791*** (0.0760)	0.571*** (0.121)	1.038*** (0.0981)
SGR*PRIV	-0.0750*** (0.00540)	-0.135*** (0.0134)	-0.0630*** (0.00631)	-0.0541*** (0.0167)	-0.0638 (0.0495)	-0.0500*** (0.0185)
CF*PRIV	0.314*** (0.0342)	0.397*** (0.0488)	0.319*** (0.0486)	0.263*** (0.0756)	0.223* (0.123)	0.262*** (0.0945)
Industry dummies (3-digit)	yes	yes	yes			
Year dummies	yes	yes	yes	yes	yes	yes
Country dummies	yes	yes	yes			
Year dummies * private dummy	yes	yes	yes	yes	yes	yes
Observations	66,800	30,579	36,221	66,804	30,581	36,223
Firms	17,968	10,000	9,845	17,971	10,001	9,847
R ²	0.331	0.317	0.342	0.380	0.363	0.409

Consistent with FHPBP (1988), privately held firms seem to rely on internal resources (namely cash flow) to fund investments (Table 4). The positive and significant cash flow / private interaction terms (random and fixed effects) point in this direction. Also consistent with this view, an increase in sales growth (i.e. investment opportunities) cannot be associated with an increase in investment. The sales growth / private interaction terms are significant in both the random and fixed effects formulations (regressions 1 and 4). To test if the private firm results are in fact driven by an underlying firm size effect, the sample is divided by firm

asset size into “small” and “large”, depending on the country-specific median. As can be seen in regressions (2) and (3), as well as (5) and (6), private firms of all sizes seem to rely on internal funds to finance investment.

Table 5: Results of hypothesis 3.2 –investment of financially dependent firms (young vs. old)

This table reports the results from the random effects (RE) and fixed effects (FE) investment regressions for young firms from the euro area. The dependent variable is investment and the independent variables are cash flow (CF), sales growth (SGR), and the respective interaction terms with the young dummies (young1950 or young2000). R² is the overall R² for RE and the within R² for FE regressions. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)
	young 1950	young 1950	young 2000	young 2000
	RE	FE	RE	FE
SGR	0.0864*** (0.00298)	0.0858*** (0.0118)	0.0824*** (0.000618)	0.0796*** (0.00336)
CF	0.585*** (0.0451)	0.881*** (0.171)	0.621*** (0.0148)	0.997*** (0.0455)
SGR*Y1950	-0.00743** (0.00302)	-0.00903 (0.0122)		
CF*Y1950	0.0602 (0.0459)	0.170 (0.175)		
SGR*Y2000			-0.00833*** (0.000995)	-0.00736 (0.00567)
CF*Y2000			0.0597** (0.0234)	0.142 (0.0878)
Industry dummies (3-digit)	yes		yes	
Year dummies	yes	yes	yes	yes
Country dummies	yes		yes	
Year dummies * young dummy	yes	yes	yes	yes
Observations	62,766	62,770	62,766	62,770
Firms	17,010	17,013	17,010	17,013
R ²	0.330	0.384	0.332	0.385

The results for young vs. old firms (Table 5) resemble those for private vs. public firms: The interaction terms of cash flow / young are positive. However, only the CF interaction term for “young2000” firms (3) yields significant results. The sales growth / young interaction term is always negative, and highly significant for both the young1950 and young2000 random effects regressions. Young and private firms thus seem to be facing similar financing frictions (cash flow dependence).

Table 6: Results of hypothesis 3.3 –investment of financially dependent firms (small vs. large)

This table reports the results from the random effects (RE) and fixed effects (FE) investment regressions for small firms from the euro area. The dependent variable is investment and the respective independent variables are cash flow (CF), sales growth (SGR), and the interaction terms with the small dummy. R² is the overall R² for RE and the within R² for FE regressions. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	(1) small RE	(2) small FE
SGR	0.0820*** (0.000598)	0.0798*** (0.000661)
CF	0.815*** (0.0157)	1.217*** (0.0207)
SGR*SMALL	-0.00824*** (0.000983)	-0.00828*** (0.00111)
CF*SMALL	-0.321*** (0.0200)	-0.393*** (0.0259)
Industry dummies (3-digit)	yes	
Year dummies	yes	yes
Country dummies	yes	
Year dummies * small dummy	yes	yes
Observations	66,800	66,800
Firms	17,968	17,968
R ²	0.328	0.386

There is an even more pronounced negative relationship for small firms, with “small” being defined as described above (Table 6). The interaction terms of the small dummy and sales growth / cash flow are both negative and highly significant. This means that for small European firms, neither internal resources nor promising sales opportunities may be associated with an investment inducing effect. The negative sales growth / small interaction term is similar to the one described for private firms – small firm investment is not driven by the sheer existence of viable growth opportunities. The negative cash flow / small interaction term makes the interpretation less straight forward and differs from the private / young results – external finance does not appear to be a constraining factor. Small European firms thus have to be categorized as being “bearish”: Despite the absence of financing constraints, investment will be decreased in the presence of investment opportunities.

It could be that small European firms use excess internal resources for other purposes than investment, e.g. debt service. An investment-reducing effect of debt ratios above 80-85% is discussed by Gebauer et al. (2017). Alternatively, cash flow may be transformed to

precautionary cash reserves (Campello et al., 2009), intended at reducing future financing frictions. Also, small firms may simply be lacking attractive investment opportunities.

Table 7: Results of hypothesis 3.4a –investment sensitivity to absolute debt ratio

This table reports the results from the random effects (RE) and fixed effects (FE) investment regressions for firms from the euro area. The dependent variable is investment and the independent variables are cash flow (CF), sales growth (SGR), and the absolute debt ratio (DR). R^2 is the overall R^2 for RE and the within R^2 for FE regressions. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)
	debt ratio	debt ratio
	RE	FE
SGR	0.0741*** (0.00158)	0.0708*** (0.00939)
CF	0.583*** (0.0321)	0.869*** (0.0935)
DR	0.161*** (0.00704)	0.355*** (0.0240)
SGR*DR	0.00693*** (0.00237)	0.00844 (0.0141)
CF*DR	0.327*** (0.0515)	0.572*** (0.156)
Industry dummies (3-digit)	yes	
Year dummies	yes	yes
Country dummies	yes	
Observations	65,703	65,703
Firms	17,776	17,776
R^2	0.340	0.399

The absolute debt ratio and both interaction variables have a positive and significant impact on investment (at least for the random effects formulation; Table 7). The impact of the cash flow / debt ratio interaction term is however much larger than the sales growth / debt ratio effect. It can be inferred, that an increase in leverage coupled with sufficient internal resources has a significant investment boosting effect. This finding supports the results of Campello et al. (2010).

Table 8: Results of hypothesis 3.4b –investment of financially dependent firms (high vs. low indebtedness)

This table reports the results from the random effects (RE) and fixed effects (FE) investment regressions for highly indebted firms from the euro area. The dependent variable is investment and the independent variables are cash flow (CF), sales growth (SGR), and the respective interaction terms with the indebtedness dummy. R^2 is the overall R^2 for RE and the within R^2 for FE regressions. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)
	debt ratio	debt ratio
	large	large
	RE	FE
SGR	0.0791*** (0.000626)	0.0773*** (0.00337)
CF	0.712*** (0.0156)	1.116*** (0.0451)
DR	0.168*** (0.00777)	0.397*** (0.0214)
SGR*DR_large	-0.00127 (0.000953)	-0.00273 (0.00550)
CF*DR_large	0.153*** (0.0229)	0.224*** (0.0615)
Industry dummies (3-digit)	yes	
Year dummies	yes	yes
Country dummies	yes	
Year dummies * high debt dummy	yes	yes
Observations	65,703	65,703
Firms	17,776	17,776
R-squared	0.341	0.400

The results of the high vs. low debt ratio regressions (Table 8) are similar to those for private and young firms – a significantly positive cash flow / high debt ratio interaction term and a negative (though insignificant) sales growth / high debt ratio interaction term. The interpretation is intuitive: Highly indebted firms will face difficulties in raising additional external funds. In Europe, where most firms finance their operations through banks, a sound financial statement is more important than promising investment opportunities. The consistently positive effect of debt on firm investment as seen in the regressions with the absolute debt ratio (Table 7) and interaction terms (Table 8) only hold on average. As soon as a certain threshold is passed, debt has an investment hampering effect. This compares to the findings of Gebauer et al. (2017) for certain European countries.

Overall, Hypotheses 3 is confirmed. A higher degree of financial dependence leads to a pronounced sensitivity to internal finance, as measured by cash flow (except for small firms that display a bearish behavior).

5.4.2. Investment of R&D- and capital intensive firms

5.4.2.1. Measuring R&D – and capital intensity

R&D intensity

To measure the degree of R&D intensity, the firm R&D ratio definition is as follows:

$$R\&D\ Ratio = \frac{R\&D\ expenditures_t}{total\ assets_t}$$

As with the variables described earlier, the median value (per country) of this variable to classifies firms as high / low R&D intensity firms. The denomination “very capital intensive” is applied if the R&D ratio is in the 75th percentile of the country’s firm set. “Very low capital intensity” is attributed to those firms with a R&D ratio in the country’s 25th percentile.

Capital intensity

To assess the behavior of firms operating in capital intensive industries, a variable measuring the degree of fixed assets investments is formulated:

$$Fixed\ Assets\ Ratio = \frac{fixed\ assets_t}{total\ assets_t}$$

The threshold used to divide firms into a more and less capital intensive group, is similar to the one used for R&D intensity.

5.4.2.2. Empirical findings

Hypothesis 4a: *Firms from industries that rely on fixed assets investment will become more sensitive to cash flow and less sensitive to Tobin’s q.*

Hypothesis 4b: *For R&D-intensive firms, results may be less pronounced with respect to cash flow, given that investment-smoothing cash reserves exist.*

Interacting sales growth / R&D ratio large and cash flow / R&D ratio large yields

interesting results (Table 9):

Table 9: Results of hypothesis 4a and b –investment of firms with high R&D and fixed asset ratios

This table reports the results from the random effects (RE) and fixed effects (FE) investment regressions for firms highly engaged in R&D and fixed assets investments from the euro area. The dependent variable is investment and the independent variables are cash flow (CF), sales growth (SGR), and the interaction terms with the R&D and fixed assets dummies. R² is the overall R² for RE and the within R² for FE regressions. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
	RD ratio large	RD ratio large	RD ratio very large	RD Ratio very large	FA Ratio large	FA Ratio large
	RE	FE	RE	FE	RE	FE
SGR	0.246*** (0.0262)	0.179** (0.0886)	0.252*** (0.0158)	0.190*** (0.0492)	0.0908*** (0.000710)	0.0886*** (0.00358)
CF	0.522*** (0.112)	1.196*** (0.363)	0.524*** (0.0796)	1.093*** (0.264)	0.565*** (0.0150)	0.954*** (0.0424)
R&D	-0.178 (0.111)	-1.610*** (0.375)	-0.109 (0.121)	-1.516*** (0.412)		
SGR* RD_large	-0.0965*** (0.0291)	-0.0845 (0.105)				
CF* RD_large	-0.260** (0.128)	-0.525 (0.414)				
SGR* RD_verylarge			-0.182*** (0.0239)	-0.155* (0.0813)		
CF* RD_verylarge			-0.377*** (0.112)	-0.663* (0.378)		
FA					-0.0211*** (0.00741)	0.102*** (0.0238)
SGR* FA_large					-0.0206*** (0.000952)	-0.0215*** (0.00514)
CF* FA_large					0.177*** (0.0223)	0.226*** (0.0606)
Industry dummies (3-digit)	yes		yes		yes	
Year dummies	yes	yes	yes	yes	yes	yes
Country dummies	yes		yes		yes	
Year dummies *R&D ratio / FA ratio	yes	yes	yes	yes	yes	yes
Observations	2,129	2,129	2,129	2,129	66,793	66,793
Firms	439	439	439	439	17,964	17,964
R ²	0.206	0.222	0.226	0.244	0.331	0.387

An increase in the ex-ante R&D ratio (“large”) leads to a decrease in investment (regressions 1 and 2). The results are significant in the random effects formulation only. The size of the negative coefficients increases as the interaction terms include very large R&D ratios. Also, fixed effects results become significant (3 and 4).

The results can be summarized as follows: The higher the existing R&D ratio, the smaller the propensity to invest (interaction terms). Despite promising investment opportunities (measured by sales growth) firms already highly invested in R&D projects will reduce

investment. This result is intuitive, given the speculative nature of R&D endeavors. Especially scientific projects of biotech or pharmaceutical firms tend to bind significant human and financial resources over long periods of time, with the (positive) outcome only known at very late stages. These firms will reduce additional investments during such periods of high uncertainty. At the same time, these firms do not seem dependent on internal cash flows, which may be consistent with the notion that R&D firms engage in precautionary savings, accumulating sufficient cash buffers to smooth investment (Brown and Petersen, 2011).

The just described uncertainty is less prevalent in fixed assets investment, which is also reflected in the regression results. Firms with up-front high levels of fixed assets investment depend on internal resources. Fixed assets investments tend to deliver predictable cash flows, as opposed to R&D. At the same time, the coefficient of the “sales growth / fixed assets ratio large” variable yields a negative relationship. Despite a positive sales outlook of expanding fixed assets, it seems difficult to raise additional, external funds to finance investments. Both interaction term coefficients are highly significant for the random effects and fixed effects formulations.

Hypotheses 4a is thus fully confirmed for fixed assets investments. The higher the up-front fixed assets existent in a firm, the more dependent is future investment on the existence of internal funds. For R&D investment, neither promising growth opportunities nor sufficient internal resources boost investment activities in firms already highly engaged in R&D projects. This negative relationship amplifies as a firm moves from “high” to “very high” up-front R&D investment. Hypothesis 4b is thus confirmed: High R&D firms’ sensitivity to cash flow declines. It could be that investment-smoothing cash reserves drive this result.

5.5. Hypotheses and results - investment in times of macroeconomic turmoil (ESM)

5.5.1. ESM vs. non-ESM country firm results

5.5.1.1. Measuring macroeconomic turmoil: ESM effects

Next to firm-level determinants of financial dependence, dummy variables capturing macroeconomic challenges are defined. Firms from countries that received financial aid through the European Stability Mechanism (ESM) are assumed to be especially burdened by an unhealthy business environment, marked by insecurity.

The “ESM dummy” marks firm observations from Portugal, Ireland, Spain, Cyprus, and Greece. Adding the starting point of ESM assistance, the final dummy “ESMyesTime emerges.

Table 10: Overview of ESM program starting years per country

Country	Start of ESM
Portugal	≥ 2012
Ireland	≥ 2013
Spain	≥ 2012
Cyprus	≥ 2013
Greece	≥ 2015

In the first step, dummy variables only differentiate between ESMyes and ESMno. The notion behind the ESMyesTime variable with a “time stamp” is that ESM-receiving countries might exhibit less investment-hindering properties after the onset of government-supporting ESM aids. This is not directly comparable to McLean and Zhao’s (2014) definition of an expansionary and positive investor sentiment environment but should theoretically be an improvement to pre-assistance times. Generally, it is assumed that firms become less dependent on cash flow and more dependent on the availability of growth opportunities, which can be financed through re-accessed external funds.

5.5.1.2. Empirical findings

Hypothesis 5: *Firms incorporated in euro zone countries that received aid through the European Stability Mechanism will become less sensitive to cash flow and more sensitive to Tobin's q.*

Table 11: Results of hypothesis 5 –investment of (financially dependent) firms from ESM recipient countries

This table reports the results from the random effects (RE) and fixed effects (FE) investment regressions for firms from ESM recipient countries. The dependent variable is investment and the independent variables are cash flow (CF), sales growth (SGR), and multiple interaction terms with the “ESMyesTime” dummy and dummies indicating financial dependence. ESMyesTime marks all firm level observations after the onset of the ESM program. ESM countries analyzed within this data set are Spain, Greece, and Portugal. R2 is the overall R2 for RE and the within R2 for FE regressions. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	(1) all RE	(2) all FE	(3) private RE	(4) private FE	(5) small RE	(6) small FE
SGR	0.0796*** (0.000481)	0.0774*** (0.00271)	0.157*** (0.00558)	0.140*** (0.0167)	0.0820*** (0.000597)	0.0798*** (0.00353)
CF	0.648*** (0.0122)	1.039*** (0.0381)	0.298*** (0.0364)	0.770*** (0.0916)	0.833*** (0.0165)	1.191*** (0.0538)
SGR* ESMyesTime	-0.0409*** (0.00536)	-0.0577*** (0.0135)	-0.0703*** (0.0201)	-0.164*** (0.0360)	-0.0359*** (0.00687)	-0.0519** (0.0239)
CF* ESMyesTime	-0.0520 (0.0455)	-0.0673 (0.0723)	-0.0157 (0.135)	0.113 (0.147)	-0.134** (0.0570)	-0.142 (0.0921)
SGR*PRIV			-0.0780*** (0.00560)	-0.0630*** (0.0169)		
CF*PRIV			0.383*** (0.0378)	0.292*** (0.0940)		
SGR*ESMyesTime*PRIV			0.0265 (0.0209)	0.112*** (0.0389)		
CF*ESMyesTime*PRIV			-0.0594 (0.134)	-0.198 (0.141)		
PRIV			-0.0470*** (0.00491)	-0.0217* (0.0113)		
SGR*SMALL					-0.00774*** (0.000977)	-0.00788 (0.00529)
CF*SMALL					-0.350*** (0.0223)	-0.319*** (0.0615)
SGR*ESMyesTime*SMALL					-0.0114 (0.0109)	-0.00944 (0.0270)
CF*ESMyesTime*SMALL					0.170*** (0.0592)	0.116 (0.0808)
SMALL					0.00819*** (0.00292)	-0.0390*** (0.00842)
Industry dummies (3-digit)	yes		yes		yes	
Year dummies	yes	yes	yes	yes	yes	yes
Country dummies	yes		yes		yes	
Year dummies *ESMyesTime	yes	yes	yes	yes	yes	yes
Observations	66,800	66,804	66,800	66,804	66,800	66,804
Firms	17,968	17,971	17,968	17,971	17,968	17,971
R ²	0.326	0.380	0.331	0.381	0.329	0.387

Table 12: Results of hypothesis 5 –investment of (financially dependent) firms from ESM recipient countries (continued)

This table reports the results from the random effects (RE) and fixed effects (FE) investment regressions for firms from ESM recipient countries. The dependent variable is investment and the independent variables are cash flow (CF), sales growth (SGR), and multiple interaction terms with the “ESMyesTime” dummy and dummies indicating financial dependence. ESMyesTime marks all firm level observations after the onset of the ESM program. ESM countries analyzed within this data set are Spain, Greece, and Portugal. R2 is the overall R2 for RE and the within R2 for FE regressions. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	(7)	(8)	(9)	(10)	(11)	(12)
	young	young	young	young	debt ratio	debt ratio
	1950	1950	2000	2000	large	large
	RE	FE	RE	FE	RE	FE
SGR	0.0850*** (0.00297)	0.0844*** (0.0117)	0.0822*** (0.000617)	0.0796*** (0.00337)	0.0796*** (0.000627)	0.0781*** (0.00341)
CF	0.682*** (0.0494)	0.886*** (0.164)	0.647*** (0.0155)	0.999*** (0.0457)	0.676*** (0.0157)	1.024*** (0.0442)
SGR* ESMyesTime	0.103*** (0.0380)	0.238** (0.113)	0.00778 (0.0106)	-0.0402 (0.0249)	-0.0479*** (0.00787)	-0.0754*** (0.0157)
CF* ESMyesTime	-0.270** (0.131)	-0.309 (0.191)	-0.107** (0.0531)	-0.0874 (0.0799)	-0.0313 (0.0487)	0.00457 (0.0746)
SGR*Y1950	-0.00574* (0.00301)	-0.00738 (0.0120)				
CF*Y1950	-0.0406 (0.0508)	0.170 (0.168)				
SGR*ESMyesTime*Y1950	-0.147*** (0.0384)	-0.301*** (0.114)				
CF*ESMyes Time*Y1950	0.237* (0.130)	0.259 (0.187)				
Y1950	0.0248*** (0.00644)					
SGR*Y2000			-0.00738*** (0.000989)	-0.00711 (0.00571)		
CF*Y2000			-0.00808 (0.0257)	0.150* (0.0879)		
SGR*ESMyesTime*Y2000			-0.0650*** (0.0124)	-0.0268 (0.0290)		
CF*ESMyesTime*Y2000			0.117* (0.0650)	0.0396 (0.105)		
Y2000			0.0303*** (0.00344)			
SGR*DR_large					-0.00120 (0.000950)	-0.00290 (0.00556)
CF*DR_large					0.129*** (0.0229)	0.212*** (0.0615)
SGR*ESMyesTime*DR_large					0.0118 (0.0107)	0.0402 (0.0279)
CF*ESMyes Time*DR_large					-0.0624 (0.0661)	-0.285*** (0.0959)
DR_large					0.0443*** (0.00283)	0.0436*** (0.00678)
Industry dummies (3-digit)	yes		yes		yes	
Year dummies	yes	yes	yes	yes	yes	yes
Country dummies	yes		yes		yes	
Year dummies *ESMyesTime	yes	yes	yes	yes	yes	yes
Observations	62,766	62,770	62,766	62,770	65,703	65,707
Firms	17,010	17,013	17,010	17,013	17,776	17,779
R ²	0.331	0.385	0.333	0.385	0.338	0.390

The first two regressions show the basic regression framework (Table 11 & 12), in which only sales growth and cash flow are interacted with the “ESMyesTime” dummy. The latter marks those firm level observations that are incorporated in a) countries that received ESM aid and that took place b) after the aid has been granted. As can be seen in regressions 1 and 2, sales growth / ESMyesTime is significantly negative, and holds for the random effects and fixed effects versions. Cash flow interacted with ESMyesTime is also negative, although not to a significant extent. Despite the existence of viable growth opportunities (as measured by sales growth), investment does not increase. It could thus be inferred, that ESM aid has not had an investment stimulating effect on average. Viable investment opportunities may however be hard to find (and finance) in an economic environment marked by insecurity, recession, and high unemployment, as seen in the euro periphery after the onset of the crisis.

When dividing the firm sample by characteristics of financial dependence (regressions 3-12, Table 11 & 12), an interaction term consisting of three parts is used: the sales growth (cash flow) variable is interacted with the ESMyesTime dummy, as well as the measure of financial dependence (e.g. private, young etc.)⁷.

As can be seen for the private regressions (3 and 4), being a “private” firm has a negative effect on investment, as depicted by the private dummy coefficient. Private firms, however, seem to seize investment opportunities after the respective country of incorporation received ESM assistance. Cash flow / ESM interaction continues to have an (insignificantly) negative sign, as seen in regressions 1 and 2 in Table 11. Random and fixed effects results yield the same coefficient signs. Overall, private firms might find it easier to raise external funds to finance attractive investments after the onset of ESM activities, making it possible to pursue growth projects. It could be that close firm-bank relationships drive the just described result.

⁷ An alternative way would have been dividing the sample into sub-samples consisting of small, young etc. firms. Using the second method and working de-facto with n different samples increases the risk of introducing noise, that distorts the real question of how financially dependent vs. financially independent firms behave.

This is not the case for small firms, which significantly differ in their results (regressions 5 and 6). The interaction terms “sales growth / cash flow * ESMyesTime*small” display a (partly significant) relationship inverse to the one found for private firms: Small firms are still dependent on internal funds (for random and fixed effects). It seems as if small firms still have difficulties in accessing bank finance, making them dependent on internal resources.

The same interaction term relationship is detected for young firms (1950 as well 2000 definition; regressions 7-10, Table 12): These firms seem to increase investment if sufficient internal resources exist, but display a negative relationship between sales growth and investment. The “up-front disadvantage” of being young is in fact an advantage: Both the “young1950” and the “young2000” dummies have a significant investment-enhancing effect. This could be due to the fact that young firms are still in a pre-mature phase that makes ongoing investment necessary. The interaction terms however hint at continued difficulties in accessing external financing.

The most interesting results are found for highly indebted firms in the years after the provision of ESM funding (regressions 11 and 12): These firms seem to be investing more than their lowly indebted peers (positive “debt ratio large” coefficient) and seem to be relying less on internal funds (negative CF interaction term).

The interpretation of the above results in Tables 11 and 12 and the confirmation / rejection of Hypothesis 3 is complex: The (partly significant) positive effect of sales growth on investment activities as seen in private (regressions 3 and 4) and highly indebted firms (regressions 11 and 12) could be driven by the existence of close ties between banks and firms in ESM countries. This notion is consistent with previous research (Jimenez et al, 2014; Blattner et al., 2018). It seems as if firms have (re-)accessed bank funding after financial institutions had been provided with liquidity through the ESM program. At the same time, small (regressions 5 and 6) and young firms (regressions 7-10) still have to rely on internal resources to fund investment. This view is again consistent with previous research by

Ciccarelli and Maddaloni (2013), who describe the on-going weakness of borrower balance sheets. It could be that highly indebted, private firms crowd-out small and young firms with interesting investment opportunities in their competition for bank finance: As described by Jimenez et al. (2014); Blattner et al. (2018), Spanish and Portuguese banks may have preferred existing and highly indebted corporations when granting loans.

The risk of borrowers defaulting on their older bank debt, thereby negatively affecting an institution's balance sheet, liquidity, and credibility might have been sufficient to provide these financially constrained "clients" with even more credit. This interpretation is supported by the findings for highly indebted firms: These firms display a higher up-front propensity to invest ("debt ratio large" dummy) and are less dependent on internal liquidity than their less indebted peers. This finding, especially during one of the most substantial financial crises of the past decades, is counterintuitive. How is it possible then that those firms, already bearing high levels of debt take advantage of investment opportunities - mostly financed by outside funds - in times of tight credit markets? Or has the intervention of the European Stability Mechanism led to a liquidity rush in the banking sector, which these institutions passed on to highly indebted firms? Or is it just this combination of both factors that explains this initially illogical picture?

Have troubled banks, which benefited most of selling illiquid and highly depreciated sovereign debt to the European Stability Mechanism fund, used the proceeds to stabilize another position in their balance sheets, namely debt outstanding, used by long-standing and severely impaired corporate clients? The phenomenon of corporate "zombies" as well as their institutional "peers", which only survive thanks to the extremely (at times even negative) key interest rates, is stressed by various authors. Especially an OECD study (2017) discusses this concept: "While finance is necessary to sustain corporate investment and productivity, too much debt relative to investment can also undermine the allocation efficiency of productive capital". As highly indebted firms lose their ability to raise new debt to fund investments, they

lose their competitiveness: “As a result, firms with persistently high level of indebtedness and low profits can become chronically unable to grow and become “zombie” firms”. The positive indebtedness / increased investment relationship for firms incorporated in ESM countries does not rule out that only replacement investment took place, not advancing the competitive position of the corporation.

ESM aids provided to the five European countries have differed in nuances. The ESM possesses six instruments, of which two have been used so far: First, loans within a macroeconomic adjustment program, granted to Ireland, Portugal, Greece, and Cyprus. The objective is described as follows by the ESM: “To assist ESM Members in significant need of financing, and which have lost access to the markets, either because they cannot find lenders or because the financing costs would adversely impact the sustainability of public finances.”⁸ To be eligible for the loan, the respective country agrees to implement macroeconomic reforms, prepared by the European Commission (EC). The EC, the International Monetary Fund (IMF), and the ECB monitor the progress of the predetermined reforms. The second instrument, loans for indirect bank recapitalization, was provided to the Spanish banking system. The objective differs from the first instrument and is described as follows: “(To) preserve the financial stability of the euro area by addressing those cases where the financial sector is primarily at the root of a crisis, rather than fiscal or structural policies”. The eligibility of the member state is determined by the inability to “meet capital shortfalls via private sector solutions” and to “recapitalise the institutions without adverse effects for its own financial stability and fiscal sustainability”. Further, the institutions in question have to be of systemic relevance or threaten the financial stability of the euro area. Lastly, the recipient country has to demonstrate its ability to reimburse the granted loan. Monitoring is provided by the EC, the ECB, and the respective supervisory authority. The other four

⁸ https://www.esm.europa.eu/assistance/lending-toolkit#lending_toolkit

(unused) tools are primary market purchases, secondary market purchases, precautionary credit lines, and direct recapitalization of institutions.

In what follows, the just described regressions will be repeated on a country-by-country basis. Unfortunately, there have been insufficient observations for Cyprus and Ireland, which leaves “only” Spain, Greece, and Portugal to be described in more detail.

5.5.2. Country-specific differences: Portugal vs. Spain vs. Greece

The ESM and the SMP programs have not been implemented identically across receiving countries. Further, the economic conditions prevalent during the implementation phase of the respective program differed. This heterogeneity is discussed by Jäger and Grigoriadis (2017), and Burriel and Galesi (2018).

Jäger and Grigoriadis (2017) analyze and compare four different measures of monetary policy. The authors describe an OMT-induced reduction of 10-year bond yield spreads for crisis and non-crisis countries. LTROs (longer-term refinancing operations) and a lowered deposit rate of 0% are only beneficial to crisis countries’ spreads. The SMP also benefits crisis countries, but leads to an increase in non-crisis bond yield spreads. This is due to the increased fiscal risk for non-crisis countries, driven by the accumulation of crisis’ countries sovereign bonds on the ECB balance sheet.

Burriel and Galesi (2018) document a beneficiary UMP (unconventional monetary policy) effect for most euro area countries. Heterogeneity in the effectiveness is introduced by spillover effects across member countries and the fragility of the respective national banking system. The least benefit (in terms of economic output) is achieved in financially stressed countries (i.e. Cyprus, Greece, Ireland, Italy, Portugal, and Spain) with fragile banking systems. The authors suggest “the existence of a potential bottleneck (...) which works via the bank lending channel”.

The effectiveness of unconventional monetary policy on the real economy is verified by Foley-Fisher et al. (2016) for the U.S. The aim of the Fed's maturity extension program (MEP) lies in flattening the yield curve. By reducing the supply of long-term Treasuries, interest rates drop. Foley-Fisher et al. (2016) find that firms dependent on long-term debt increase bond issues. Especially older and larger firms seem to take advantage of improved financing conditions and subsequently increase investment and employment. At the same time, these firms engage in gap filling, providing the market with long-term debt instruments and dampening the public debt supply shock.

Independently of the unconventional monetary measures employed during the recent financial crisis, cash-flow / investment sensitivities seem to have declined over the past decades. While the sensitivity is stable for firms in poor countries, it has significantly decreased for firms in rich countries (Larkin et al, 2018). The authors attribute this finding not only to the level of economic resources (as measured by GDP / capita), but also to the level of financial development. Equity finance emerges as the main driver behind the reduction of financial constraints on the firm level, which eventually results in increased corporate investment. Thus, the degree of overall country financial development will influence the corporate investment sensitivities.

Based on the just described heterogeneity in central bank program effectiveness (with regards to firm characteristics and crisis / non-crisis country of incorporation), it is assumed that financing and investment reactions will also show a significant degree of heterogeneity across (support package) ESM recipient countries. This is exactly depicted in the different country regressions for Portugal, Spain, and Greece. An interpretation of the country-specific results and a discussion of the different drivers of investment can be found in the following section.

The country-specific results for the "basic" regressions are shown in Table 13. Overall results for ESM receiving countries (model 1) are driven by Spain (model 3). The

interpretation of the cumulative ESM firm results (models 1 & 5) also holds for models 3 & 7 (Spain) and 4 & 8 (Greece): The substantial market interventions lead to Spanish and Greek corporate investment to be neither positively related to the quality of investment opportunities, nor to the availability of internal funds. The interaction terms sales growth / ESMyesTime and cash flow / ESMyesTime indicate a significantly negative effect on investment for the Spanish random effects regression in model 3. Greek interaction results are also negative but not significantly so. The negative cash flow interaction term could be indicative of improved access to external finance, but the simultaneous negative sales growth interaction term is disturbing: Why are Spanish (and Greek) businesses not seizing growth opportunities as financing constraints have been alleviated? Why do firms remain “bearish”?

Portuguese firms seem to behave just the opposite of Spanish and Greek firms. The interaction term sales growth / ESMyesTime is positive and highly significant; cash flow / ESMyesTime also displays a positive sign but is not significant. An improvement in the overall economic and business environment in Portugal may have sparked new and interesting growth opportunities of which local firms take advantage of, using internal funds.

Table 13: Results of hypothesis 5.1 – Portuguese, Spanish, and Greek “basic” country-specific regressions

This table reports the results from the random effects (RE) and fixed effects (FE) country-specific investment regressions for firms from ESM recipient countries. The dependent variable is investment and the independent variables are cash flow (CF), sales growth (SGR), and interaction terms with the “ESMyesTime” dummy. ESMyesTime marks all firm level observations that took place after the onset of the respective home country’s ESM program. Portugal = POR, Spain = SPN, Greece = GRE, POR+SPN+GRE=ESM. R² is the overall R² for RE and the within R² for FE regressions. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	basic ESM	basic POR	basic SPN	basic GRE	basic ESM	Basic POR	basic SPN	Basic GRE
	RE	RE	RE	RE	FE	FE	FE	FE
SGR	0.0796*** (0.000481)	0.0464** (0.0198)	0.0707*** (0.00324)	0.142*** (0.0175)	0.0774*** (0.00271)	0.0643* (0.0339)	0.0622*** (0.0160)	0.111** (0.0552)
CF	0.648*** (0.0122)	0.494*** (0.183)	0.818*** (0.0458)	0.482*** (0.0889)	1.039*** (0.0381)	0.595** (0.257)	1.158*** (0.156)	0.710** (0.291)
SGR*ESMyesTime	-0.0409*** (0.00536)	0.216*** (0.0270)	-0.0406*** (0.00626)	-0.0294 (0.0695)	-0.0577*** (0.0135)	0.177*** (0.0514)	-0.0524*** (0.0196)	-0.0716 (0.124)
CF* ESMyesTime	-0.0520 (0.0455)	0.00933 (0.192)	-0.220*** (0.0616)	-0.0678 (0.223)	-0.0673 (0.0723)	0.0174 (0.231)	-0.132 (0.105)	-0.0276 (0.262)
Industry dummies (3-digit)	yes	yes	yes	yes				
Year dummies	yes	yes	yes	yes	yes	Yes	yes	Yes
Country dummies	yes	yes	yes	yes				
Year dummies *ESMyesTime	yes	yes	yes	yes	yes	Yes	yes	Yes
Observations	66,800	784	7,961	1,168	66,804	784	7,961	1,168
Firms	17,968	407	2,198	357	17,971	407	2,198	357
R ²	0.326	0.302	0.133	0.191	0.380	0.268	0.150	0.185

These contrasting results could be driven by fundamentally different firm characteristics prevalent in the firm data sets analyzed. An analysis of this hypothesis follows in the coming part, which dissects the firms by measures of financial dependence. The basic formulation results per country are always compared to those of the different definitions of financially dependent firm results. Nevertheless, if Spanish / Greek / Portuguese financially constrained firm results also differ from each other, it could be that these differences are either driven by substantially varying economic / financing environments prevalent in these countries or by the workings of the country-specific ESM assistance provided.

Being a privately held firm reduces the propensity to invest in all countries as measured by the “private” dummy (Table 14). The results are, however, only significant for the multi-country regressions 1 & 5. Overall, private firm investment seems to be positively related to investment opportunities and less dependent on internal resources - an indication that external financing frictions have been eliminated. Private firms’ access to bank finance (external capital markets are not an option for unlisted firms) may have improved. Moving from multi-country (models 1 & 5) to single-country results (models 2-4 and 6-8) this simple interpretation does not hold. Again, Spanish results seem to drive the multi-country (fixed effects) results.

The interpretation of firms’ reaction to investment opportunities is tenuous (inconsistencies between random and fixed effects) and yields only one significant interaction term result, which stands in stark contrast to the basic regression (Table 13): Spanish private firm investment is positively and significantly related to the existence of growth opportunities. Private firms in Spain may also have regained access to external (bank) finance, as indicated by the consistently negative (but insignificant) cash flow interaction term. The Greek sales growth interaction term is not significant but at least consistent between both regression types (models 4 & 8): Private firms seem to increase investment as

opportunities arise. Further, Greek private firm results are just the opposite of what is found for the overall Greek firm data set.

Summarizing, only Spanish private firms (fixed effects) bear the expected interaction term signs: The dependence to internal finance is reduced and a positive investment opportunity / investment activity relationship is found. It should be kept in mind that Greek and Portuguese results are never significant and can thus only be regarded as indicative: Portuguese interaction terms hint in the same direction as Spanish firm results. Greek firms seem “bullish” after all, investing as growth prospects arise, funding these endeavors with internal means.

Table 14: Results of hypothesis 5.2 – Portuguese, Spanish, and Greek “private” country-specific regressions

This table reports the results from the random effects (RE) and fixed effects (FE) country-specific investment regressions for private firms from ESM recipient countries. The dependent variable is investment and the independent variables are cash flow (CF), sales growth (SGR), and interaction terms with the “ESMYesTime” dummy and the private dummy. ESMYesTime marks all firm level observations that took place after the onset of the respective home country’s ESM program. Portugal = POR, Spain = SPN, Greece = GRE, POR+SPN+GRE=ESM. R² is the overall R² for RE and the within R² for FE regressions. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	private ESM	private POR	private SPN	private GRE	private ESM	private POR	private SPN	private GRE
	RE	RE	RE	RE	FE	FE	FE	FE
SGR	0.157*** (0.00558)	0.0298 (0.313)	0.106*** (0.00814)	0.0692** (0.0351)	0.140*** (0.0167)	-0.271 (0.172)	0.122*** (0.0167)	0.0443 (0.0442)
CF	0.298*** (0.0364)	-0.301 (0.675)	0.679*** (0.231)	0.428*** (0.162)	0.770*** (0.0916)	-0.117 (0.444)	1.183*** (0.350)	1.056*** (0.340)
SGR*ESMYesTime	-0.0703*** (0.0201)	-0.279 (0.417)	-0.0123 (0.0209)	-0.0665 (0.196)	-0.164*** (0.0360)	0.712* (0.377)	-0.153*** (0.0360)	-0.114 (0.129)
CF*ESMYesTime	-0.0157 (0.135)	0.712 (0.637)	-0.209 (0.203)	-0.383 (0.433)	0.113 (0.147)	0.495 (0.387)	-0.0411 (0.222)	-0.526 (0.579)
SGR*PRIV	-0.0780*** (0.00560)	0.0162 (0.314)	-0.0425*** (0.00887)	0.0966** (0.0402)	-0.0630*** (0.0169)	0.341* (0.176)	-0.0706*** (0.0232)	0.0877 (0.0835)
CF*PRIV	0.383*** (0.0378)	0.835 (0.674)	0.148 (0.232)	0.0738 (0.184)	0.292*** (0.0940)	0.745 (0.470)	-0.00916 (0.341)	-0.416 (0.377)
SGR*ESMYesTime*PRIV	0.0265 (0.0209)	0.497 (0.418)	-0.0264 (0.0219)	0.0243 (0.209)	0.112*** (0.0389)	-0.540 (0.381)	0.114*** (0.0415)	0.0353 (0.196)
CF*ESMYesTime*PRIV	-0.0594 (0.134)	-0.729 (0.622)	-0.0285 (0.202)	0.356 (0.431)	-0.198 (0.141)	-0.513 (0.364)	-0.107 (0.217)	0.690 (0.575)
PRIV	-0.0470*** (0.00491)	-0.0141 (0.0407)	-0.0317 (0.0224)	-0.00843 (0.0174)	-0.0217* (0.0113)	-0.00850 (0.0438)	-0.0225 (0.0339)	0.0168 (0.0333)
Industry dummies (3-digit)	yes	yes	yes	yes				
Year dummies	yes	yes	yes	yes	yes	yes	yes	yes
Country dummies	yes	yes	yes	yes				
Year dummies *ESMYesTime	yes	yes	yes	yes	yes	yes	yes	yes
Observations	66,800	784	7,961	1,168	66,804	784	7,961	1,168
Firms	17,968	407	2,198	357	17,971	407	2,198	357
R ²	0.331	0.309	0.138	0.197	0.381	0.272	0.158	0.193

As opposed to being private, being a small firm does not clearly decrease the propensity to investment on average (Table 15): The small dummy is mostly negative (even if often insignificantly so) for all models, except the international random effects model 1, which displays a significantly positive relationship. Focusing on the random effects multinational model 1, European small firms seem to be relying on cash flow (significantly positive cash flow interaction term) rather than external funds and seem to be bypassing investment opportunities. This finding is completely the opposite of the one found for private firms (Table 14). It thus seems that smaller firms have not regained access to bank finance after major parts of (bank-held) sovereign government debt was bought by the ESM. A substantial intersecting set of small firms will also be private; nonetheless, the average small firm still depends on internal finance. Also, this result differs from the basic regression framework (hypothesis 5.1), where no cash flow dependence is established.

Spanish results are partly significant (model 3, random effects): Small Spanish firms display a propensity to react positively to external growth opportunities, which they however fund using internal means. Small firms can be regarded as behaving just the opposite of the average - bearish- Spanish firm. Private Spanish firms are somewhat “in between”.

A contrarian (with regards to the average firm, Table 13) result is also found for Portuguese firms. Small firms in Portugal are able to raise external funds (negative insignificant cash flow interaction term) but also display a significantly negative sales growth interaction term. It seems as if small Portuguese firms may be provided with external funds, which are not used for attractive investment projects (as indicated by the negative sales growth coefficient).

Only small Greek firms show the expected signs: Cash flow dependence decreases while investment becomes significantly more dependent on the existence of viable growth opportunities.

Table 15: Results of hypothesis 5.3 – Portuguese, Spanish, and Greek “small” country-specific regressions

This table reports the results from the random effects (RE) and fixed effects (FE) country-specific investment regressions for small firms from ESM recipient countries. The dependent variable is investment and the independent variables are cash flow (CF), sales growth (SGR), and interaction terms with the “ESMyesTime” dummy and the small dummy. ESMyesTime marks all firm level observations that took place after the onset of the respective home country’s ESM program. Portugal = POR, Spain = SPN, Greece = GRE, POR+SPN+GRE=ESM. R² is the overall R² for RE and the within R² for FE regressions. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	small	small	small	small	small	small	small	small
	ESM	POR	SPN	GRE	ESM	POR	SPN	GRE
	RE	RE	RE	RE	FE	FE	FE	FE
SGR	0.0820*** (0.000597)	0.0140 (0.0229)	0.0731*** (0.00354)	0.213*** (0.0245)	0.0798*** (0.00353)	0.0716** (0.0297)	0.0658*** (0.0183)	0.193** (0.0760)
CF	0.833*** (0.0165)	-0.0849 (0.290)	0.965*** (0.0574)	0.454*** (0.115)	1.191*** (0.0538)	-0.502* (0.303)	1.307*** (0.210)	0.770* (0.398)
SGR*ESMyesTime	-0.0359*** (0.00687)	0.354*** (0.0347)	-0.0374*** (0.00771)	-0.143 (0.0997)	-0.0519** (0.0239)	0.260*** (0.0471)	-0.0487* (0.0289)	-0.273* (0.151)
CF*ESMyesTime	-0.134** (0.0570)	0.286 (0.291)	-0.311*** (0.0753)	-0.00563 (0.276)	-0.142 (0.0921)	0.393 (0.251)	-0.181 (0.124)	0.115 (0.388)
SGR*SMAL	-0.00774*** (0.000977)	0.0931** (0.0408)	-0.0175** (0.00864)	-0.141*** (0.0341)	-0.00788 (0.00529)	0.0919 (0.156)	-0.0193 (0.0310)	-0.166* (0.0924)
CF*SMALL	-0.350*** (0.0223)	0.728** (0.302)	-0.287*** (0.0767)	0.131 (0.170)	-0.319*** (0.0615)	1.401*** (0.363)	-0.338 (0.232)	-0.0852 (0.433)
SGR*ESMyesTime*SMALL	-0.0114 (0.0109)	-0.293*** (0.0546)	0.00283 (0.0140)	0.222* (0.135)	-0.00944 (0.0270)	-0.255 (0.187)	0.00521 (0.0401)	0.451** (0.187)
CF*ESMyesTime*SMALL	0.170*** (0.0592)	-0.235 (0.289)	0.187** (0.0784)	-0.179 (0.329)	0.116 (0.0808)	-0.296 (0.253)	0.0846 (0.0976)	-0.356 (0.447)
SMALL	0.00819*** (0.00292)	-0.0245 (0.0174)	-0.00434 (0.00817)	-0.00770 (0.0166)	-0.0390*** (0.00842)	-0.142* (0.0736)	-0.0263 (0.0233)	-0.0125 (0.0390)
Industry dummies (3-digit)	yes	yes	yes	yes				
Year dummies	yes	yes	yes	yes	yes	yes	yes	yes
Country dummies	yes	yes	yes	yes				
Year dummies *ESMyesTime	yes	yes	yes	yes	yes	yes	yes	yes
Observations	66,800	784	7,961	1,168	66,804	784	7,961	1,168
Firms	17,968	407	2,198	357	17,971	407	2,198	357
R ²	0.329	0.336	0.136	0.202	0.387	0.320	0.156	0.208

Young European firms from ESM recipient countries behave on average (models 1, 5, 9, 13) like small firms (Table 16 & 17): Internal funds remain important and the sales growth interaction term displays a negative sign. Being a young firm increases the up-front propensity to invest (significantly positive dummy). In comparison to the basic regression (Table 13), where both sales growth and cash flow display negative signs, young firms are more reliant on internal resources than the overall ESM firm / country sample. The results just described hold for average young firms having been established both after 1950 and after 2000. However, the country-specific results differ for these two cut-off dates (1950 / 2000).

Spanish firms having been founded after 1950 show a significantly negative relation to sales growth but are not clearly positively related to cash flow. These firms display the opposite reaction of what would be expected after a major liquidity infusion. Portuguese firms, in contrast, show exactly what would be expected: The reliance on cash flow seems to decrease (insignificantly but consistently negative) and the existence of growth opportunities becomes a significant driver of investment activity. There are an insufficient number of Greek firm observations to yield regression results.

When analyzing firms with a founding date of 2000 or later, the just described relationships for Spanish and Portuguese “young 1950” firms turn completely. For very young firms in Spain, the dependence on internal funds becomes (insignificantly but consistently) negative and growth opportunities become a significant driver for investment. The same significant relationship is found for very young Greek firms. For very young Portuguese firms, investment becomes positively and significantly related to the availability of cash flow, while sales growth has a significantly negative effect on investment.

The ESM program has thus led to better access to bank finance for very young Spanish and Greek firms. Very young Portuguese firms however seem to have a disadvantage with respect to their slightly older peers, in that these firms are still shut-off their access to external finance.

Table 16: Results of hypothesis 5.4 – Portuguese, Spanish, and Greek “young” country-specific regressions

This table reports the results from the random effects (RE) and fixed effects (FE) country-specific investment regressions for young firms from ESM recipient countries. The dependent variable is investment and the independent variables are cash flow (CF), sales growth (SGR), and interaction terms with the “ESMyesTime” dummy and the young dummy. ESMyesTime marks all firm level observations that took place after the onset of the respective home country’s ESM program. Portugal = POR, Spain = SPN, Greece = GRE, POR+SPN+GRE=ESM. R² is the overall R² for RE and the within R² for FE regressions. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	young 1950	young 1950	young 1950	young 1950	young 1950	young 1950	young 1950	young 1950
	ESM	POR	SPN	GRE	ESM	POR	SPN	GRE
	RE	RE	RE	RE	FE	FE	FE	FE
SGR	0.0850*** (0.00297)	0.256 (0.522)	0.0254 (0.0201)	0.121*** (0.0425)	0.0844*** (0.0117)	0.508*** (0.154)	0.366*** (0.112)	0.0791 (0.131)
CF	0.682*** (0.0494)	-0.273 (0.556)	0.484*** (0.128)	0.598** (0.255)	0.886*** (0.164)	-0.270 (0.277)	0.274 (0.447)	0.231 (0.633)
SGR*ESMyesTime	0.103*** (0.0380)	-0.138 (0.532)	0.164*** (0.0434)	-0.0387 (0.149)	0.238** (0.113)	-0.623** (0.244)	-0.00129 (0.137)	-0.113 (0.255)
CF*ESMyesTime	-0.270** (0.131)	0.168 (0.544)	-0.306** (0.153)	0.0555 (0.584)	-0.309 (0.191)	0.355 (0.240)	-0.136 (0.164)	0.852 (0.690)
SGR*Y1950	-0.00574* (0.00301)	-0.210 (0.522)	0.0463** (0.0203)		-0.00738 (0.0120)	-0.448*** (0.156)	-0.305*** (0.113)	
CF*Y1950	-0.0406 (0.0508)	0.817 (0.556)	0.368*** (0.133)		0.170 (0.168)	0.945** (0.383)	0.995** (0.467)	
SGR*ESMyesTime*Y1950	-0.147*** (0.0384)	0.361 (0.532)	-0.209*** (0.0439)		-0.301*** (0.114)	0.815*** (0.251)	-0.0558 (0.138)	
CF*ESMyesTime*Y1950	0.237* (0.130)	-0.149 (0.537)	0.0757 (0.152)		0.259 (0.187)	-0.344 (0.221)	-0.0355 (0.159)	
Y1950	0.0248*** (0.00644)	-0.0364 (0.0320)	-0.0155 (0.0174)	0.0618 (0.272)				
Industry dummies (3-digit)	yes	yes	yes	yes				
Year dummies	yes	yes	yes	yes	yes	yes	yes	yes
Country dummies	yes	yes	yes	yes				
Year dummies *ESMyesTime	yes	yes	yes	yes	yes	yes	yes	yes
Observations	62,766	784	7,961	195	62,770	784	7,961	195
Firms	17,010	407	2,198	66	17,013	407	2,198	66
R ²	0.331	0.310	0.135	0.370	0.385	0.288	0.163	0.274

Table 17: Results of hypothesis 5.4 – Portuguese, Spanish, and Greek “young” country-specific regressions (continued)

This table reports the results from the random effects (RE) and fixed effects (FE) country-specific investment regressions for young firms from ESM recipient countries. The dependent variable is investment and the independent variables are cash flow (CF), sales growth (SGR), and interaction terms with the “ESMyesTime” dummy and the young dummy. ESMyesTime marks all firm level observations that took place after the onset of the respective home country’s ESM program. Portugal = POR, Spain = SPN, Greece = GRE, POR+SPN+GRE=ESM. R² is the overall R² for RE and the within R² for FE regressions. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
	young 2000 ESM	young 2000 POR	young 2000 SPN	young 2000 GRE	young 2000 ESM	young 2000 POR	young 2000 SPN	young 2000 GRE
	RE	RE	RE	RE	FE	FE	FE	FE
SGR	0.0822*** (0.000617)	0.0158 (0.0364)	0.123*** (0.00508)	0.225*** (0.0524)	0.0796*** (0.00337)	-0.0929 (0.104)	0.116*** (0.0326)	0.205 (0.146)
CF	0.647*** (0.0155)	0.447** (0.202)	0.758*** (0.0518)	-0.181 (0.458)	0.999*** (0.0457)	0.476 (0.290)	1.081*** (0.193)	-0.0826 (1.145)
SGR*ESMyesTime	0.00778 (0.0106)	0.330*** (0.0455)	-0.0483*** (0.0119)	-0.0632 (0.159)	-0.0402 (0.0249)	0.384*** (0.115)	-0.0862** (0.0399)	-0.267 (0.268)
CF*ESMyesTime	-0.107** (0.0531)	-0.356* (0.215)	-0.192*** (0.0668)	0.792 (0.667)	-0.0874 (0.0799)	-0.320 (0.257)	-0.0795 (0.109)	1.394* (0.712)
SGR*Y2000	-0.00738*** (0.000989)	0.0436 (0.0420)	-0.0881*** (0.00654)	-0.247*** (0.0804)	-0.00711 (0.00571)	0.161 (0.115)	-0.0865** (0.0351)	-0.380** (0.181)
CF*Y2000	-0.00808 (0.0257)	0.0692 (0.307)	0.120 (0.0828)	1.077** (0.535)	0.150* (0.0879)	0.467 (0.535)	0.161 (0.254)	0.554 (1.240)
SGR*ESMyesTime*Y2000	-0.0650*** (0.0124)	-0.202*** (0.0554)	0.0261* (0.0139)	0.0503 (0.319)	-0.0268 (0.0290)	-0.275** (0.138)	0.0503 (0.0446)	0.757* (0.384)
CF*ESMyesTime*Y2000	0.117* (0.0650)	0.688** (0.290)	-0.0998 (0.0853)	-1.462 (1.076)	0.0396 (0.105)	0.490* (0.290)	-0.154 (0.120)	-3.122** (1.275)
Y2000	0.0303*** (0.00344)	-0.0283 (0.0181)	0.0360*** (0.00885)	0.0876 (0.0553)				
Industry dummies (3-digit)	yes	yes	Yes	Yes				
Year dummies	yes	yes	Yes	Yes	yes	yes	yes	yes
Country dummies	yes	yes	yes	Yes				
Year dummies *ESMyesTime	yes	yes	yes	Yes	yes	yes	yes	yes
Observations	62,766	784	7,961	195	62,770	784	7,961	195
Firms	17,010	407	2,198	66	17,013	407	2,198	66
R ²	0.333	0.331	0.158	0.432	0.385	0.292	0.169	0.371

The multi-country regression results of highly indebted firms from ESM recipient countries display the expected investment relationship (Table 18): sales prospects / growth opportunities become an important investment driver, while the reliance on cash flow significantly decreases. Highly indebted firms have thus re-accessed sources of external finance (probably mainly bank finance). Interestingly, the upfront propensity to invest increases for firms marked as being “highly indebted”.

Country-specific highly indebted Portuguese and Greece firms indicate exactly the just described relationship between investment and positive sales growth / negative cash flow sensitivity (only fixed effects in the case of Portuguese firms), even though never significantly so.

Spanish results tell a different story and are highly significant (both random and fixed effects regressions): For these highly indebted firms, cash flow dependence is reduced but at the same time, the existence of viable growth opportunities is also negatively related to investment activity. The negative cash flow relation is a multiple of the sales growth effect. It seems then, that Spanish firms definitely tap external sourced of finance, despite their already high levels of debt holdings. As described for the basic regression, which yields similar results for Spain, it remains very questionable what these newly raised funds are used for. An interesting set of investment opportunities, which would be captured in the sales growth interaction term, does not seem to be a driving force for investment. Overall, Spanish highly indebted firms show a negative propensity to invest, even after being alleviated from their financing problems.

Nevertheless, almost all single-country regressions (FE) show a negative cash flow interaction term. This result is very interesting, given the potentially impaired balance sheet of borrowing firms. These firms are provided with access to external finance despite the fact that euro-periphery banks (with questionable balance sheets themselves) have just been supported by central bank liquidity. The cycle continues, even after the onset of ESM assistance.

Table 18: Results of hypothesis 5.5 – Portuguese, Spanish, and Greek “highly indebted” country-specific regressions

This table reports the results from the random effects (RE) and fixed effects (FE) country-specific investment regressions for highly indebted firms from ESM recipient countries. The dependent variable is investment and the independent variables are cash flow (CF), sales growth (SGR), and interaction terms with the “ESMyesTime” dummy and the high debt ratio dummy. ESMyesTime marks all firm level observations that took place after the onset of the respective home country’s ESM program. Portugal = POR, Spain = SPN, Greece = GRE, POR+SPN+GRE=ESM. R² is the overall R² for RE and the within R² for FE regressions. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	(1) debt large ESM RE	(2) debt large POR RE	(3) debt large SPN RE	(4) debt large GRE RE	(5) debt large ESM FE	(6) debt large POR FE	(7) debt large SPN FE	(8) debt large GRE FE
SGR	0.0796*** (0.000627)	-0.00512 (0.0346)	0.0408*** (0.00833)	0.0876*** (0.0249)	0.0781*** (0.00341)	-0.0196 (0.128)	0.0302 (0.0221)	0.0283 (0.0485)
CF	0.676*** (0.0157)	0.642*** (0.186)	0.773*** (0.0559)	0.635*** (0.122)	1.024*** (0.0442)	0.566* (0.294)	0.999*** (0.177)	0.846** (0.335)
SGR*ESMyesTime	-0.0479*** (0.00787)	0.197*** (0.0503)	-0.00991 (0.0114)	-0.0230 (0.0803)	-0.0754*** (0.0157)	0.218* (0.129)	-0.0313 (0.0265)	-0.117 (0.134)
CF*ESMyesTime	-0.0313 (0.0487)	0.0717 (0.194)	-0.130** (0.0653)	0.0316 (0.253)	0.00457 (0.0746)	0.0667 (0.276)	-0.0208 (0.101)	0.208 (0.254)
SGR*debtlarge	-0.00120 (0.000950)	0.0700* (0.0403)	0.0311*** (0.00901)	0.101*** (0.0345)	-0.00290 (0.00556)	0.121 (0.135)	0.0351 (0.0283)	0.154 (0.0944)
CF*debtlarge	0.129*** (0.0229)	-0.470 (0.332)	0.418*** (0.0778)	-0.210 (0.166)	0.212*** (0.0615)	-0.411 (0.430)	0.634*** (0.239)	-0.225 (0.362)
SGR*ESMyesTime*DR_large	0.0118 (0.0107)	0.0778 (0.0580)	-0.0344** (0.0139)	0.0752 (0.152)	0.0402 (0.0279)	0.0558 (0.138)	-0.00883 (0.0363)	0.199 (0.187)
CF*ESMyesTime*DR_large	-0.0624 (0.0661)	0.0443 (0.322)	-0.326*** (0.0869)	-0.296 (0.360)	-0.285*** (0.0959)	-0.0331 (0.373)	-0.477*** (0.142)	-0.709 (0.453)
DR_large	0.0443*** (0.00283)	0.0592*** (0.0171)	0.0512*** (0.00780)	0.0301* (0.0159)	0.0436*** (0.00678)	0.0931** (0.0369)	0.0289 (0.0198)	-0.00549 (0.0256)
Industry dummies (3-digit)	yes	yes	yes	yes				
Year dummies	yes	yes	yes	yes	yes	yes	yes	yes
Country dummies	yes	yes	yes	yes				
Year dummies *ESMyesTime	yes	yes	yes	yes	yes	yes	yes	yes
Observations	65,703	762	7,870	1,158	65,707	762	7,870	1,158
Firms	17,776	402	2,189	355	17,779	402	2,189	355
R2	0.338	0.362	0.164	0.206	0.390	0.383	0.172	0.211

5.6. Hypotheses and results – investment of non-euro European firms

5.6.1. Defining European non-euro firms

The following part is concerned with investment sensitivities of financially dependent firms from Europe that do not operate primarily in euro, using company observations from Great Britain and Switzerland. Both countries possess economies and currencies of global importance. Eastern European firms that operate in their respective currencies (Polish Zloty, Czech Crown) are more dependent on developments in the euro area, making a clear distinction of effects difficult. The firms used in the British and Swiss sample are defined analogous to the European corporations (no financial and utility firms, definition of firm level variables etc.). In what follows, British and Swiss results will always be compared to the overall European results shown in Tables 4 – 9.

5.6.2. Empirical findings

Hypothesis 6: *Financially dependent firms financing their operations primarily in euro will be more sensitive to cash flow and less sensitive to Tobin's q compared to their European peers not operating in euro.*

Private firms (hypothesis 6.1.): Unfortunately, none of the overall Swiss and British regression results are significant (Table 19, regressions 2 & 5). If taken as indicative, the above hypothesis is partly confirmed. Euro-private firm investment is highly dependent on cash flow and negatively related to sales growth. Swiss and British firms are also dependent on internal resources, but take advantage of growth opportunities, as indicated by the positive sales growth coefficient. Interestingly, small and private British firms (which can be regarded as being double-financially dependent) show the expected result (regression 6): Their investment is highly and significantly dependent on cash flow, and negatively related to sales growth. These especially “impaired” British firms thus react like the “average” private euro-

firm. Further, private and large Swiss firms (4) seem to be neither dependent on internal resources, nor on sales opportunities.

Young firms (hypothesis 6.2.): The young euro firm results differ markedly from the Swiss and British results with regards to the dependence on cash flow (Table 20). Euro firms are – insignificantly - dependent on cash flow. For all subsamples from Switzerland and Great Britain except the British “young1950” regression (5), there is an (insignificantly) negative relationship between cash flow and investment. This means, that Swiss and British young firms have better access to external finance compared to their euro peers.

This result, indicating a distorted lending channel for euro firms, is not surprising given the increased risk of supplying loans to young firms in a situation where bank balance sheets are highly damaged by holdings of governmental and corporate debt from struggling countries. Interestingly, young firms from Switzerland and Great Britain display a significantly negative sales growth / investment relationship (holds for all regressions except 4). There seems to be access to bank finance, but the proceeds are not used based on the existence of growth opportunities. These results are highly significant.

Small firms (hypothesis 6.3.): Small firms in all “regions” show the same (significant) investment relationship (Table 21): The dependence on internal resources is highly negative and significant. At the same time, the existence of growth opportunities does not appear to be a driver for investment. The results for small and young non-euro firms are thus quite similar. Small and young firms do not seem cut-off of external funding (again, most probably bank loans due to the “small” firm size). However, for small or young firms the existence of sales growth opportunities is not an important investment driver. This is a very concerning result, with SMEs being the backbone of the European economy. These firms are behaving “bearish”. External funds are not transferred into investment, given positive NPV projects. These firms appear stuck and having a negative outlook on future economic development.

Highly indebted firms (hypothesis 6.4.): The regressions of highly indebted firms in the euro zone indicate a positive dependence on cash flow and a negative dependence on sales growth (Table 23). This result is expected for financially dependent firms. British and Swiss firms face external financing frictions – just as their euro peers – but seem to seize sales growth opportunities as indicated by the insignificantly positive sales growth term.

The comparison to ESM country results (Table 12) yields a markedly opposing result: Highly indebted firms from countries that were aided by the fund show a negative dependence on internal cash flow. This subgroup thus behaves completely the opposite of average U.K. and euro-member firms: A high level of indebtedness is not synonymous with being cut-off of external funds in an ESM-assisted business environment.

R&D / fixed assets-intensive firms (hypothesis 6.5.): The euro firm regression results show a clearly bearish behavior (Table 25, models 1 & 2): Both the cash flow and the sales growth interaction terms display negative coefficients. The negative relationship increases as the R&D ratio moves from large to very large. This stands in contrast to the results for Swiss and British firms with a large R&D ratio, where there is no clear and significant result.

When it comes to fixed assets investment, euro firms display a financially constrained behavior: The cash flow coefficient is significantly positive, while the sales growth coefficient is significantly negative. British firms show the same relationship, even if not significantly so.

Table 19: Results of hypothesis 6.1 – Euro area, Swiss and British “private” country-specific regressions

This table reports the results from the fixed effects (FE) country-specific investment regressions for private firms from the euro area, Switzerland, and Great Britain. The dependent variable is investment and the independent variables are cash flow (CF), sales growth (SGR), and respective interaction terms with the private dummy. EUR = euro area, SWI = Switzerland, GB = Great Britain. R² is the within R² for FE regressions. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	(1) private EUR FE	(2) private SWI FE	(3) private & small SWI FE	(4) private & large SWI FE	(5) private GB FE	(6) private & small GB FE	(7) private & large GB FE
SGR	0.131*** (0.0165)	0.0972 (0.0876)	0.00785 (0.0842)	0.422*** (0.126)	0.0563*** (0.0134)	0.0850** (0.0422)	0.0498*** (0.0142)
CF	0.791*** (0.0760)	0.684*** (0.227)	0.512* (0.290)	1.157*** (0.228)	0.780*** (0.108)	0.469*** (0.112)	0.888*** (0.133)
SGR*PRIV	-0.0541*** (0.0167)	0.157 (0.147)	0.248 (0.182)	-0.131 (0.178)	0.0152 (0.0150)	-0.0270 (0.0430)	0.0218 (0.0170)
CF*PRIV	0.263*** (0.0756)	0.0885 (0.322)	0.111 (0.396)	-0.00961 (0.195)	0.0296 (0.108)	0.270** (0.116)	-0.00324 (0.134)
Year dummies	yes	yes	yes	yes	yes	yes	yes
Year dummies * private dummy	yes	yes	yes	yes	yes	yes	yes
Observations	66,804	1,493	703	790	35,467	16,550	18,917
Firms	17,971	253	139	135	10,363	6,074	5,467
R ²	0.380	0.143	0.107	0.294	0.131	0.181	0.121

Table 20: Results of hypothesis 6.2 – Euro area, Swiss and British “young” country-specific regressions

This table reports the results from the fixed effects (FE) country-specific investment regressions for young firms from the euro area, Switzerland, and Great Britain. The dependent variable is investment and the independent variables are cash flow (CF), sales growth (SGR), and respective interaction terms with the young1950 or young2000 dummy. EUR = euro area, SWI = Switzerland, GB = Great Britain. R² is the within R² for FE regressions. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
	young 1950	young 2000	young 1950	young 2000	young 1950	young 2000
	EUR	EUR	SWI	SWI	GB	GB
	FE	FE	FE	FE	FE	FE
SGR	0.0858*** (0.0118)	0.0796*** (0.00336)	0.377*** (0.131)	0.143* (0.0832)	0.190*** (0.0243)	0.0849*** (0.0104)
CF	0.881*** (0.171)	0.997*** (0.0455)	0.800*** (0.285)	0.777*** (0.234)	0.675*** (0.0808)	0.818*** (0.0446)
SGR*Y1950	-0.00903 (0.0122)		-0.262* (0.150)		-0.124*** (0.0251)	
CF*Y1950	0.170 (0.175)		-0.120 (0.357)		0.134 (0.0905)	
SGR*Y2000		-0.00736 (0.00567)		0.0218 (0.142)		-0.0252* (0.0130)
CF*Y2000		0.142 (0.0878)		-0.224 (0.402)		-0.0316 (0.0756)
Year dummies	yes	yes	yes	yes	yes	yes
Year dummies * young dummy	yes	yes	yes	yes	yes	yes
Observations	62,770	62,770	1,493	1,493	35,455	35,455
Firms	17,013	17,013	253	253	10,361	10,361
R ²	0.384	0.385	0.146	0.139	0.131	0.132

Table 21: Results of hypothesis 6.3 – Euro area, Swiss and British “small” country-specific regressions

This table reports the results from the fixed effects (FE) country-specific investment regressions for small firms from the euro area, Switzerland, and Great Britain. The dependent variable is investment and the independent variables are cash flow (CF), sales growth (SGR), and respective interaction terms with the small dummy. EUR = euro area, SWI = Switzerland, GB = Great Britain. R^2 is the within R^2 for FE regressions. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	(1) Small EUR FE	(2) Small SWI FE	(3) Small GB FE
SGR	0.0798*** (0.000661)	0.397*** (0.0455)	0.0754*** (0.00334)
CF	1.217*** (0.0207)	0.894*** (0.154)	0.869*** (0.0230)
SGR*SMALL	-0.00828*** (0.00111)	-0.321*** (0.0518)	-0.0207*** (0.00572)
CF*SMALL	-0.393*** (0.0259)	-0.330* (0.175)	-0.153*** (0.0292)
Year dummies	yes	yes	yes
Year dummies * small dummy	yes	yes	yes
Observations	66,800	1,493	34,985
Firms	17,968	253	10,205
R^2		0.176	0.138

Table 22: Results of hypothesis 6.4a – Euro area, Swiss and British country-specific regressions with absolute debt ratio

This table reports the results from the fixed effects (FE) country-specific investment regressions for firms from the euro area, Switzerland, and Great Britain. The dependent variable is investment and the independent variables are cash flow (CF), sales growth (SGR), the absolute debt ratio and respective interaction terms with the debt ratio dummy. EUR = euro area, SWI = Switzerland, GB = Great Britain. R^2 is the within R^2 for FE regressions. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	(1) debt ratio EUR FE	(2) debt ratio SWI FE	(3) debt ratio GB FE
SGR	0.0708*** (0.00939)	0.336*** (0.122)	0.0524*** (0.0145)
CF	0.869*** (0.0935)	0.721* (0.380)	0.750*** (0.0906)
DR	0.355*** (0.0240)	0.365*** (0.132)	0.323*** (0.0347)
SGR*DR	0.00844 (0.0141)	-0.337 (0.220)	0.0252 (0.0234)
CF*DR	0.572*** (0.156)	0.124 (0.860)	0.372** (0.165)
Year dummies	yes	yes	yes
Observations	65,703	1,477	31,675
Firms	17,776	250	9,578
R^2	0.399	0.158	0.147

Table 23: Results of hypothesis 6.4b – Euro area, Swiss and British “highly indebted” country-specific regressions

This table reports the results from the fixed effects (FE) country-specific investment regressions for highly indebted firms from the euro area, Switzerland, and Great Britain. The dependent variable is investment and the independent variables are cash flow (CF), sales growth (SGR), the absolute debt ratio and respective interaction terms with the high debt ratio dummy. EUR = euro area, SWI = Switzerland, GB = Great Britain. R² is the within R² for FE regressions. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	(1) debt ratio large EUR FE	(2) debt ratio large SWI FE	(3) debt ratio large GB FE
SGR	0.0773*** (0.00337)	0.145** (0.0599)	0.0644*** (0.00953)
CF	1.116*** (0.0451)	0.753*** (0.185)	0.866*** (0.0499)
DR	0.397*** (0.0214)	0.299** (0.122)	0.336*** (0.0345)
SGR*DR_large	-0.00273 (0.00550)	0.00124 (0.112)	0.00313 (0.0137)
CF*DR_large	0.224*** (0.0615)	0.215 (0.354)	0.172** (0.0678)
Year dummies	yes	yes	yes
Year dummies * high debt dummy	yes	yes	yes
Observations	67,180	1,477	31,675
Firms	18,026	250	9,578
R ²	0.394	0.165	0.148

Table 24: Results of hypothesis 6.5a – Euro area, Swiss and British investment regressions with absolute R&D and fixed assets ratio

This table reports the results from the random effects (RE) and fixed effects (FE) investment regressions for firms from the euro area, Switzerland, and Great Britain highly engaged in R&D and fixed assets investments. The dependent variable is investment and the independent variables are cash flow (CF), sales growth (SGR), and the respective interaction terms with the absolute R&D and fixed assets (FA) ratios. Dummies as indicated in the table. R^2 is the within R^2 for FE regressions. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
	RD ratio EUR	FA ratio EUR	RD ratio SWI	FA ratio SWI	RD ratio GB	FA ratio GB
	FE	FE	FE	FE	FE	FE
SGR	0.217*** (0.0437)	0.101*** (0.00561)	0.177 (0.154)	0.0828 (0.119)	0.0844*** (0.0278)	0.0815*** (0.0119)
CF	0.958*** (0.272)	0.741*** (0.0695)	0.176 (0.333)	0.987*** (0.349)	0.615*** (0.136)	0.746*** (0.0604)
R&D ratio	-1.555*** (0.491)		0.521 (0.373)		-0.444 (0.344)	
SGR*RD ratio	-0.793*** (0.205)		-0.402 (0.608)		-0.0187 (0.132)	
CF*RD ratio	-1.643 (1.704)		2.069 (1.575)		1.206* (0.676)	
FA ratio		0.0448* (0.0257)		0.0635 (0.100)		0.0567 (0.0412)
SGR*FA ratio		-0.0574*** (0.0128)		0.142 (0.247)		-0.0275 (0.0212)
CF*FA ratio		0.795*** (0.171)		-0.634 (0.635)		0.174 (0.147)
Year dummies	yes	yes	yes	yes	yes	yes
Observations	2,129	66,793	514	1,486	3,373	34,945
Firms	439	17,964	87	251	1,172	10,193
R^2	0.244	0.387	0.275	0.135	0.110	0.130

Table 25: Results of hypothesis 6.5b – Euro area, Swiss and British investment regressions of firms with high R&D and fixed asset ratios

This table reports the results from the fixed effects (FE) investment regressions for firms highly engaged in R&D and fixed assets investments from the euro area, Switzerland, and Great Britain. The dependent variable is investment and the independent variables are cash flow (CF), sales growth (SGR), R&D ratio and fixed assets (FA) ratio and the respective interaction terms with the R&D and fixed assets dummies. Dummies as indicated in the table. R² is the within R² for FE regressions. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	RD large EUR	RD very large EUR	FA large EUR	RD large SWI	RD very large SWI	FA large SWI	RD large GB	RD very large GB	FA ratio large GB
	FE	FE	FE	FE	FE	FE	FE	FE	FE
SGR	0.179** (0.0886)	0.190*** (0.0492)	0.0886*** (0.00358)	0.0196 (0.121)	0.0875 (0.141)	0.157* (0.0858)	0.0644** (0.0293)	0.0843*** (0.0301)	0.0786*** (0.00964)
CF	1.196*** (0.363)	1.093*** (0.264)	0.954*** (0.0424)	0.393 (0.321)	0.597*** (0.203)	0.762*** (0.215)	0.721*** (0.157)	0.663*** (0.162)	0.798*** (0.0412)
R&D ratio	-1.610*** (0.375)	-1.516*** (0.412)		0.608 (0.390)	0.597 (0.378)		-0.348 (0.313)	-0.352 (0.315)	
SGR*RD ratio large	-0.0845 (0.105)			0.103 (0.148)			0.0343 (0.0530)		
CF*RD ratio large	-0.525 (0.414)			0.191 (0.435)			0.0234 (0.179)		
CGR*RD ratio very large		-0.155* (0.0813)			0.00425 (0.175)			-0.0104 (0.0563)	
CF*RD ratio very large		-0.663* (0.378)			-0.0677 (0.273)			0.188 (0.190)	
FA ratio			0.102*** (0.0238)			0.0256 (0.116)			0.0484 (0.0407)
SGR*FA ratio large			-0.0215*** (0.00514)			-0.0170 (0.135)			-0.0186 (0.0126)
CF*FA ratio large			0.226*** (0.0606)			-0.182 (0.253)			0.0435 (0.0671)
Year dummies	yes	yes	yes	yes	yes	yes	yes	yes	yes
Year dummies * R&D ratio	yes	yes		yes	yes		yes	yes	
Year dummies * FA ratio			yes			yes			yes
Observations	2,129	2,129	66,793	514	514	1,486	3,373	3,373	34,945
Firms	439	439	17,964	87	87	251	1,172	1,172	10,193
R ²	0.222	0.244	0.387	0.220	0.224	0.138	0.109	0.109	0.132

6. Discussion

The following discussion part is divided into two parts: First, potential caveats and shortcomings with regards to data analyzed, regressions formulated, and the interpretation of results will be discussed. Second, a number of macro-economic policy implications will be introduced and developed.

6.1. Limitations of regression results presented

6.1.1. Data quality

a) Firm-level data quality

The firm-level data have been gathered from Bureau van Dijk's (BvD) AMADEUS data base. While this is probably the only source for European firm financial data, and acknowledging that the BvD team is investing in quality control, the information present in the database has to be treated with caution.

By building ratios, plotting variables, and accounting for outliers (winsorizing), annual firm financial information drawn from AMADEUS have been double-checked. Still, due to the fact that financial information of European firms is included in AMADEUS from as late as the early 1990s, standard European accounting techniques cannot be assumed to have been in place. Even after the standardization of annual reporting rules, the same firm variable may have different abbreviations / codes in AMADEUS.

b) Measures of investor sentiment and economic conditions

The ESI (European Sentiment Index) has been introduced and explained in an earlier section. The limitations with regards to the index are twofold: First, on a single-country basis, it could be that the underlying indices (industrial confidence, services confidence etc.) are not answered / measured consistently and are subjectively biased. For example, the consumer confidence indicator measures "unemployment expectations". The unemployment expectations may be influenced by the social system, the family's role in society, and the

general economic conditions prevalent in the respective country analyzed. These factors are however highly heterogeneous across Europe and also include a cultural notion.

Second, as the ESI moves from a single- to a multi-country index, it becomes even more difficult to measure “one” European sentiment. This is why a single-country ESI value is used in all of the regressions. However, joint “Euro” regressions have been presented for all hypotheses, which may be including information highly impacted by diverging national sentiments prevalent at that point in time.

6.1.2. Regression framework

a) Unbalanced panel

The firm level data analyzed are highly skewed toward larger countries, i.e. Germany, France, Italy etc. This is due to the fact that larger economies consist of more (large and medium-sized) firms than smaller countries. As a consequence, “euro” regressions presented do not consist of the equal-size country / firm-level proportions, but will include more firm data from large European economies.

b) Time period analyzed

Due to the fact that AMADEUS data is only available from the early 1990, it is impossible to infer European investment regressions for more than 30 years. This stands in contrast to McLean and Zhao’s (2014) results, which are based on Compustat data ranging from 1965-2010.

The European regression results thus fall into a period marked by major economic changes: 1. The reunification of Germany and the access to Eastern European export markets, which led to a massive economic growth; 2. The introduction of the single European currency “euro”, which replaced 18 national currencies, placed increased importance on the European Central Bank and the Maastricht Treaty, and accelerated market integration across the continent; 3. The global financial crisis of 2008, which had (and continues to have) a negative

effect on firms, governments, and households in Europe (especially its peripheral member countries). All these macroeconomic effects should be kept in mind when interpreting the investment regression results.

c) Company sizes analyzed

The larger European economies are based on small- and medium-sized firms, which are often family-held and not publicly listed (e.g. Germany, Italy). The firm-level data extracted from AMADEUS and analyzed however consists of “very large” and “large” firms (as defined by BvD). Firstly, this allows for results that are comparable to McLean and Zhao’s (2014), who analyze firms with book values >10m\$ and who analyze share / debt issues, which are mostly found at (large) publicly listed companies. Secondly, the sheer amount of small- and medium-sized European firms in AMADEUS would have been challenging to process and analyze.

d) ESM regression framework

Hypothesis 5 compares firm regressions of companies incorporated in one of the ESM recipient countries (using the ESMyesTime dummy) to those of companies situated in one of the other 13 euro member countries. Thus, the data set analyzed encompasses all of the ca. 66k firm level observations. The regression results therefore contrast a business environment marked by the need for and the effect of ESM assistance to one in which no such program has been launched.

An alternative test setup encompasses only firm observations from ESM recipient countries and compares cash flow and q investment sensitivities before and after the onset of the program. The results of this alternative formulation can be found in the appendix (Tables 34 and 35). While the number of firm observations declines to ca. 9k, the same fundamental relations persist and similar conclusions can be drawn. However, due to the reduction in observations analyzed, there is a drop in the coefficient results` significance.

6.1.3. Interpretation of results

a) Unprecedented monetary policy actions

As stated under the “time period analyzed” section, a large part of the firm-level data have been gathered during a time of macro-economic turmoil. This has led the ECB, but also all other major central banks, to take unprecedented policy actions. Central banks have acquired large amounts of sovereign and private (business) debt - even company shares have been bought by central bank institutions. The aim behind these measures was to reduce the adverse effects of the financial sector on the “real economy”. This would have led to a worldwide recession encompassing sovereign, business, and household bankruptcies. The U.S. American TARP program or the European ESM / EFSF actions are examples of more targeted measures to lower the overall interest rate level and providing all market participants with sufficient liquidity. When interpreting the euro, but also the Swiss and the British investment regressions, this unique economic environment marked by insecurity and recession, should be kept in mind.

b) ESM program aid different across countries

The just-mentioned ESM program has taken on different forms across recipient countries. While the ESM fund has been established to acquire sovereign debt of troubled euro-member countries, which are unable to raise funds on the open market, the ESM has also operated differently. In Spain, for example, troubled banks have been provided directly with additional liquidity through the fund. While the “ESMyesTime” dummy flags all firm observations from a given country in the year ESM assistance started, there is no “quality” dummy. The quality of the assistance differs across countries, and so will the effect on bank lending, corporate borrowing, and investment.

c) Single European currency implications

Just the opposite of the ESM assistance is true for the ECB policy: There is no country-specific variation with regards to key interest rates, exchange rates, or bank regulation. Albeit this policy uniformity, the effect of central bank decisions on each of the 18 Euro member states will differ. The fact that different Euro economies will react differently to the same ECB measure will have an effect on national financing conditions and the economic environment influencing investment decisions.

6.2. Policy implications

6.2.1. Euro area considerations

The main problem that has become evident during the research is related to the euro area and ECB policy, namely that *“one size doesn’t fit all”*. An example of this is the ECB’s quantitative easing taking place since 2008 / 2009, which supports the euro area’s economic stability. ECB’s policy has led to lowered interest rates across the continent, providing especially troubled governments with access to continued funding at reasonable costs. Governments from Greece, Portugal, Spain, but also Italy, have re-accessed sovereign debt markets through programs like SMP, ESM, EFSF. Financial markets have further been “soothed” by the fact that the ECB is theoretically ready to implement OMT. This has effectively provided governments in the south of the EU with the financial means to continue public operations and with time to implement necessary economic and fiscal reforms. At the same time, “healthy” economies as the German, Austrian, and Dutch have also had the possibility to raise new sovereign debt at lower rates than before the crisis – even though the necessity may not have been as urgent as in the euro-periphery. This, in turn, has increased the economic imbalance within the euro area, with the “north” progressing and the “south” falling further behind.

However, there are two aspects that will hinder troubled countries from fully reviving to pre-crisis levels: The first aspect refers to the inability to re-balance the value of goods and services produced or imported through national exchange rates. This has been possible before the introduction of the euro as the only currency for 18 fundamentally different economies. For southern European goods to become competitive again, prices have to adjust downwards. This is not possible though, since all input factors are also denominated in Euro. Coupled with production processes lacking necessary R&D investment, goods are becoming increasingly uncompetitive, which in turn hinders economic recovery.

The second aspect refers to moral hazard: As long as sovereign debt rates stay low and as long as there is financial backing-up funded by all euro member countries (ESM, OMT), troubled governments will not pursue economic and fiscal reforms with focus and urgency. This has led to ongoing political conflicts within the group of euro member countries and has introduced involuntary dependencies between governments.

6.2.2. Corporate financing and investment

In order to re-ignite economic growth in some parts of the Euro-zone, more targeted measures focusing on firm investment are needed. The SMP / ESM has alleviated national financial systems from “toxic sovereign assets” and should have restored lending activities to the private sector. As pointed out by Blatter et al. (2018), many financial institutions are still holding “toxic assets” which inhibit them from issuing new credit. The solution should not lie in transferring these toxic assets to another European fund. Moral hazard problems associated with this option should not be underestimated. Rather, a financing bypass for corporations should be introduced. Firms with viable growth opportunities should not be forced to forgo these, but should be supported on an individual and targeted manner.

A connected question with regards to corporate investment is however linked to the pure existence of attractive investment opportunities. Providing necessary funding to firms is

important; providing a stable and fruitful economic environment is undoubtedly more important. The simple existence of “cheap” funding, as seen in the past years, has not resulted in increased investment. Many of the regression results presented earlier indicate that neither sufficient internal resources nor the unhindered access to external finance have led to increased investment. This reaction can be explained by “the big picture”: The economic environment is still marked by insecurity, remaining in a state of emergency with all market participants being dependent on unlimited and low-cost liquidity. The indebtedness prevalent in households, firms, and governments is still significantly increased. “Cheap money” postpones the bankruptcy of overly indebted insolvent agents. As described by the OECD (2017), zombie firms have emerged that crowd-out new growth and hinder other firms from accessing bank credit. As long as these zombies exist, it will be very difficult for non-zombie firms to ignite new growth and dissolve the overall economy’s dependence on central bank interventions. The magnitude of the 2008 / 2009 financial crisis has been reduced by central bank policy and has prevented economies around the world from going through a healthy process in which uncompetitive market participants are eliminated.

6.2.3. Facing the truth

There are two further conclusions from the latest global financial crisis, which are concerned with the way academic and political discussions are conducted.

The global financial crisis should be regarded as a warning to academic research. Despite econometric advances and detailed models, this event and its dimensions have come as a surprise to most researchers. This has to do with the most researchers’ focus as described by Caballero (2010). The author points out two important aspects of macroeconomic research: First, researchers have engaged in “fine-tuning” of econometric models, while not fully grasping the big picture. Second, policy makers relying on the faulty assumption of “understanding it all” could be basing their decision making on wrong assumptions.

This “surprise” and the financial crisis’ effects are however also linked to subsequent governmental and central bank actions, which could not have been forecasted by any model. There are several examples: 1. Banks extending credit to individuals with low- or no credit worthiness, subsequently bundling these “assets”, and selling them world-wide; 2. European governments extending default guarantees to other nation’s sovereign debt and engaging in unprecedented purchases of bonds (ESM); 3. Central banks lowering key interest rates to below-zero levels to “keep the system running”. These actions were not necessarily included in econometric models because they were either unthinkable (negative interest rates), or because they were actually forbidden by law (one government extending default guarantees for another one). Another example is the actual vs. assumed creation of liquidity. As described by Jakab and Kumhof (2015), private banks are the actual creators of additional liquidity, which stands in contrast to the deposit multiplier model proposed by traditional academia. The latter aspect underlines the importance of comparing theoretically derived assumptions with real-world developments.

The second conclusion is concerned with the way macroeconomic and fiscal public debate should be handled in the future. Political discussions in Europe over the past ten years have shown a tendency to be marked by finger pointing (“the south is x, the north is y”), to be overly simplistic in explaining interdependencies (“private banks have to be alleviated of their holdings of toxic assets for new credit to flow and economic growth to reignite”), and in proposing only “absolute” truths (“certain banks are too big to fail”; “there is no alternative to the euro being Europe’s single currency”). Especially the euro, which has been introduced as an European peace project and which serves as a common currency for 18 fundamentally different economies, should adhere to pluralistic, democratic, and fair rules and regulations respected by all member countries.

6.3. Future research

There are several possibilities for future research. First, instead of using investment as the dependent variable, employment growth may be used. This compares to the work of McLean and Zhao (2014) and would shed further light on the effectiveness of ECB's policy. Second, investment regressions for both pre- and post-crisis periods could be developed in the coming years. Third, a common critique with regards to the lowering of interest rates has been that the newly created liquidity has been used for unproductive investments, i.e. M&A and share buybacks. The relationship between the onset of QE programs and the rise of these "unproductive" activities could be further analyzed for European firms. Fourth, future operating performance of firms currently engaging and not engaging in investment activities could be compared in a couple of years to assess the productivity of current projects.

7. Conclusion

The past ten years have been marked by a severe global financial crisis. While the roots lay in the U.S. American real estate sector, turbulences soon spread to the financial / banking sector and the real economy. During the peak of the crisis, governments of all major industrialized nations faced roaring sovereign debt yields. A large variety of governmental and central bank policies was initiated, including the ESFS / ESM funds in the European Union. Further, key interest rates were lowered to previously unthought-of low levels. As a consequence, financial markets were flooded with unlimited liquidity. Due to the digital nature of modern finance, liquidity was created without actually increasing the monetary aggregate. So, while the consumer price indices remained relatively stable, the value of sovereign and corporate financial instruments (shares and bonds) increased significantly. Firms were thus provided with support from two sides: First, borrowing conditions improved dramatically as bank loans became available at nearly zero cost. Second, liquidity-flooded financial markets in search for productive investment were eager to buy firm shares and bonds.

This leads to the thesis' main research question, namely whether European firms used these favorable financing conditions to engage in increased corporate investment (fixed assets and R&D) to secure future competitiveness. Emerging from a severe global economic crisis that forced numerous companies to exit the market, an increased level of firm investment presents a rational and value-increasing use of "cheap finance".

Building on U.S. American evidence (McLean and Zhao, 2014), investment reacts positively to Tobin's q in a growing and optimistic business environment. Cash flow becomes an important driver of corporate investment in recessionary times. These two explanatory variables are used on a European firm data set comprising companies incorporated in one of the 18 Euro member countries. The European sub-set of euro-member countries is used to account for the fact that these economies are tied together by a common currency and thus by

the same ECB policy. The European results indicate that corporate investment in euro firms remains dependent on internal resources (cash flow), even in times of economic growth and good increased sentiment.

By further dissecting the data set according to corporate traits known to have an influence on financing conditions and investment decisions (size, age, form of incorporation etc.) , this thesis analyzes the accuracy and applicability of these traits to a European context. Corporate traits of financial dependence have the same effect on firm financing and investment as in the U.S..

To test for the effects of the unique assistance program ESM on corporate investment, a special ESM dummy is introduced in the regression framework. The results indicate that - despite targeted and powerful tools used to sooth international financial markets and provide countries with renewed access to bond finance - the effect on corporate investment has been mixed. Improved financial conditions may not have compensated for an economic environment marked by insecurity and recession. Rather, the influx of massive liquidity may have led to a situation in which de-facto insolvent companies are provided with the means to at least honor their debt obligations and keep business running (OECD, 2017). This conclusion follows especially from highly-indebted firm regression results: These firms' investment becomes significantly less dependent on internal resources. At the same time, there is no investment-inducing effect of sales growth / Tobin's q.

As pointed out by Blattner et al. (2018) financial institutions providing firms with additional leverage have an intrinsic interest to keep these zombies alive. As long as firms do not file for bankruptcy, their debt obligations may be kept in banks' balance sheets. Consequently having to write-off these loans may lead to severe financial turbulences in banks already damaged by the global financial crisis and stripped-off business opportunities by generally lowered interest rate levels.

While lowered key interest rates have had a calming effect on financial markets and the real economy, corporate investment has not sparked as a response to this liquidity rush. At the same time however, a market cleaning by firms bankruptcies has not occurred: corporate zombies have emerged that crowd out healthy firms in need for financing to fund value-increasing corporate investments.

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9. Appendix

Table 26: Results of hypothesis 4a – investment sensitivity to absolute R&D and fixed assets ratio

This table reports the results from the random effects (RE) and fixed effects (FE) investment regressions for firms from the euro area. The dependent variable is investment and the independent variables are cash flow (CF), sales growth (SGR), and the respective interaction terms with the absolute R&D and fixed assets (FA) ratios. Dummies as indicated in the table. R^2 is the overall R^2 for RE regressions. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)
	RD Ratio	RD Ratio	FA Ratio	FA Ratio
	RE	FE	RE	FE
SGR	0.263*** (0.0163)	0.217*** (0.0437)	0.101*** (0.00109)	0.101*** (0.00561)
CF	0.309*** (0.0791)	0.958*** (0.272)	0.444*** (0.0225)	0.741*** (0.0695)
R&D ratio	0.211* (0.108)	-1.555*** (0.491)		
SGR*RD Ratio	-0.753*** (0.0892)	-0.793*** (0.205)		
CF*RD Ratio	0.514 (0.497)	-1.643 (1.704)		
FA Ratio			-0.0536*** (0.00656)	0.0448* (0.0257)
SGR*FA ratio			-0.0518*** (0.00238)	-0.0574*** (0.0128)
CF*FA ratio			0.510*** (0.0504)	0.795*** (0.171)
Industry dummies (3-digit)	yes		yes	
Year dummies	yes	yes	yes	yes
Country dummies	yes		yes	
Observations	2,129	2,129	66,793	66,793
Firms	439	439	17,964	17,964
R^2	0.215	0.244	0.330	0.387

Table 27: Results of hypothesis 6.1 – Euro area, Swiss and British “private” country-specific regressions

This table reports the results from the fixed effects (FE) country-specific investment regressions for private firms from the euro area, Switzerland, and Great Britain. The dependent variable is investment and the independent variables are cash flow (CF), sales growth (SGR), and respective interaction terms with the private dummy. EUR = euro area, SWI = Switzerland, GB = Great Britain. R² is the overall R² for RE regressions. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	(1) private EUR RE	(2) private SWI RE	(3) private & small SWI RE	(4) private & large SWI RE	(5) private GB RE	(6) private & small GB RE	(7) private & large GB RE
SGR	0.154*** (0.00538)	0.229*** (0.0243)	0.159*** (0.0297)	0.555*** (0.0507)	0.0978*** (0.00546)	0.0803*** (0.00950)	0.0924*** (0.00709)
CF	0.356*** (0.0334)	0.0770 (0.0726)	-0.128 (0.0959)	0.330*** (0.114)	0.440*** (0.0378)	0.247*** (0.0561)	0.532*** (0.0524)
SGR*PRIV	-0.0750*** (0.00540)	0.0762* (0.0417)	0.120** (0.0538)	-0.213*** (0.0755)	-0.00646 (0.00592)	-0.0102 (0.00992)	0.00392 (0.00785)
CF*PRIV	0.314*** (0.0342)	0.141 (0.103)	0.136 (0.137)	0.244 (0.170)	0.0825** (0.0392)	0.277*** (0.0575)	0.0657 (0.0550)
Industry dummies (3-digit)	yes	yes	yes	yes	yes	yes	yes
Year dummies	yes	yes	yes	yes	yes	yes	yes
Country dummies	yes						
Year dummies * private dummy	yes	yes	yes	yes	yes	yes	yes
Observations	66,800	1,493	703	790	34,988	16,449	18,539
Firms	17,968	253	139	135	10,203	6,024	5,351
R ²	0.331	0.156	0.142	0.277	0.126	0.153	0.117

Table 28: Results of hypothesis 6.2 – Euro area, Swiss and British “young” country-specific regressions

This table reports the results from the fixed effects (FE) country-specific investment regressions for young firms from the euro area, Switzerland, and Great Britain. The dependent variable is investment and the independent variables are cash flow (CF), sales growth (SGR), and respective interaction terms with the young1950 or young2000 dummy. EUR = euro area, SWI = Switzerland, GB = Great Britain. R² is the overall R² for RE regressions. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
	young 1950	young 2000	young 1950	young 2000	young 1950	young 2000
	EUR	EUR	SWI	SWI	GB	GB
	RE	RE	RE	RE	RE	RE
SGR	0.0864*** (0.00298)	0.0824*** (0.000618)	0.496*** (0.0553)	0.249*** (0.0231)	0.156*** (0.0161)	0.0998*** (0.00419)
CF	0.585*** (0.0451)	0.621*** (0.0148)	0.224* (0.128)	0.135** (0.0675)	0.507*** (0.0570)	0.592*** (0.0200)
SGR*Y1950	-0.00743** (0.00302)		-0.275*** (0.0590)		-0.0655*** (0.0163)	
CF*Y1950	0.0602 (0.0459)		-0.108 (0.136)		0.00496 (0.0579)	
SGR*Y2000		-0.00833*** (0.000995)		-0.0126 (0.0456)		-0.0121** (0.00489)
CF*Y2000		0.0597** (0.0234)		0.145 (0.134)		-0.134*** (0.0247)
Industry dummies (3-digit)	yes	yes	yes	yes	yes	yes
Year dummies	yes	yes	yes	yes	yes	yes
Country dummies	yes	yes				
Year dummies * young dummy	yes	yes	yes	yes	yes	yes
Observations	62,766	62,766	1,493	1,493	34,981	34,981
Firms	17,010	17,010	253	253	10,202	10,202
R ²	0.330	0.332	0.165	0.157	0.126	0.128

Table 29: Results of hypothesis 6.3 – Euro area, Swiss and British “small” country-specific regressions

This table reports the results from the fixed effects (FE) country-specific investment regressions for small firms from the euro area, Switzerland, and Great Britain. The dependent variable is investment and the independent variables are cash flow (CF), sales growth (SGR), and respective interaction terms with the small dummy. EUR = euro area, SWI = Switzerland, GB = Great Britain. R² is the overall R² for RE regressions. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	(1) Small EUR RE	(2) Small SWI RE	(3) Small GB RE
SGR	0.0820*** (0.000598)	0.448*** (0.0419)	0.104*** (0.00266)
CF	0.815*** (0.0157)	0.356*** (0.102)	0.549*** (0.0166)
SGR*SMALL	-0.00824*** (0.000983)	-0.263*** (0.0473)	-0.0353*** (0.00450)
CF*SMALL	-0.321*** (0.0200)	-0.346*** (0.117)	-0.0632*** (0.0223)
Industry dummies (3-digit)	yes	yes	yes
Year dummies	yes	yes	yes
Country dummies	yes		yes
Year dummies * small dummy	yes	yes	yes
Observations	66,800	1,493	34,988
Firms	17,968	253	10,203
R ²	0.328	0.183	0.130

Table 30: Results of hypothesis 6.4a – Euro area, Swiss and British country-specific regressions with absolute debt ratio

This table reports the results from the fixed effects (FE) country-specific investment regressions for firms from the euro area, Switzerland, and Great Britain. The dependent variable is investment and the independent variables are cash flow (CF), sales growth (SGR), the absolute debt ratio and respective interaction terms with the debt ratio dummy. EUR = euro area, SWI = Switzerland, GB = Great Britain. R² is the overall R² for RE regressions. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	(1) debt ratio EUR RE	(2) debt ratio SWI RE	(3) debt ratio GB RE
SGR	0.0741*** (0.00158)	0.431*** (0.0512)	0.0948*** (0.00507)
CF	0.583*** (0.0321)	0.182 (0.121)	0.540*** (0.0296)
DR	0.161*** (0.00704)	0.158*** (0.0347)	0.107*** (0.00927)
SGR*DR	0.00693*** (0.00237)	-0.312*** (0.0820)	-0.00732 (0.00783)
CF*DR	0.327*** (0.0515)	-0.0509 (0.231)	0.0388 (0.0534)
Industry dummies (3-digit)	yes	yes	yes
Year dummies	yes	yes	yes
Country dummies	yes		
Observations	65,703	1,477	31,676
Firms	17,776	250	9,576
R ²	0.340	0.168	0.126

Table 31: Results of hypothesis 6.4b – Euro area, Swiss and British “highly indebted” country-specific regressions

This table reports the results from the fixed effects (FE) country-specific investment regressions for highly indebted firms from the euro area, Switzerland, and Great Britain. The dependent variable is investment and the independent variables are cash flow (CF), sales growth (SGR), the absolute debt ratio and respective interaction terms with the high debt ratio dummy. EUR = euro area, SWI = Switzerland, GB = Great Britain. R² is the overall R² for RE regressions. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	(1) debt ratio large EUR RE	(2) debt ratio large SWI RE	(3) debt ratio large GB RE
SGR	0.0791*** (0.000626)	0.274*** (0.0305)	0.0963*** (0.00330)
CF	0.712*** (0.0156)	0.141* (0.0731)	0.534*** (0.0169)
DR	0.168*** (0.00777)	0.116** (0.0474)	0.0779*** (0.0115)
SGR*DR_large	-0.00127 (0.000953)	-0.0260 (0.0404)	-0.0116** (0.00461)
CF*DR_large	0.153*** (0.0229)	0.0956 (0.120)	0.0756*** (0.0268)
Industry dummies (3-digit)	yes	yes	yes
Year dummies	yes	yes	yes
Country dummies	yes		
Year dummies * high debt dummy	yes	yes	yes
Observations	67,180	1,477	31,676
Firms	18,026	250	9,576
R ²	0.341	0.172	0.127

Table 32: Results of hypothesis 6.5a – Euro area, Swiss and British investment regressions with absolute R&D and fixed assets ratio

This table reports the results from the random effects (RE) and fixed effects (FE) investment regressions for firms from the euro area, Switzerland, and Great Britain highly engaged in R&D and fixed assets investments. The dependent variable is investment and the independent variables are cash flow (CF), sales growth (SGR), and the respective interaction terms with the absolute R&D and fixed assets (FA) ratios. Dummies as indicated in the table. R² is the overall R² for RE regressions. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
	RD ratio	FA ratio	RD ratio	FA ratio	RD ratio	FA ratio
	EUR	EUR	SWI	SWI	GB	GB
	RE	RE	RE	RE	RE	RE
SGR	0.263*** (0.0163)	0.101*** (0.00109)	0.261*** (0.0338)	0.228*** (0.0383)	0.110*** (0.0109)	0.113*** (0.00420)
CF	0.309*** (0.0791)	0.444*** (0.0225)	-0.0421 (0.0960)	0.372*** (0.122)	0.316*** (0.0485)	0.365*** (0.0207)
R&D ratio	0.211* (0.108)		0.661*** (0.111)		0.596*** (0.0554)	
SGR*RD ratio	-0.753*** (0.0892)		-0.590*** (0.165)		-0.0737 (0.0529)	
CF*RD ratio	0.514 (0.497)		1.638*** (0.508)		0.502** (0.201)	
FA ratio		-0.0536*** (0.00656)		-0.00384 (0.0320)		-0.0543*** (0.00777)
SGR*FA ratio		-0.0518*** (0.00238)		0.0379 (0.0684)		-0.0413*** (0.00708)
CF*FA ratio		0.510*** (0.0504)		-0.485** (0.225)		0.363*** (0.0438)
Industry dummies (3-digit)	yes	yes	yes	yes	yes	yes
Year dummies	yes	yes	yes	yes	yes	yes
Country dummies	yes	yes				
Observations	2,129	66,793	514	1,486	3,373	34,948
Firms	439	17,964	87	251	1,171	10,191
R ²	0.215	0.330	0.372	0.151	0.250	0.128

Table 33: Results of hypothesis 6.5b – Euro area, Swiss and British investment regressions of firms with high R&D and fixed asset ratios

This table reports the results from the fixed effects (FE) investment regressions for firms highly engaged in R&D and fixed assets investments from the euro area, Switzerland, and Great Britain. The dependent variable is investment and the independent variables are cash flow (CF), sales growth (SGR), R&D ratio and fixed assets (FA) ratio and the respective interaction terms with the R&D and fixed assets dummies. Dummies as indicated in the table. R² is the overall R² for RE regressions. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	RD large EUR	RD very large EUR	FA large EUR	RD large SWI	RD very large SWI	FA large SWI	RD large GB	RD very large GB	FA ratio large GB
	RE	RE	RE	RE	RE	RE	RE	RE	RE
SGR	0.246*** (0.0262)	0.252*** (0.0158)	0.0908*** (0.000710)	0.152*** (0.0439)	0.213*** (0.0373)	0.258*** (0.0265)	0.117*** (0.0138)	0.132*** (0.0126)	0.107*** (0.00337)
CF	0.522*** (0.112)	0.524*** (0.0796)	0.565*** (0.0150)	-0.00302 (0.133)	0.0805 (0.107)	0.260*** (0.0761)	0.418*** (0.0698)	0.394*** (0.0568)	0.452*** (0.0159)
R&D ratio	-0.178 (0.111)	-0.109 (0.121)		0.618*** (0.0891)	0.649*** (0.0941)		0.681*** (0.0431)	0.666*** (0.0458)	
SGR*RD ratio large	-0.0965*** (0.0291)			0.0481 (0.0580)			-0.0270 (0.0187)		
CF*RD ratio large	-0.260** (0.128)			0.152 (0.165)			-0.0997 (0.0840)		
CGR*RD ratio very large		-0.182*** (0.0239)			-0.0757 (0.0575)			-0.0673*** (0.0188)	
CF*RD ratio very large		-0.377*** (0.112)			0.0870 (0.157)			-0.0863 (0.0813)	
FA ratio			-0.0211*** (0.00741)			-0.115*** (0.0431)			-0.0422*** (0.0103)
SGR*FA ratio large			-0.0206*** (0.000952)			-0.0157 (0.0403)			-0.0250*** (0.00438)
CF*FA ratio large			0.177*** (0.0223)			-0.315*** (0.115)			0.128*** (0.0253)
Industry dummies (3-digit)	yes	yes	yes	yes	yes	yes	yes	yes	yes
Year dummies	yes	yes	yes	yes	yes	yes	yes	yes	yes
Country dummies	yes	yes	yes						
Year dummies *R&D ratio / FA ratio	yes	yes	yes	yes	yes	yes	yes	yes	yes
Observations	2,129	2,129	66,793	514	514	1,486	3,371	3,371	34,948
Firms	439	439	17,964	87	87	251	1,171	1,171	10,191
R ²	0.206	0.226	0.331	0.312	0.322	0.159	0.258	0.258	0.129

Table 34: Results of hypothesis 5 –investment of (financially dependent) firms from ESM recipient countries only

This table reports the results from the random effects (RE) and fixed effects (FE) investment regressions for firms from ESM recipient countries. The dependent variable is investment and the independent variables are cash flow (CF), sales growth (SGR), and multiple interaction terms with the “ESMyesTime” dummy and dummies indicating financial dependence. ESMyesTime marks all firm level observations after the onset of the ESM program. ESM countries analyzed within this data set are Spain, Greece, and Portugal solely. R2 is the overall R2 for RE and the within R2 for FE regressions. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
	all	all	private	private	small	small
	RE	FE	RE	FE	RE	FE
SGR	0.0726*** (0.00309)	0.0640*** (0.0158)	0.104*** (0.00764)	0.118*** (0.0149)	0.0750*** (0.00340)	0.0685*** (0.0183)
CF	0.750*** (0.0397)	1.092*** (0.136)	0.539*** (0.133)	1.226*** (0.240)	0.866*** (0.0501)	1.221*** (0.185)
SGR* ESMyesTime	-0.0320*** (0.00595)	-0.0448** (0.0203)	-0.00658 (0.0201)	-0.148*** (0.0346)	-0.0279*** (0.00736)	-0.0406 (0.0295)
CF* ESMyesTime	-0.164*** (0.0544)	-0.0962 (0.0955)	-0.133 (0.158)	-0.0405 (0.186)	-0.245*** (0.0670)	-0.150 (0.115)
SGR*PRIV			-0.0382*** (0.00835)	-0.0638*** (0.0220)		
CF*PRIV			0.230* (0.136)	-0.127 (0.241)		
SGR*ESMyesTime*PRIV			-0.0234 (0.0210)	0.117*** (0.0409)		
CF*ESMyesTime*PRIV			-0.0495 (0.157)	-0.0664 (0.182)		
PRIV			-0.0154 (0.0128)	0.0130 (0.0224)		
SGR*SMALL					-0.0163** (0.00802)	-0.0227 (0.0297)
CF*SMALL					-0.218*** (0.0671)	-0.282 (0.201)
SGR*ESMyesTime*SMALL					-0.00119 (0.0131)	0.00462 (0.0402)
CF*ESMyesTime*SMALL					0.160** (0.0709)	0.0760 (0.0940)
SMALL					-0.00585 (0.00685)	-0.0342* (0.0202)
Industry dummies (3-digit)	yes		yes		yes	
Year dummies	yes	yes	yes	yes	yes	yes
Country dummies	yes		yes		yes	
Year dummies *ESMyesTime	yes	yes	yes	yes	yes	yes
Observations	9,913	9,913	9,913	9,913	9,913	9,913
Firms	2,962	2,962	2,962	2,962	2,962	2,962
R ²	0.134	0.150	0.138	0.156	0.137	0.156

Table 35: Results of hypothesis 5 –investment of (financially dependent) firms from ESM recipient countries only (continued)

This table reports the results from the random effects (RE) and fixed effects (FE) investment regressions for firms from ESM recipient countries. The dependent variable is investment and the independent variables are cash flow (CF), sales growth (SGR), and multiple interaction terms with the “ESMyesTime” dummy and dummies indicating financial dependence. ESMyesTime marks all firm level observations after the onset of the ESM program. ESM countries analyzed within this data set are Spain, Greece, and Portugal solely. R2 is the overall R2 for RE and the within R2 for FE regressions. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	(7)	(8)	(9)	(10)	(11)	(12)
	young	young	young	young	debt ratio	debt ratio
	1950	1950	2000	2000	large	large
	RE	FE	RE	FE	RE	FE
SGR	0.0241 (0.0197)	0.364*** (0.112)	0.124*** (0.00495)	0.119*** (0.0328)	0.0446*** (0.00766)	0.0302 (0.0209)
CF	0.445*** (0.121)	0.242 (0.422)	0.710*** (0.0493)	1.020*** (0.186)	0.738*** (0.0490)	0.975*** (0.156)
SGR* ESMyesTime	0.151*** (0.0410)	-0.0325 (0.148)	-0.0282** (0.0113)	-0.0783* (0.0412)	-0.00979 (0.0107)	-0.0277 (0.0256)
CF* ESMyesTime	-0.313** (0.143)	-0.104 (0.158)	-0.192*** (0.0629)	-0.0584 (0.106)	-0.0966* (0.0583)	-0.00550 (0.0918)
SGR*Y1950	0.0485** (0.0199)	-0.302*** (0.113)				
CF*Y1950	0.376*** (0.126)	0.979** (0.441)				
SGR*ESMyesTime*Y1950	-0.186*** (0.0415)	-0.0167 (0.149)				
CF*ESMyes Time*Y1950	0.108 (0.142)	-0.0265 (0.154)				
Y1950	-0.0172 (0.0154)					
SGR*Y2000			-0.0881*** (0.00636)	-0.0898** (0.0353)		
CF*Y2000			0.166** (0.0770)	0.209 (0.240)		
SGR*ESMyesTime*Y2000			0.0111 (0.0133)	0.0495 (0.0461)		
CF*ESMyesTime*Y2000			-0.0507 (0.0799)	-0.103 (0.117)		
Y2000			0.0290*** (0.00781)		0.0297*** (0.00833)	0.0381 (0.0274)
SGR*DR_large					0.302*** (0.0678)	0.497** (0.206)
CF*DR_large					-0.0216* (0.0131)	0.000514 (0.0382)
SGR*ESMyesTime*DR_large					-0.243*** (0.0781)	-0.410*** (0.134)
CF*ESMyes Time*DR_large					0.0499*** (0.00655)	0.0298* (0.0164)
DR_large					0.0446*** (0.00766)	0.0302 (0.0209)
Industry dummies (3-digit)	yes		yes		yes	
Year dummies	yes	yes	yes	yes	yes	yes
Country dummies	yes		yes		yes	
Year dummies *ESMyesTime	yes	yes	yes	yes	yes	yes
Observations	8,940	8,940	8,940	8,940	9,790	9,790
Firms	2,671	2,671	2,671	2,671	2,946	2,946
R2	0.139	0.161	0.162	0.169	0.161	0.168