Banking Crises and Cash Holdings

Evidence from regulated and unregulated Industries

DISSERTATION

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Science is the first expression of punk, because it doesn't advance without challenging authority. It doesn't make progress without tearing down what was there before and building upon the structure.

Greg Graffin

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Abbreviations

ADR	**A**merican **D**epository **R**eceipts.
AEX	**A**msterdam **Ex**change Index.
ATHEX	**Ath**ens Stock **Ex**change.
ATX	**A**ustrian **T**raded Inde**x**.
BEL 20	**Bel**gian **20** Index.
BETI	**B**ucharest **E**xchange **T**rading **I**ndex
CFO	**C**hief **F**inancial **O**fficer.
CROBEX	**Cro**atia Zagre**b** Stock **Ex**change.
CYFT	**Cy**prus/**FT**SE Top 20.
DAX	***D**eutscher **A**ktien Inde**x**.*
Diff	**Diff**erence.
EPRA	**E**uropean **P**ublic **R**eal **E**state **A**ssociation.
EWS	**E**arly **W**arning **S**ignal.
FRED	**F**ederal **R**eserve **E**conomic **D**atabase.
FTSE MIB	**F**inancial **T**imes **S**tock **E**xchange and ***M**ilano **I**talia **B**orsa.*
GDP	**G**ross **D**omestic **P**roduct.
GICS	**G**lobal **I**ndustry **C**lassification **S**tandard.
IBEX 35	**Ibe**ria Inde**x** **35**.
ICB	**I**ndustry **C**lassification **B**enchmark.
ISEQ 20	**I**rish **S**tock **E**xchange Overall **20**.
CAC 40	***C**otation **A**ssistée en **C**ontinu* **40**.
Obs	**Obs**ervations.
OBX	***O**slo **B**ørs* Inde**x**.
OMX	*Aktiebolaget **O**ptionsmäklarna*/Helsinki Stock E**x**change.
OMXC 20	**OMX** **C**openhagen **20**.

OMXH 25	**OMX H**elsinki **25**.
OMXS 30	**OMX S**tockholm **30**.
PSI 20	**P**ortuguese **S**tock **I**ndex **20**.
M1	**M**oney stock (sub-set 1).
M2	**M**oney stock (sub-set 2).
MSCI	**M**organ **S**tanley **C**apital **I**nternational.
NAICS	**N**orth **A**merican **I**ndustry **C**lassification **S**ystem.
NAREIT	**N**orth **A**merican **R**eal **E**state **I**nvestment **T**rust.
NPV	**N**et **P**resent **V**alue.
REIT	**R**eal **E**state **I**nvestment **T**rust.
RR	**R**einhardt and **R**ogoff.
SBI TOP	**S**lovenian **B**lue-Chip **I**ndex TOP.
SEC	United States **S**ecurities and **E**xchange **C**ommission.
SIC	**S**tandard **I**ndustrial **C**lassification.
SGX	**S**ingapore **Ex**change.
SMI	**S**wiss **M**arket **I**ndex.
S&P's	**S**tandard & **P**oor's.
TSE	**T**okyo **S**tock **E**xchange.
WIG	***W**arszawski **I**ndeks **G**iełdowy.*

Chapter 1

Introduction

This study examines to what extent a banking crisis and the ensuing potential liquidity shortage affect corporate cash holdings. Specifically, how do firms adjust their liquidity management prior to and during a banking crisis when they are restricted in their financing options? These restrictions might not result from firm-specific characteristics but also incorporate the effects of certain regulatory requirements.

The relevant literature may be divided into two broader fields: On the one hand, there is a large body of literature on crisis detection via early warning signals and on the consequences of a crisis on the economy (Demirgüç-Kunt and Detragiache, 1998, Kaminsky and Reinhart, 1999, Reinhart and Rogoff, 2014, among others). These studies focus on aggregated effects such as output reduction in an economy or costs of a crisis as a fraction of GDP. On the other hand, there are several empirical studies that use single crisis events, such as the sub-prime crisis, to analyse their effects on investments, dividend policies and corporate cash holdings (Duchin et al., 2010, Campello et al., 2010, Kahle and Stulz, 2013, Bliss et al., 2015, among others). To the best of my knowledge, the literature has so far not analysed the connection between early warning signals and the management of corporate cash holdings. Further, there seems to be no research on the interaction of an early warning signal and the actual occurrence of a banking crisis on corporate liquidity. In addition, research on corporate cash holdings predominantly focuses on non-regulated industries, ignoring possible effects of external restrictions.

The objective is to combine these fields: I analyse the real effects of indicators of a potential crisis and the occurrence of a crisis event on corporate cash holdings for both unregulated and regulated firms from 31 different countries. In contrast to existing studies, I perform this analysis on the basis of a long observation period (1997 to 2014 respectively 2003 to 2014) using multiple early warning signals and multiple crisis events. For regulated firms, this study makes use of a unique sample of country-specific regulatory information, which is collected by hand for 15 countries and converted into an ordinal scale based on the severity of the regulation. Regulated firms are selected from a single industry: Real Estate Investment Trusts (henceforth: REIT). These firms invest in real estate properties and let these properties to third parties. REITs that comply with the aforementioned regulations are exempt from income taxation and are punished for a breach, which makes this industry particularly interesting for the analysis of capital structure decisions.

To derive testable predictions, I develop a simple conceptional framework where firms can observe two types of signals. The first signal indicates an upcoming banking crisis whereas the second signal indicates the actual occurrence of a banking crisis and the resulting liquidity shortage for firms. It is assumed that firms hedge against future liquidity shortages to secure their going concern by adjusting their cash holdings. Firms differ in their flexibility to obtain or secure external funding, thereby creating four information scenarios: (1) A firm does not observe a signal. The question is whether a more constraint or more tightly regulated firm holds higher levels of cash in the absence of crisis relevant information. (2) Only the first signal is observed. Do firms increase precautionary savings when a liquidity shortage is expected? (3) Only the second signal is observed. How do financially inflexible firms react to a liquidity shortage? (4) Firms observe both signals. Is there a joint effect in case a banking crisis is preceded by an early warning signal? Empirical results are derived from an univariate test setting as well as from panel regressions controlling for firm-, country-, industry- and regulation-specific effects.

My dissertation is structured as follows: Chapter 2 provides a brief literature review and is divided into two sections. The first one discusses the theoretical and empirical literature on corporate cash holdings. The second section covers the literature on early warning signals, crisis identification as well as the impact of banking crises on the real economy. In Chapter 3, I analyse the effect of financing constraints on cash holdings prior to and during a banking crisis by means of an empirical study of publicly traded firms from Europe and the US. Chapter 4 uses a closely related framework but focuses on a regulated industry during times of crises. Chapter 5 concludes. Appendix A (B) provides additional information on Chapter 3 (4).

Chapter 2

Literature Review

2.1 Capital Structure Theory: Corporate Cash Holding

The following chapter will give a brief synopsis of theoretical and empirical capital structure research focusing on corporate cash holdings. Major advances in the academic literature will be covered while others will be mentioned only in brief. The content of this chapter is structured as follows. At first, I will discuss early theoretical advances. Some articles are not directly linked to corporate cash holdings but provide meaningful implications under certain assumptions, e. g. cash is negative debt. Every theoretical approach is accompanied by a summary of implications. This subsection is followed by empirical research on financing constraints and a display of determinants of corporate cash holdings. The latter is further structured in three different sub areas: (1) Micro-level: company characteristics, (2) Macro-level: legal framework, and (3) Meso-level: public vs. private firms. These sub areas are mainly based on the determinants of two articles: Kim et al. (1998) and Opler et al. (1999).

2.1.1 Early Theoretical Work

Keynes (1936) identifies three motives for the accumulation of cash holdings: the transaction motive, precautionary motive and speculative motive. The transaction motive arises from the need for liquidity to undertake current business transactions (Keynes, 1936). For example, a company sells produced goods. The production process itself generates an outflow of money and the sale a larger inflow. In- and outflow are usually not perfectly synchronised in amount and date. A company has to hold cash prior to the production to bridge this gap.

According to the second motive, companies tend to keep additional liquidity to protect themselves against unexpected negative future events, i. e. uncertainty in future cash flows. Hence, one would expect that an increase in cash flow volatility leads to an increase of cash holdings as a precautionary measure (Kim et al., 1998, Opler et al., 1999).

Companies hold cash for speculative reasons to realise future investment opportunities. This motive arises from "[...] [their objective] of securing profit from knowing better than the market what the future will bring forth" (Keynes, 1936, 108-109).

Transaction Cost of Cash

Baumol (1952) uses an inventory-based static approach to determine an optimal amount of cash holdings.[1] In principle, the costs and benefits of holding cash are modelled in a simplified way. Cash outflows (or transactions) are predictable and "[...] occur in *steady stream*" (Baumol, 1952, 545). In addition, cash inflows are known and regular. To finance a future outflow, the rational decider has two options: (1) to borrow external funds or (2) to withdraw funds from an investment, i. e. turn marketable securities into cash. Each withdrawal (bank or sale of assets) triggers a fixed charge and, in both cases, the cost of interest is assumed to be constant per monetary unit per year. The cost of interest can be seen as a foregone yield (opportunity costs). Hence, there is a trade-off between the cost of holding cash and the cost of withdrawing cash from the bank account. For example, a company needs a certain amount of money to finance their day-to-day operations. It can withdraw the full amount (less transaction costs) and therefore have higher costs for holding money; or increase the frequency of transactions and have lower opportunity costs.

[1] See Tobin (1956) for a closely related theoretical model.

The model of Miller and Orr (1966) has a similar objective with a few modified assumptions. A company has two types of assets: cash and marketable securities. Unlike Baumol (1952)'s approach, the cash flows are assumed to be completely stochastic. In addition, the cash balance can fluctuate in both directions. In Baumol (1952)'s model, the cash balance only has a steady outflow between two points in time. The transfer between two accounts still costs a fixed fee and can take place instantaneously. Miller and Orr (1966) restrict the cash balance to a minimal amount of zero. Bank overdrafts are ruled out. "[E]ven firms with open lines of credit must go through the formality (and expense) of a transfer to the cash balance before an overdrawn check will be cleared" (Miller and Orr, 1966, 418). Both models determine the optimal amount of cash by minimizing the cost for holding cash. Following Figure 2.1, the optimal cash balance

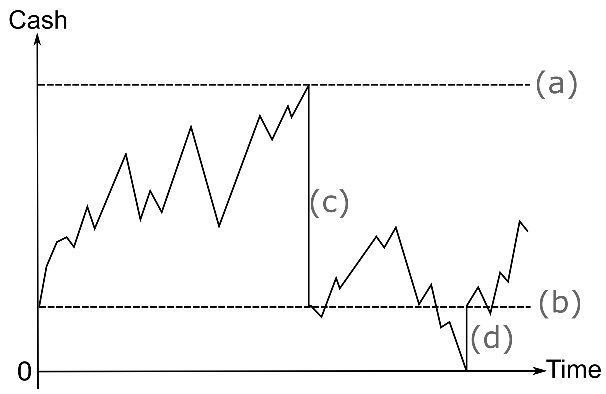


FIGURE 2.1: Adapted from Miller and Orr (1966): Volatile cash holdings over time.

fluctuate between (a) and (b). If the cash balance moves below the lower dashed line (b), additional liquidity will be supplied (d). In case the upper bound (a) has been reached, the amount (a) minus (b) will be transferred from the cash account to interest bearing securities (c). Under the given assumptions, the two models have the following implications for corporate cash holdings:

(1) According to Baumol (1952), there is an optimal amount of cash holdings which is not zero as long as a company has ongoing operations.

(2) Following Baumol (1952) and Miller and Orr (1966), the cost of interest should be higher for firms with higher investment opportunities.[2]

[2] According to Bates et al. (2009), these firms value cash higher. They find that possible costs associated with being financially constrained are higher for firms with higher investment opportunities.

(3) (Miller and Orr, 1966): The expected total transaction cost will be higher for more volatile future cash flows. In order to limit the total transaction cost, the lower bound (b) will be higher. (Keynes, 1936, Kim et al., 1998).

Trade-off Model

Kraus and Litzenberger (1973) develop a model to determine the optimal capital structure by introducing an additional market friction to the Modigliani and Miller (1958, 1963) framework. In Modigliani and Miller (1958), perfect capital markets are assumed. As a consequence, the value of a firm is independent of its capital structure. Modigliani and Miller (1963) extend their previous approach introducing corporate taxes. They find that the value of a company increases in its debt-level because of the tax benefit of debt, i. e. a positive monotonic relationship follows. Kraus and Litzenberger (1973) adjust this approach further by incorporating the expected cost of insolvency. Hence, there is a trade-off between tax benefits and the expected cost of insolvency. For clarification, see Figure 2.2: (a) is Modigliani and Miller (1958); (b) is Modigliani and Miller (1963); (c) is Kraus and Litzenberger (1973) and the black dot shows the optimal ratio of debt to equity. The distance between (a) and (b) marks the tax advantage of debt and between (b) and (c) marks the disadvantage from possible costs of insolvency.

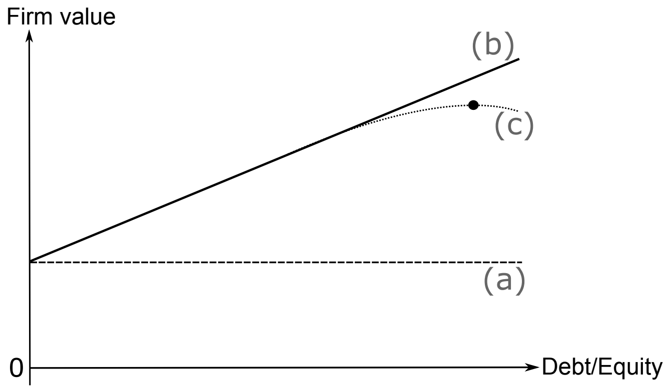


Figure 2.2: Adapted from Modigliani and Miller (1958, 1963), Kraus and Litzenberger (1973): Capital structure and firm value.

Opler et al. (1999) employ the framework of Kraus and Litzenberger (1973) to determine an optimal amount of cash holdings. Yet, Opler et al. (1999) compare the marginal benefit of holding one monetary unit of cash to its marginal costs. As benefits, they list lower total transaction costs (external finance), lower cost "[...] through the liquidation of assets, dividend cuts, and renegotiations" (Opler et al., 1999, 9). Marginal costs are foregone yields from investments and a missed tax advantage from debt financing.

The direct and indirect implications of the trade-off theory on corporate cash holdings can be summarised as follows:

(1) Following Modigliani and Miller (1958, 1963), the composition of a company's capital structure is irrelevant, and cash and debt are perfect substitutes. Hence, there is no unique solution for an optimal level of cash. Companies can borrow at any point in time to finance projects if and only if their net present value (NPV) is positive.

(2) According to Kraus and Litzenberger (1973), riskier firms should have a lower debt ratio.[3]

(3) Following Opler et al. (1999), higher taxation of interest payments should lead to lower cash holdings. Taxation of interest payments would cause additional costs for larger cash reserves. According to Opler et al. (1999), liquid assets will be taxed at two levels: first, while holding cash and second, when generating income for shareholders.[4]

(4) Based on Opler et al. (1999), cash holdings should be higher for financially constrained firms with a large number of profitable investment opportunities (Denis and Sibilkov, 2010).

(5) According to Opler et al. (1999), companies with difficulties accessing external funding tend to have larger cash reserves.[5]

[3] Gao et al. (2013) find a (weak) negative relationship between cash flow volatility and leverage for public and private firms.

[4] While researching multinational US firms, Foley et al. (2007) find evidence that these US firms accumulate large cash reserves abroad. This is due to the US tax system, since cash repatriations are taxed in the US.

[5] Harford et al. (2014) support this prediction. US industrial firms tend to mitigate their refinancing risk by increasing their cash balance through cash flows.

Pecking Order Theory

Following, I will focus on the pecking order theory from Myers (1984) and the remarks in Myers and Majluf (1984) and Opler et al. (1999).[6] The theory is based on the existence of asymmetric information between management and shareholders.

It is assumed that a firm has one asset and one investment opportunity. To finance the possible investment, the firm is able to use internal resources such as cash and other securities. In addition, it can issue default-free debt or new stocks as a financing option. Existing shareholders cannot influence the decision whether to invest or not. Thus, the firm's management is virtually free in their decision-making. Further, the firm knows more about the investment opportunity than potential new shareholders. The rationale is to minimise the cost of asymmetric information between the management and new shareholders, and therefore the cost of external financing.

Assuming the firm issues equity, due to asymmetric information, new shareholders are not able to tell if the newly issued shares are under- or overvalued. Companies tend to conduct seasoned equity offerings when their equity is overvalued (Loughran and Ritter, 1995). Bolton et al. (2013) show similar results. According to Bolton et al. (2013), shares are issued to market conditions, which are favorable to firms. Under the assumption that company outsiders anticipate this behaviour, shares will only be sold at a discount. The discount should be larger for higher degrees of asymmetric information. Following Myers (1984), the company would choose a less information-sensitive claim and issue default-free debt, unless there are sufficient internal resources. The firm would prefer cash over debt "[...] for two reasons: first, to avoid any material costs of financial distress; and second, to maintain financial slack in the form of reserve borrowing power. "Reserve borrowing power" means that it can issue safe debt if it needs to" (Myers and Majluf, 1984, 589).

From Myers (1984) and Myers and Majluf (1984), the following conclusion has been drawn:

[6] There are earlier mentions in finance literature, such as Donaldson (1961). However, the main contribution is attributed to Myers (1984).

(1) To finance investment opportunities, a company will first use cash. If there is insufficient cash, it will reduce or cut dividend payments and then liquidate marketable securities. Companies that are not able to finance themselves internally, issue debt, beginning with the safest security. "That is, they start with debt, then possibly hybrid securities such as convertible bonds, then perhaps equity as a last resort" (Myers and Majluf, 1984, 581).

(2) Following Myers (1984) and Myers and Majluf (1984), cash should be more valuable in times when information asymmetry is high.

(3) With a shortage of liquid assets, a higher degree of information asymmetry should lead to a higher leverage.[7]

(4) There is no optimal capital structure. "Changes in debt ratios are driven by the need for external funds, not by any attempt to reach an optimal capital structure" (Shyam-Sunder and Myers, 1999, 221). Following Opler et al. (1999), in the pecking order framework, there is a negative relationship between debt and cash. If there are no positive NPV-projects, excess cash will be used to repay debt and therefore reduce leverage.

Free Cash Flow Theory

In prior theoretical studies, it is assumed that the managers act in the interest of their shareholders. Jensen (1986) relaxes this assumption. The theory is based on the conflict of interest between principal (shareholders) and agents (corporate management). Following Jensen (1986), shareholders want an efficient management which generates high distributable future cash flows. However, a corporate management has the incentive to increase internal resources and therefore maintain flexibility in their decision-making. Specifically, high levels of cash holdings allow the management to invest in projects that might be in their own interest and not necessarily in the interest of the existing shareholders, i. e. inefficient use of funds. Thus, active monitoring from outsiders can be reduced or avoided by financing projects internally.

[7] Bharath et al. (2009) find a positive relationship for leverage and asymmetric information between the management and outside investors.

According to Jensen (1986), the management has two options to signal their willingness to work efficiently. First, it can decide to pay out dividends or repurchase stocks instead of spending free cash flow on bad projects[8]. Jensen (1986) argues that the promise of permanent increase in dividends is not a credible signal. The management is not contractually bound to this promise and is therefore still flexible to reduce future payments to shareholders. Alternatively, the firm can issue new debt. The firm is now contractually obliged to make future payments to debt holders. The threat of not being able to meet forthcoming debt services is a credible signal. In addition, costs of monitoring are reduced by other market participants such as investment banks.[9]

The optimal level of debt is, according to the results of Jensen (1986), a trade-off between the cost of insolvency and the agency cost of free cash flow. Until the optimal level is reached, management should repurchase stocks financed with additional debt. Additional free cash flow should be distributed to shareholders.

The conclusion of Jensen (1986) can be summarised as follows:

(1) Following Jensen (1986), a firm should hold zero cash. An additional unit of cash provides financial flexibility for the management and therefore increases the agency cost of free cash flow.

(2) A high level of cash leads to inefficient investments, and in consequence to a decrease in firm value (Kalcheva and Lins, 2007, Harford et al., 2008).

(3) Cost of monitoring increases in the level of cash holdings and decreases in the level of debt.[10] Following Jensen (1986), these divergences are higher for companies with higher cash holdings and lower for companies with higher leverage.

(4) Cash should be negatively related to dividend payments and leverage.[11]

[8]Following Lang et al. (1991), management would choose to invest in negative NPV-projects over the distribution of excess funds to its shareholders.

[9]Management's incentive to take risk is reduced by bank monitoring; this effect is even stronger after a covenant violation (Saunders and Song, 2018).

[10]"[...] [B]anks are more likely to impose particularly strong monitoring on borrowing firms with large divergences between ownership and control" (Lin et al., 2013, 518).

[11]Foley et al. (2007) find a negative relationship between cash and leverage while researching US firms. Fazzari et al. (1988), Almeida et al. (2004) and Gao et al. (2013) among others find the opposite is the case for dividend payments.

2.1.2 Financing Constraints

Within this subsection, I will focus on major advances in the literature on financing constraints. This specifically includes the identification of proxies for later empirical analysis. There will be no detailed discussion on the quality of a constraint measure. A detailed analysis can be found in Farre-Mensa and Ljungqvist (2016).

Fazzari et al. (1988) identify investment-cash flow sensitivity as an indicator of financing constraints while analysing US manufacturing firms.[12] Specifically, how do investments depend on the availability of funds when internal funds are restricted? To test whether a company reacts more sensitive to changes, they split their sample by the criterion of dividend payments into three groups: firms with a ratio of dividends to income over at least ten years of (1) less than 0.1, (2) less than 0.2, and (3) all other firms. Based on Fazzari et al. (1988)'s results, a low dividend payout ratio indicates a low level of internal funds. Companies with low internal resources and a potential investment should react more sensitively to changes in cash flows.

Kaplan and Zingales (1997) use a subset of Fazzari et al. (1988)'s sample. Their sample contains 49 low dividend paying firms from 1970 to 1984. To distinguish between constrained and unconstrained firms, they use a more precise classification: (1) Not financially constrained: There is explicit reporting[13] on excess liquidity, a company pays dividends (or increases dividend payments) or repurchases stocks. (2) Likely not to be financially constrained: (2) differs from (1) by the absence of explicit reporting. (3) Possibly financially constrained: A company shows no signs for the absence or presence of liquidity. (4) Likely to be financially constrained: Dividends are reduced or cut, equity offerings are postponed or there are other difficulties gaining external financing. (5) Undoubtedly financially constrained: A company breaches debt covenants, reduces investments due to liquidity needs or defers the payment of debt service.

[12] The sample consists of annual data from 1969 to 1984 excluding the year 1985. Fazzari et al. (1988) justify the omission because of strong decline in observations in 1985.

[13] Kaplan and Zingales (1997) check for explicit reporting in 10-K filings, management discussion on liquidity and public news.

Companies in group (1) tend to have low debt ratios and high cash holdings (Kaplan and Zingales, 1997). They argue that "[t]he investment-cash flow sensitivities are significantly lower for [undoubtedly financially constrained], [likely to be financially constrained], and [possibly financially constrained] firm-years than for [likely not to be financially constrained] and [not financially constrained] firm-years" (Kaplan and Zingales, 1997, 200). Fazzari et al. (2000) argue that the empirical results are affected by the composition of Kaplan and Zingales (1997)'s sample. 49 low-dividend paying firms are too similar to assign the right degree of financing constraint. Cleary (1999) supports Kaplan and Zingales (1997)'s results while replicating their study on a large US sample consisting of 1,317 firms. Following Allayannis and Mozumdar (2004), the results of Kaplan and Zingales (1997) and Cleary (1999) are driven by observations with negative cash flows. Allayannis and Mozumdar (2004) find evidence that the investment-cash flow sensitivity is higher for more constrained firms while using negative cash flows as an indicator for severe distress.

Whited (1992) extends Fazzari et al. (1988) by focusing on debt finance as a proxy for a better access to external funding. She analyses 325 US manufacturing firms from 1972 to 1986. According to Whited (1992), a company is more affected by financing constraints when it does not participate in the corporate bond market. Calomiris et al. (1995) study the effect of short-term public debt. Due to the maturity structure, the issuance of commercial papers is only accessible for companies with high creditworthiness, i. e. high and stable cash flows. Hence, a company should be less financially constrained with an easier access to external financial markets. Faulkender and Petersen (2005) find that companies with access to public debt markets tend to have a higher leverage.

In addition to dividend payout ratios, Gilchrist and Himmelberg (1995) analyse the effect of company size as an indicator of access to capital markets. Assuming that size is related to age, younger and therefore smaller companies are more affected by frictions in capital markets (Gertler and Gilchrist, 1994). The empirical results of Hadlock and Pierce (2010) indicate that size and age are positive related. According to Almeida and Campello (2007), the size-effect should be stronger for companies with less pledgeable assets. Alti (2003) reports that the investment-cash flow sensitivity is higher for fast growing, younger, smaller firms with low dividend payout ratios. Further, "[Gilchrist and Himmelberg] find no excess sensitivity of investment to cash flow for firms with easy access to publicly traded debt, as measured by the existence of either a debt or commercial paper rating" (Gilchrist and Himmelberg, 1995, 566).

TABLE 2.1: Adapted from Almeida et al. (2004):
Financing constraints and cash holdings.

Criterion	Mean	Median	N
(1) *Payout ratio*			
Constrained firms	0.145	0.074	9,010
Unconstrained firms	0.090	0.051	8,821
(2) *Size*			
Constrained firms	0.178	0.110	9,002
Unconstrained firms	0.079	0.051	9,272
(3) *Bond rating*			
Constrained firms	0.146	0.085	15,805
Unconstrained firms	0.081	0.049	14,149
(4) *Commercial paper rating*			
Constrained firms	0.129	0.070	21,931
Unconstrained firms	0.076	0.051	8,023
(5) *Kaplan-Zingales index*			
Constrained firms	0.055	0.030	7,421
Unconstrained firms	0.179	0.134	7,208

Remark: The table displays the mean and median of corporate cash holdings as a fraction of total assets. N is the number of total observations. The differences in means are significantly different from zero ($p < .01$) for each criteron. Classification: (1) Top/bottom three deciles of dividend payments, (2) top/bottom three deciles of total assets (author's assumption), (3) existence of bond rating, (4) existence of commercial paper rating, and (5) top/bottom three deciles of Kaplan-Zingales index.

Almeida et al. (2004) investigate the cash flow sensitivity of cash. This sensitivity is positive for constrained firms and shows no effect on unconstrained firms. Their sample consists of 29,954 firm year observations focusing on US manufacturing firms from 1971 to 2000. On average, constrained firms hold 15 % of their assets in cash and marketable securities. This figure is significantly lower for unconstrained firms (8 % to 9 % on average). To distinguish between constrained and unconstrained firms, Almeida et al. (2004) use proxies for dividend payments, size, access to external finance and a multi-factor approach. The latter is known in literature as Kaplan-Zingales index (or KZ-index), but is created by Lamont et al. (2001) and only closely based on Kaplan and

Zingales (1997). Lamont et al. (2001) construct a five factor model containing cash flow, market to book value of total assets, leverage, dividend payments and cash holdings as explanatory factors.[14] Table 2.1 shows, with the exception of the KZ-index, that companies facing financing constraints have more cash holding than their unconstrained counterparts. Acharya et al. (2007), Denis and Sibilkov (2010) and Chang et al. (2014) support these results. Acharya et al. (2007) use a similar sample as Almeida et al. (2004). Acharya et al. (2007) extend the observation period by one year to 2001, but also apply more adjustments to the sample (20,146 firm-year observations). Denis and Sibilkov (2010) analyse US public firms from 1985 to 2006 of 74,347 firm-year observations in total. Chang et al. (2014) study US firms from 1971 to 2011.

2.1.3 Determinants of Corporate Cash Holdings

Two of the earliest empirical studies on corporate cash holdings are Meltzer (1963) and Frazer (1964). Meltzer (1963) studies US firms from fourteen industries over a period of nine years: 1938, 1944, 1951, 1953 to 1957. As a result of his analysis of the elasticity of cash to sales[15], he finds inconclusive evidence for economies of scale. Frazer (1964) uses quarterly data from 1956 to 1961 to analyse the relation between corporate liquidity and total assets[16]. His results indicate that an increase in size leads to a decrease in leverage with stable cash holdings and marketable securities as a fraction of total assets.

Major advances in empirical research on cash holdings are attributed to Kim et al. (1998) and Opler et al. (1999). They identify a broad set of determinants of corporate cash holdings, which are summarised in Table 2.2. A determinant covered in either Kim et al. (1998) or Opler et al. (1999) is marked by a ✓, and in case it is not covered by a ✗.

In this subsection, the determinants identified by Kim et al. (1998) or Opler et al. (1999) are discussed and accompanied by more recent literature. This is done at three different levels (micro, meso and macro). Most of these determinants influence cash holdings not

[14]For different multi-factor approaches, see Whited and Wu (2006) and Hadlock and Pierce (2010). Whited and Wu (2006) use the variables dividend payments, sales growth, natural logarithm of total assets (size), industry sales growth, and long-term debt to total assets ratio. Hadlock and Pierce (2010)'s index consists of variables for age and size.

[15]Sales is used as a proxy of firm size.

[16]Frazer (1964) uses the term asset-size and presumably means total assets.

only from a micro but rather from a meso or macro perspective. To give an example, a risky company is listed in a country with strong investor protection. While risk is an industry or company characteristic (micro-level), investor protection is determined by the country's government (macro-level). The listing decision has an impact on the liquidity of a company as well, i. e. a private firm has a different access to external funds than its public counterpart (meso-level).

TABLE 2.2: Summarising Kim et al. (1998) and Opler et al. (1999): *Determinants of corporate cash holdings.*

Determinants	Kim et al. (1998)	Opler et al. (1999)
Bankruptcy risk	✓	✗
Cash flow uncertainty	✓	✓
Cash cycle	✓	✗
Capital expenditure	✗	✓
Company size	✓	✓
Corporate governance and organisational structure	✗	✓
Cost of financial distress	✗	✓
Credit rating	✗	✓
Dividend payments	✗	✓
Growth opportunities	✓	✓
Hedging	✗	✓
Industry classification	✓	✗
Industry regulation	✗	✓
Industry volatility	✗	✓
Investment opportunities	✓	✗
Leverage	✓	✓
Marketable securities	✗	✓

Remark: Technically, there should be no difference between investment and growth opportunities. However, Kim et al. (1998) distinguish between current and future investment opportunities.

Micro-Level: Company Characteristics

According to Kim et al. (1998), the optimal target cash-level depends on the cost of external financing, the variability of future cash flows, and the profitability of investment opportunities. Cash holdings are positively related to these factors. Further, there is a negative relationship to firm size and marketable securities. Opler et al. (1999) find similar results for firm size, cash flow volatility, and investment opportunities. Consistent with Almeida et al. (2004), Opler et al. (1999)'s results indicate that firms with better access to capital markets hold less cash. Further, agency costs of managerial discretion lead to larger cash holdings. In contrast, Dittmar and Duchin (2012) argue "[...] that cash-rich firms are large, mature firms with high earnings, low cash flow volatility, high credit ratings, and few investment opportunities" (Dittmar and Duchin, 2012, 2).

While Opler et al. (1999) analyse target levels of cash, Harford (1999), Mikkelson and Partch (2003) and Faleye (2004) study the effect of cash-richness or excess cash on firms. Harford (1999) estimates a multi-factor regression model that he uses to predict values for their endogenous variable cash to sales. In case there is a positive prediction error in one firm year of 1.5 times the standard deviation of the variable cash to sales, a firm year is marked as cash-rich. He finds that cash-rich firms are more likely to acquire. Mikkelson and Partch (2003) choose a fixed threshold of 25 % of cash and cash equivalents as a fraction of total assets minus cash and cash equivalents. Following Mikkelson and Partch (2003), holding large cash balances over a longer period does not affect corporate performance. Mikkelson and Partch (2003) use operating income over operating assets as a proxy for corporate performance. Similar to Harford (1999), Faleye (2004) defines excess cash as the prediction error of the Opler et al. (1999)'s regression model. Faleye (2004) argues that targets hold on average 23 % more cash than comparable firms. Further, the announcement of a proxy fight leads to excess cash on the part of the target.

Bates et al. (2009) study changes in liquidity management of US firms over time. They find that on average the ratio of cash-to-assets increases by 0.46 % per year. In the 1980s, the cash-to-assets ratio is at 10.5 % and at the end of the observation period in 2006 at 23.2 %. In addition, there is a decrease in the net debt ratio for non-dividend payers. According to Bates et al. (2009), the increase in cash is not attributable to agency conflicts, but rather to an increase in cash flow riskiness over time. Duchin (2010) and Faff et al. (2016) support these results. According to Duchin (2010), the effect is stronger for specialised firms. Diversified firms have higher net debt ratios and hold less cash as a fraction of total assets than their specialised counterparts. Subramaniam et al. (2011) find similar results.

"[...] [T]he relation between cash holdings and diversification is stronger in well-governed firms" (Duchin, 2010, 958). Dittmar and Mahrt-Smith (2007) show that the value of cash is higher in a well-governed firm. Poorly-governed firms tend to waste cash which reduces future operating performance. This negative effect of large cash reserves does not impact well-governed firms. Following Faff et al. (2016), firms increase cash holdings in early stages of their life-cycle, i. e. in times of higher cash flow riskiness. Begenau and Palazzo (2017) support these results and argue that the rise in cash holdings of US firms over time is predominantly driven by a higher number of research and development-intensive firms entering the market. Boileau and Moyen (2016) extend the observation period of Bates et al. (2009) and find that "[f]irms facing various taxes and issuing costs were likely more prudent in the 1970s in terms of their payout policies than firms in the late 1990s and early 2000s" (Boileau and Moyen, 2016, 1496).

Acharya et al. (2012) find a positive relationship between cash and credit risk for rated US firms, i. e. riskier firms tend to hold more cash. Palazzo (2012) support this result. He states that riskier firms have higher hedging needs against future cash flow shortfalls, higher expected returns, and tend to use external finance more often.

Macro-Level: Legal Framework

La Porta et al. (1998) study the influence of different legal origins on rights attached to securities such as equity and debt. In order to show how investor protection laws differ, they research 49 countries from Europe, North and South America, Africa, Asia and Australia. They divide their sample into 18 common-law and 31 civil-law countries. Civil-law countries are further grouped in French (21), German (6) and Scandinavian (4) civil-law. La Porta et al. (2008) expand the sample further to 150 countries. La Porta et al. (1998) find that common-law countries afford the best creditor and shareholder protection and French civil-law the worst. German and Scandinavian civil-law are somewhere inbetween for both cases. La Porta et al. (2008) support these results for investor protection in civil-law countries. They find weaker evidence for creditor protection for Scandinavian civil-law and no significant results for German civil-law.

Dittmar et al. (2003)'s sample consists of 16,157 companies from 80 different countries. According to them, companies located in countries with a low level of investor protection tend to hold more cash. In addition, they find no evidence for higher cash holdings for firms "[...] because it is more difficult to access capital markets in countries with poor shareholder protection. If anything, firms hold more cash when it is easier to raise funds" (Dittmar et al., 2003, 132). Pinkowitz et al. (2006) support these results on a smaller sample of companies from 35 different countries. Further, they find that minority shareholders value cash less in these countries and dividend payments more.

Kalcheva and Lins (2007) find weak evidence that firms with controlling managers hold more cash when country-level shareholder protection is weak. Kalcheva and Lins' results indicate that firm values are negatively affected by weak protection and large cash reserves. Harford et al. (2008) show similar evidence. "[...] [W]eaker governance structures are negatively related to firm value and that this relation is more pronounced when combined with excess cash holdings" (Harford et al., 2008, 546). Further, their results partially contradict Dittmar et al. (2003). According to Harford et al. (2008), weaker governance structures are positively related to low cash reserves for US firms. Gao et al. (2013) find similar evidence on another US sample.

Kusnadi and Wei (2011) study the relationship between investor protection and cash flow sensitivity of cash for firms from 39 countries from 1995 to 2004. Firms in countries with strong legal protection of minority investors experience a lower cash flow sensitivity of cash. Kusnadi and Wei (2011) state that strong legal protection reduces the effect of financing constraints for firms. This would be consistent with the argument that investors are more willing to fund projects in more secure conditions. Consistent with Kusnadi and Wei (2011), McLean et al. (2012) find that the investment-cash flow sensitivity is lower in countries with stronger investor protection. In addition, their results indicate that "[...] low cash flow firms issue more shares and debt in these countries, thereby overcoming financing shortfalls" (McLean et al., 2012, 314).

Meso-Level: Public vs. Private Firms

The empirical capital structure literature mostly focuses on publicly traded companies. Due to disclosure requirements for listed companies, the quantity of information is higher, easily accessible and therefore more suitable for broad empirical studies.[17]

[17]The terms listed and public are used interchangeably.

Faulkender (2002) studies cash holdings of small US businesses. It is assumed that small companies are generally younger and therefore less likely to be listed (Berger and Udell, 1998, Hadlock and Pierce, 2010). Faulkender (2002)'s sample consists of 2,808 for-profit non-financial, non-farm firms with less than 500 employees. Small firms tend to have a higher leverage and more expenditures for research and development. The relationship between cash holdings and leverage is positive. Small firms hold more cash than larger firms.[18] Bigelli and Sánchez-Vidal (2012) show that cash holdings "[...] are significantly related with smaller size, higher risk and lower effective tax rates [...]" (Bigelli and Sánchez-Vidal, 2012, 26). They also state that smaller firms are financially more constrained. In contrast, Campello et al. (2010) find no evidence of a correlation between financing constraints and ownership structure. However, this can be caused by the relationship between managerial ownership and cash holdings. According to Ozkan and Ozkan (2004), the relationship is non-monotonic and somewhat u-shaped.

Brav (2009) analyses the access to capital on a data set of public and private UK firms from 1993 to 2003. The sample consists of 54,285 private and 1,600 public firms. He finds evidence that private firms have higher leverage ratios compared to their public counterpart. On average, private firms hold about 34 % of their total assets in debt (public firms: 23 %). In addition, the fraction of short-term debt on total debt is almost twice as high for private firms (64 %) as it is for public firms (37 %). Harford et al. (2014) argue that debt maturity is negatively related to cash holdings, i. e. shorter debt maturity goes in hand with larger cash balances. In addition, the effect is stronger for more highly indebted firms and when the conditions on credit markets are weak.[19] Further, Brick and Liao (2017) provide evidence that the relationship between debt maturity and cash holdings is positive for financially constrained firms.

Lins et al. (2010) survey chief financial officers of firms from 29 different countries worldwide.[20] They find support for the results of Faulkender (2002) and Brav (2009). Consistent with Campello et al. (2011), private firms are more likely to hold excess cash and to

[18]See Subsection 2.1.2 on page 12.

[19]Harford et al. (2014) define strong credit market conditions as "[...] the years when the [Commercial & Industrial] rate spread is below the median value [...] from 1980 to 2008 [...]" (Harford et al., 2014, 994).

[20]The survey has a total response rate of 8.85 %. Due to invalid answering, 5.10 % of the questionnaires are used in regressions. The interviewed companies are mainly located in Germany (46 of 204).

use lines of credit. Lins et al. (2010) define excess cash as "[...] cash and marketable securities above that used in the normal course of business, held as compensating balances, or cash trapped in a foreign jurisdiction" (Lins et al., 2010, 164).

Asker et al. (2011) study the investment behaviour of about 35,714 public and private US firms from 2001 to 2007 and find that private firms hold less cash, more debt and are more profitable than public firms. Private firms tend to invest more than public firms. According to Gao et al. (2013), public firms hold on average almost twice as much cash as private firms.

2.2 Banking Crises

This section deals with the impact of banking crises on corporate liquidity. Due to the extensiveness of the topic, this section will restrict itself to a brief discussion of the general issues. Overlaps with the previous chapters are kept at a minimum, but cannot be avoided entirely, especially in case of real effects to the capital structures of corporate entities. This section is divided into two subsections. The first one reviews the literature in a chronological order and focusses on signals that indicated an upcoming crises, on possible consequences of such signals and on the identification of a banking crisis. The second subsection focusses on the real effect of a crisis at a macro- (economy) and micro-level (bank and firm). Figure 2.3 summarises the content of this chapter by its occurrence in time: Early warning signals (henceforth: EWS), banking crisis and then its real effects. The transmission of an EWS that causes a banking crisis is discussed in Subsections 2.2.1.

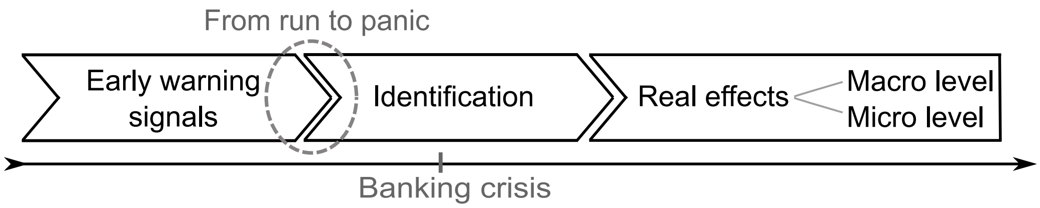


FIGURE 2.3: Section overview (2.2).

2.2.1 Origins of a Banking Crisis

Subsection 2.2.1 is divided in three parts. The first one presents the core elements of literature on EWS. EWS are intended to give an indication for the likelihood of the occurrence of a crisis and usually precede a financial crisis. Major methodological advances on EWS and crises prediction start with Frankel and Rose (1996), Kaminsky et al. (1998) and Kaminsky and Reinhart (1999). Frankel and Rose (1996) and Kaminsky et al. (1998) focus on currency crises and Kaminsky and Reinhart (1999) on banking crises. As mentioned before, the second part provides a short discussion of a possible consequence of a single or of multiple EWS. This part is mainly based on Diamond and Dybvig (1983) which discus the transmission of *bad news* to the banking sector.

Part three is especially important for the empirical analysis of this study and covers different identification strategies which assign a banking crisis to a certain date or period.

Early Warning Signals

Frankel and Rose (1996) analyse currency crashes from 1971 to 1992 in an event study. The total sample consists of 100 emerging countries. A year is marked as a crash if a threshold of 25 % nominal depreciation of the currency is exceeded. They find that "[c]ountries experiencing currency crashes tend to have: high proportions of their debt lent by commercial banks [...], high proportions of their debt on variable-rate terms and in short maturities; and relatively low fractions of debt that are concessional, lent by the multilateral organizations or lent to the public sector. Crash countries tend to experience disproportionately small inflows of FDI [Foreign Direct Investments] (i. e. relatively high 'hot money' portfolio) flows" (Frankel and Rose, 1996, 359). In addition, they identify foreign interest rates as a signal. Frankel and Rose (1996) define foreign interest rates "[...] as the weighted average of short-term interest rates for the United States, Germany, Japan, France, the United Kingdom and Switzerland; the weights for the debtor in question are proportional to its fractions of debt denominated in the relevant currencies (Frankel and Rose, 1996, 359)." This figure tends to be high before a currency crisis.

Kaminsky et al. (1998) develop an approach to distinguish between a informative signal or an uninformative signal. The observance of an informative signal would be followed by the occurrence of a currency crisis in a certain time frame. Kaminsky et al. (1998) set the time frame to 24 months. An uninformative signal would be if an indicator leads to the wrong response, e. g. a signal is observed but not followed by a currency crisis. For clarification, see Table 2.3 on page 24. An uninformative signal would have been more frequently classified as B or C (least informative signal: A = 0, D = 0, B > 0 and C > 0). They use the sample from Kaminsky and Reinhart (1999)[21] to find sensible indicators. The original sample consists of 15 developing and five industrial countries covering 76 currency crises and 26 banking crises from 1970 to 1995. Kaminsky et al. (1998) focus

[21]Kaminsky et al. (1998) use data from a prior version of the article *The Twin Crises: The Causes of Banking and Balance-of-Payments Problems* published in: International Finance Discussion Paper No. 544, 1996 (Washington: Board of Governors of the Federal Reserve System).

solely on currency crises. According to Kaminsky et al. (1998), international reserves, real exchange rates, credit growth and inflation seem the most suitable indicators to predict a currency crisis.

Table 2.3: Adapted from Kaminsky et al. (1998), 18: Signalling approach.

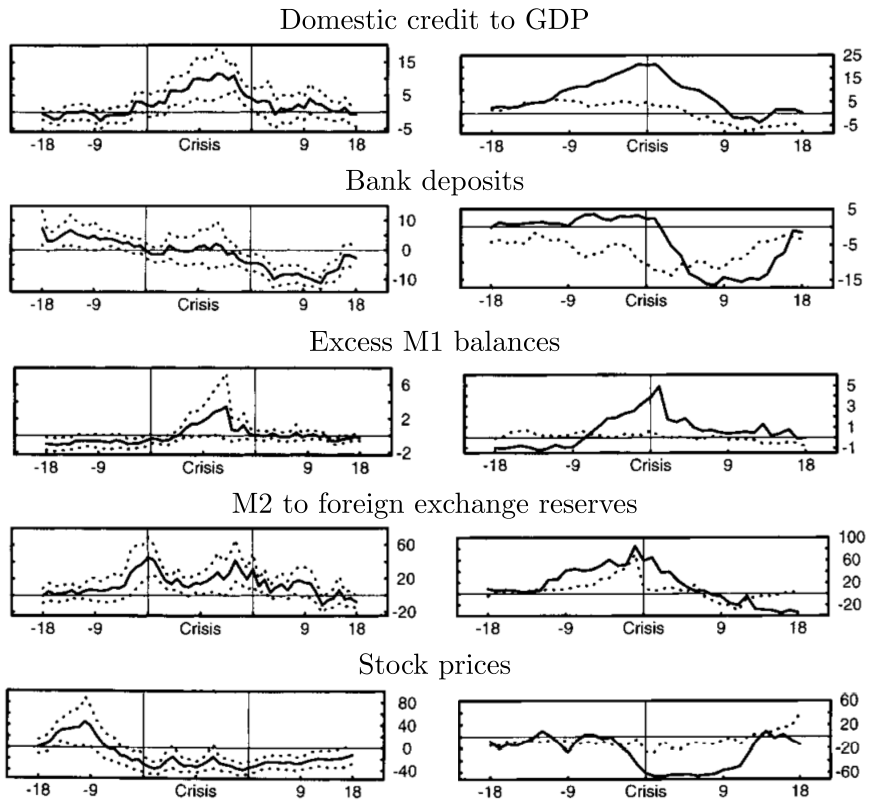
	Crisis	No crisis
Signal was issued	A	B
No Signal was issued	C	D

Remark: "[...] A is the number of months in which the indicator issued a good signal, B is the number of months in which the indicator issued a bad signal or "noise", C is the number of months in which the indicator failed to issue a signal [...], and D is the number of months in which the indicator refrained from issuing a signal [...]" (Kaminsky et al., 1998, 18-19).

Kaminsky and Reinhart (1999) study the causal link between a banking and a currency crisis. According to Kaminsky and Reinhart (1999), currency crises usually succeed difficulties in the banking sector and tend to magnify certain effects of a banking crisis. They gather 16 proxies to measure the degree of financial liberalization, current accounts and capital account balances, real sector developments among other things. Table 2.4 on page 25 displays a subset of theses variables. The table is divided into two columns. The column on the left hand side shows selected variables in case of a banking crisis and the column on the right hand side shows the combination of a banking and a currency crisis (twin crisis). The solid line denotes the explanatory variable in a banking and a twin crisis. Note that the dotted lines in the left column display a positive and a negative standard error of the explanatory variable, and the dotted line in the right column displays the variable during a currency crisis. In addition, a relative comparison takes place, i. e. the deviation of a time series from its *normal* level. Kaminsky and Reinhart (1999) define normal (normal/tranquil times) by using the average value of a variable. This average is based on the remaining observations that are not included in the analysed time frame. To give an example, prior to a banking crisis, the excess M1 balance (deflated M1 minus the estimated demand for money) is below its normal level, while cash in hand (bank deposits) seems to be above this level. Hardy and Pazarbaşıoğlu (1999) support this argument. They find empirical evidence for a decline in deposits at the onset of a crisis. Focusing on the stock market and comparing banking and twin crises, the preceding run-up in stock prices appears to be limited to banking crises.

TABLE 2.4: Adapted from Kaminsky and Reinhart (1999), 482-483: Twin crises.

Banking crises | Twin crises



Remark: "The values of the variables relative to "tranquil" times are reported on the vertical axes. The horizontal axes represent the number of months before (with a negative sign) and after a crisis" (Kaminsky and Reinhart, 1999, 482-483). Note, the scaling on the horizontal but especially on the vertical axis differs.

Borio and Lowe (2002) modify Kaminsky and Reinhart (1999)'s approach. Their approach differs in the following key aspects: The observation period before crisis is prolonged (> 18 month); only information that is known at the time is used; instead of a single indicator they use a combination of indicators; and they study different time horizons to predict a crisis (one, two, and three years). Their sample consists of 34 countries from 1960 to 1999. They analyse asset price gaps, credit gaps, investment gaps, and real credit growth.[22] Based on the signalling approach mentioned above, the credit gap considered alone and the combination of credit gap (threshold: 4 %) and asset price gap (threshold: 40 %) are the most suitable indicators to predict a crisis. These results are consistent with Kaminsky and Reinhart (1999) and Drehmann and Juselius (2014). Borio and Drehmann (2009) extend Borio and Lowe (2002) by additionally studying the effect of property prices. For clarification, see Figure 2.4. The horizontal axis displays the quarters before and after a banking crisis and the vertical axis displays the deviation from the trend. The solid line is the "[w]eighted average of real residential and commercial property prices with weights corresponding to estimates of their share in overall property wealth [...]" (Borio and Drehmann, 2009, 35). The dashed upper and lower line denote the 90th and 10th percentile. The slope of the deviation changes to a negative sign about two years prior to the crisis. This marks the onset of the decline in property prices. Acharya et al. (2012) and Crowe et al. (2013) find similar results for the housing market. They record a sharp decline in price to rent ratios roughly two years prior to the sub-prime crisis.

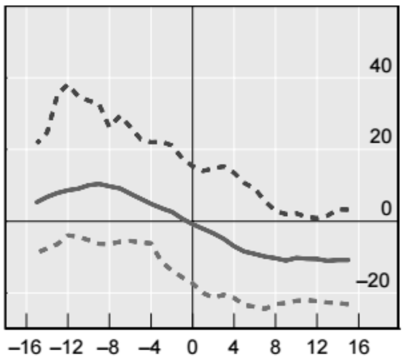


FIGURE 2.4: Adapted from Borio and Drehmann (2009), 35: Property price gap.

Most of the contributions mentioned use the signalling approach to try to identify a proper indicator. Besides using a logit regression to estimate the likelihood of a crisis, Demirgüç-Kunt and Detragiache (1998) also consider the severity of a crisis by its costs measured as a share of GDP. The sample is obtained from Caprio and Klingebiel (1996b). Demirgüç-Kunt and Detragiache (1998) point out that there is a sample size problem. Thus, their results are to be interpreted with due care. They find that "[...]

[22] Asset/credit/investment gap is defined as the deviation of the asset/credit/investment to GDP ratio from its own trend.

low GDP growth, adverse terms of trade changes, high real interest rates, and high inflation tend to increase the cost of a crisis" (Demirgüç-Kunt and Detragiache, 1998, 102). Demirgüç-Kunt and Detragiache (2005) extend their prior study by using a broader sample and a multivariate logit regression. They find similar results as Demirgüç-Kunt and Detragiache (1998) for GDP growth, real interest rates and inflation, but no significant values for the terms of trade.[23] In addition, real GDP per capita, the ratio of M2 to international reserves, and the ratio of domestic credit to the private sector to GDP yield significant results at a 1 %-significance level. Further, they find weak support for a two period lagged credit growth. The results of Demirgüç-Kunt and Detragiache (1998, 2005) are consistent with Von Hagen and Ho (2007). Barrell et al. (2010) extend Demirgüç-Kunt and Detragiache (2005)'s set of variables by adding bank-specific characteristics and property prices. They find evidence that bank capital adequacy, bank liquidity and property prices have an effect on the likelihood of a banking crisis.

From Run to Panic

A possible consequence of warning signals is described in Diamond and Dybvig (1983). They model a bank's role[24] as a provider of liquidity in a theoretical framework, which is based on asymmetric information. To be more specific, a bank's function is to insure that depositor's (future) consumption needs are met. Assuming present or future consumption is exposed to a shock, depositors are allowed to withdraw their money in full. In addition, the withdrawal takes place in sequence, i. e. *first come, first served.* Following the interpretation of Diamond and Dybvig (1983), even in case of a healthy bank's balance sheet, a bank run can be self-fulfilling. Depositors believe that others try to make a run for their deposits at a certain point in time. Due to a sequential withdrawal of money, the fear of ending empty handed causes additional bank runs. Diamond and Dybvig (1983) state that "[t]his could be [caused by] a bad earnings report, a commonly observed run at some other bank, a negative government forecast, or even sunspots. [...] The problem is that once they have deposited, anything that causes them to anticipate

[23]For this purpose, I choose variables from the model with the lowest value of the Akaike information criterion. Other model specifications are predominantly robust to changes. For more information, see Demirgüç-Kunt and Detragiache (2005), 21.

[24]"Banks (typically) borrow short in form of savings and demand deposits. At the same time, they lend at longer maturities, in the form of direct loans to businesses, as well as other longer-dated and higher risk securities." (Reinhart and Rogoff, 2009, 144)

a run will lead to a run" (Diamond and Dybvig, 1983, 410). As a consequence and due to different maturity structures, banks are forced to sell illiquid assets at lower prices to generate short-term liquidity. These sales (or fire sales) harm the structure of a bank's balance sheet (Reinhart and Rogoff, 2009, 144). As Demirgüç-Kunt and Detragiache (1998) state, the event of a single bank run, which might not necessarily be lethal, could send a signal that affects other banks. According to Diamond and Rajan (2005), the effect of defaults can be contagious due to liquidity shortages at an aggregated level which can lead to multiple bank runs, i. e. a bank panic.

Gorton (1988) argues that bank panics do not happen at random, but are rather systematic and happen near the peak of the business cycle. Allen and Gale (1998) support this argument. Goldstein and Pauzner (2005) state that the probability of a run depends on the structure of demand-deposit contracts. A run is therefore more likely when banks offer higher short-term payments on deposits. This is consistent with Gorton (1988), because the rates on deposits tend to be higher in boom phases (Taylor, 1993, Clarida et al., 2000, among others). According to Mishkin (1990) and Demirgüç-Kunt and Detragiache (1998), bank panics predominantly occur shortly after or at the beginning of a recession. Besides negative expectations, Chari and Jagannathan (1988) argue that bank runs or bank panics occur when liquidity needs are high.

According to Diamond and Dybvig (1983) among others, the presence of a deposit insurance can prevent bank runs (or bank panics). "[...] [W]hile deposit insurance may reduce the incidence of self-fulfilling banking panics, it introduces a significant degree of moral hazard, which often has not been successfully curbed through appropriate design of the insurance scheme or through effective prudential supervision and regulation" (Demirgüç-Kunt and Detragiache, 1998, 104). Calomiris (1999) and Schneider and Tornell (2004) provide support. According to Calomiris (1999), a safety net should build up on economic objectives and political constraints. A systemic bailout guarantee leads to excessive risk taking by banks (Schneider and Tornell, 2004). The moral hazard effect seems to dominate the stabilising effect in times of crisis (Goldstein and Pauzner, 2005, Anginer et al., 2014). Further, Demirgüç-Kunt and Detragiache (2002) and Von Hagen and Ho (2007) find empirical evidence that banking crises are more likely when deposits are insured. In contrast, Karels and McClatchey (1999) argue that the presence of an insurance scheme does not lead to an increase in risk taking. Their results are based on data of credit unions.

Identification of a Banking Crisis

Since the distinction between a panic and a crisis cannot be carried out in many cases, a suitable definition to identify a banking crisis is needed. What follows is a list of definitions which is used by the scientific community or by supra-national organizations. This list is not comprehensive. In short, the literature predominantly uses event-based approaches to identify different states of distress or crisis by its severity. The following list consists of definitions for financial distress and also of definitions for a more severe form of crisis that affects a whole banking system to a larger extent, i. e. a systemic banking crisis.

Caprio and Klingebiel (1996a,b) classify a state of financial distress if the net worth of a banking system is negative. Dziobek and Pazarbaşıoğlu (1997) define a crisis as systemic when the affected banks combine 20 % of the deposits of the whole banking system.[25] According to Demirgüç-Kunt and Detragiache (1998), a period of time is classified as a crisis when "[...] at least one of the following four conditions had to hold: 1. The ratio of non performing assets to total assets in the banking system exceeded 10 percent. 2. The cost of the rescue operation was at least 2 percent of GDP. 3. Banking sector problems resulted in a large scale nationalization of banks. 4. Extensive bank runs took place or emergency measures such as deposit freezes, prolonged bank holidays, or generalised deposit guarantees were enacted by the government in response to the crisis" (Demirgüç-Kunt and Detragiache, 1998, 90-91).

Kaminsky and Reinhart (1999) define the beginning of a crisis as follows: "[...] (1) bank runs that lead to the closure, merging, or takeover by the public sector of one or more financial institutions [...]; and (2) if there are no runs, the closure, merging, takeover, or large-scale government assistance of an important financial institution (or group of institutions) that marks the start of a string of similar outcomes for other financial institutions [...]" (Kaminsky and Reinhart, 1999, 476). Reinhart and Rogoff

[25] For data on systemic banking crisis, see Laeven and Valencia (2013b).

(2009) virtually use the same definition. They distinguish between two types of events that mark the onset of a banking crisis. The first one is systemic and more severe. The second type is milder and marks a state of financial distress. According to Caprio and Klingebiel (2003), an example for the first type would be the restructuring of three banks in Slovenia in 1993 and 1994 which carried two thirds of the banking system's assets. The solvency problems of Credit Lyonnais in 1994 and 1995 in France would be categorised as the second type.

Laeven and Valencia (2013b) use a more detailed definition for a systemic banking crisis. Similar to Kaminsky and Reinhart (1999), the first year of a systemic crisis is marked (1) if there is an indication of distress in the system, such as bank runs, and (2) if there are significant banking policy interventions. Laeven and Valencia classify an intervention as "[...] significant if at least three out of the following six measures have been used:[.] (1) deposit freezes and/or bank holidays (2) significant bank nationalizations (3) bank restructuring gross costs (at least 3 percent of GDP) (4) extensive liquidity support (5 percent of deposits and liabilities to nonresidents) (5) significant guarantees put in place (6) significant asset purchases (at least 5 percent of GDP)" (Laeven and Valencia, 2013b, 229).

A non-event based approach is developed by Von Hagen and Ho (2007). They construct an index to identify banking crises based on the (excessive) demand for liquidity in the money market. According to Von Hagen and Ho, most of the approaches mentioned above tend to identify a crisis too late. Events such as the nationalization of banks or extended bank holidays are typically observed at a very late stage compared to the excessive withdrawal of deposits for example. Further, it is difficult to find objective thresholds that determine the magnitude of an intervention. In addition, the date of an intervention is usually not known. Following Von Hagen and Ho, a drastic change in aggregated demand for liquidity in a banking sector could be explained by (1) the deterioration of asset quality, such as an increase in non-performing loans; (2) bank runs; or (3) problems at the interbank-level, such as liquidity concerns. Kaminsky and Reinhart (1999) and Reinhart and Rogoff (2009) partially support this argument. Bank problems do not result from the liability side but from a prolonged decline in asset quality

(Kaminsky and Reinhart, 1999). Kaminsky and Reinhart (1999) further argue that even then the use of non-performing loans as an indicator would be improper, because banks tend not to reveal their true portfolio quality.

Table 2.5: Adapted from Von Hagen and Ho (2007) and Reinhart and Rogoff (2009): Dates of banking crises.

Country	(1)	(2)	(3) beginning	(4) peak	(5)
Finland	1991 to 1994	1991 to 1993	September 1991	June 1992	1991 to 1994
Mexico	1981 and 1982	1982	September 1982	June 1984	1981 and 1982
Norway	1987 to 1989	1987 to 1993	November 1988	October 1991	1987 to 1993
Spain	1977 to 1985		November 1978	January 1983	1977 to 1985
Turkey	1982	1982 to 1985	January 1991	March 1991	1991

Remark: This table shows a reduced version of the table presented in Von Hagen and Ho (2007), 1040-1042: (1) Caprio and Klingebiel (1996a,b), (2) Demirgüç-Kunt and Detragiache (1998), (3) and (4) Kaminsky and Reinhart (1999) and (5) Reinhart and Rogoff (2009). Note, Reinhart and Rogoff (2009) collect their information from different sources. Therefore, there might be an overlap with (1) to (4).

Despite the fact that the dates of crises overlap in most articles, the identified onset or end of a banking crisis often differ. For clarification, see the examples listed in Table 2.5. Norway's crisis in the late 80s is dated by Caprio and Klingebiel (1996a,b) from 1987 to 1989. Kaminsky and Reinhart (1999) on the other hand date the beginning to 1988 and its peak to the autumn of 1991. It is therefore important to use different methods as a robustness check later on.

2.2.2 Real Effects of a Banking Crisis

This subsection is divided into three parts, two of which cover the direct effects of banking crises at a macro- and a micro-level. The remaining part covers literature on industries and corporations that are more dependent on external finance. The latter does not include literature on relationship lending.[26]

Although there are more channels that transmit the effect of a banking crisis from the banking sector to the real economy, this subsection focuses on the supply side of funding. To be more specific, I discuss the effects that are associated with a shortage of liquidity.

[26]For literature on relationship banking, see Petersen and Rajan (1994), Boot (2000) and Elsas (2005) among others.

To give examples, banks tend to ration credit during a crisis and reallocate funding to borrowers with higher creditworthiness (flight to quality) or withdraw funding from non-domestic borrowers (flight home effect).[27] While these two examples might affect certain borrowers directly, in case of an economic downturn, credit rationing tends to worsen these economic conditions and therefore influence an economy at an aggregated level (Bernanke and Gertler, 1989, Bernanke et al., 1996, among others).

External Dependence

Kashyap et al. (1994) study US manufacturing firms during recessions. Inventories tend to decrease abruptly for bank dependent borrowers during a recession. Bank dependence is measured by the absence of a public bond rating. Chava and Purnanandam (2011) also use the absence of a rating as proxy. They examine the effect of the Russian crisis in 1998 on non-financial and non-utility US firms. Their findings "[...] strongly support the hypothesis that bank-dependent firms face adverse valuation consequences when the banking sector's financial health deteriorates" (Chava and Purnanandam, 2011, 133).

Rajan and Zingales (1998) study the relationship between financial development of a country and the growth of (manufacturing) industries. Based on a cross-country sample from 1980 to 1990, they find a positive relationship between dependence and financial development. To measure dependence, they use three different proxies. The first one is relating to a company's ability to generate internal resources and its need to meet capital expenditure: capital expenditure minus operating cash flow standardised by capital expenditure. The second ratio is defined as net share issuance to capital expenditure, which essentially represents the ability to obtain external resources if needed. Because some industries rely more on tangible assets, Rajan and Zingales incorporate investment intensity in their analysis and use the following proxy: capital expenditure to net property, plant and equipment. Table 2.6 on page 33 shows selected industries from Rajan and Zingales (1998), 566-567.[28] Focusing on column three (all companies), the top/bottom three industries are the least/most dependent on external financing. The

[27] For a more detailed discussion on the flight to quality effect and the flight home effect, see Lang and Nakamura (1995), Bernanke et al. (1996) and DeYoung et al. (2015) for the flight to quality effect; and Giannetti and Laeven (2012) and de Haas and Van Horen (2012) for the flight home effect.

[28] Note, the selection of companies was deliberately chosen, since in some industries technical progress could lead to different results nowadays. For a more detailed comparison, see Laeven and Valencia (2013a), 158.

dependence seems to be higher for younger companies within an industry. This is consistent with Gertler and Gilchrist (1994) and Hadlock and Pierce (2010). They find that mature and large companies have better access to external financing sources (Gertler and Gilchrist, 1994, Hadlock and Pierce, 2010).

Table 2.6: Adapted from Rajan and Zingales (1998), 566-567 and Laeven and Valencia (2013a), 158: External dependent industries in the US during the 1980s and from 1980 to 2006.

		External dependence			
		1980 to 1989			*1980 to 2006*
ISIC	Industrial sectors	All companies	Mature companies	Young companies	All companies
314	Tobacco	-0.45	-0.38	n/a	-1.76
313	Beverages	0.08	-0.15	0.63	0.06
381	Metal products	0.24	0.04	0.87	0.19
⋮	⋮	⋮	⋮	⋮	⋮
362	Glass	0.53	0.03	1.52	0.24
385	Professional goods	0.96	0.19	1.63	0.85
3522	Drugs	1.49	0.03	2.06	0.78

Remark: "This table reports the median level of external financing [...] for ISIC industries during the 1980's. External dependence is the fraction of capital expenditures not financed with cash flow from operations" (Rajan and Zingales, 1998, 567). The fourth column shows an update from Laeven and Valencia (2013a) for the years 1980 to 2006.

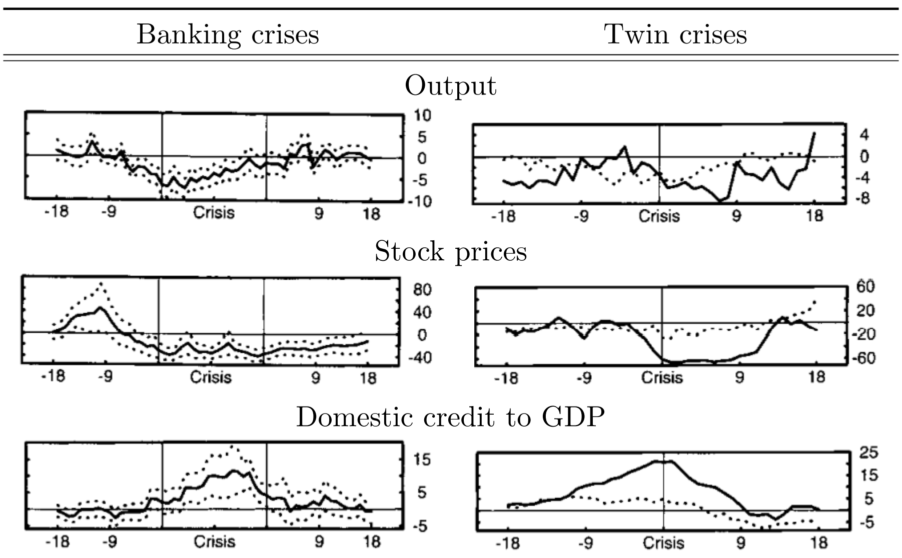
Braun and Larrain (2005) study 28 manufacturing firms in 100 different countries from 1963 to 1999. Similar to Rajan and Zingales (1998), they rank industries by bank dependence. Recessions are marked by changes in the aggregated output per country. Further, they add measures for financing frictions per country, such as "[...] number of international accounting standards used by firms [...]" (Braun and Larrain, 2005, 1098). Their findings indicate that industries which rely more on external financing are more affected by a recession. In addition, a "[d]eterioration in the country-level financial environment implies that there is a larger differential impact of recessions across industries sorted by their external dependence" (Braun and Larrain, 2005, 1122).

Dell'Ariccia et al. (2008) examine the effect of a banking crisis on bank dependent borrowers. As an additional indicator for dependence, they use the size of an industry measured by the "[...] average [number of] employees per establishment in [a] sector [.] in [a] country [.] averaged over the sample period" (Dell'Ariccia et al., 2008, 105). Following the argument of Rajan and Zingales (1998), larger and therefore more established firms are less affected during a banking crisis. Kroszner et al. (2007), Fernández et al. (2013), DeYoung et al. (2015) and Cingano et al. (2016) support these findings. Industries that consist of young growing firms with a large fraction of intangible assets are more affected by a banking crisis (Kroszner et al., 2007). Performance measured by EBIT tends to decline in times of crises for companies and industries operating in less developed financial markets (Fernández et al., 2013). Banks tend to reduce financing to small and medium sized companies during a crisis (DeYoung et al., 2015). Less mature, smaller firms with higher bank dependence tend to reduce investments more than their larger, older and less dependent counterparts (Cingano et al., 2016).

Real Effects on the Economy

The analysis of real effects on the economy is predominantly based on Kaminsky and Reinhart (1999). See Table 2.7 on page 34. As mentioned in Subsection 2.2.1, the dotted lines do not share the same definition. In the left column, the dotted line is a deviation of its mean by plus and minus one standard error. The dotted line in the right column indicates a currency crisis. Again, the comparison is relative to normal or tranquil times. This benchmark is defined as the average value of a variable based on the remaining observations that are not included in the analysed pre- and post-crisis period.

TABLE 2.7: Adapted from Kaminsky and Reinhart (1999), 482-483: Real effects: macro-level.



Remark: "The values of the variables relative to "tranquil" times are reported on the vertical axes. The horizontal axes represent the number of months before (with a negative sign) and after a crisis" (Kaminsky and Reinhart, 1999, 482-483). Note, the scaling on the horizontal but especially on the vertical axis differs.

Focusing on the upper left hand graph of Table 2.7, the decline in output, measured by industrial production, starts about nine months before a banking crisis. The lowest point is prior to the peak of a crisis. After that, output seems to converge to an average level. Bordo et al. (2001) analyses banking, currency and twin crises from 1880 to 1997. They find that the cumulative loss in output amounts between 5 % to 10 % of real GDP over a period of two to three years following a crisis. It should be noted that the results for banking crises are significant for the years 1973 to 1997 and not for the full sample period. According to Hoggarth et al. (2002) and consistent with Kaminsky and Reinhart (1999), the loss during banking crises amounts to 15 % to 20 % of the annual GDP measured in real terms. While studying twin crises from 1975 to 1997, Hutchinson and Noy (2005) identify a reduction in output of 5 % to 8 % over two to four years in case of a currency crisis and 8 % to 10 % in case of a banking crisis. Similar to Kaminsky and Reinhart (1999) and Bordo et al. (2001), the effect is worse for twin crises. According to Reinhart and Rogoff (2014), the effect of banking crises is more severe for developing as for developed markets.

As mentioned in Subsection 2.2.1, stock prices decline about nine months prior to banking crises and remain below average up until 18 months after crises. The effect seems stronger for twin crises but also short. Based on a reduced sample of Caprio and Klingebiel (1996a,b) and Caprio and Klingebiel (2003)[29], Boyd et al. (2005) find an average real stock market loss of 15.5 % (median: 7.0 %) for a time frame of four years, of which two years cover the period prior to the banking crisis. For a six year period, the loss is higher and averages 20.3 % (median: 14.9 %). Reinhart and Rogoff (2013) examine 40 crisis episodes in developing markets. Similar to Kaminsky and Reinhart (1999), their results show a run-up in equity prices until one year before a crisis, followed by a sharp decline until one year after a crisis and then succeed by a stable recovery. Figure 2.5 on page 36 provides visual evidence for US equities during the crisis in 2007 and 2008 and displays monthly data of two different indices (S&P 500 Composite Price Index; MSCI World USD Price Index) from January 1st 2004 to December 31st 2012. The data is gathered from Datastream.[30] The vertical line marks the date Lehman Brothers filed for

[29]To be exact, Boyd et al. (2005) use data from an earlier version of the data set *Episodes of Systematic and Borderline Financial Crises*, 1999 (Washington: World Bank).

[30]Additional information on the different data sources are listed in Appendix C on pages 210-211.

Chapter 11 (SEC, 2008). Partially consistent with Reinhart and Rogoff (2013), equity prices increased in the years prior to the crisis, followed by a decline three months before the bankruptcy filings of Lehman Brothers. The recovery is somewhat stable after March 2009. However, there is a broad consensus in the literature that dates the onset of the crisis to 2007 (Reinhart and Rogoff, 2009, Laeven and Valencia, 2013b, among others). Therefore, if the sequencing would have been as in the results of Kaminsky and Reinhart (1999), the equity prices should be the highest around 2006.

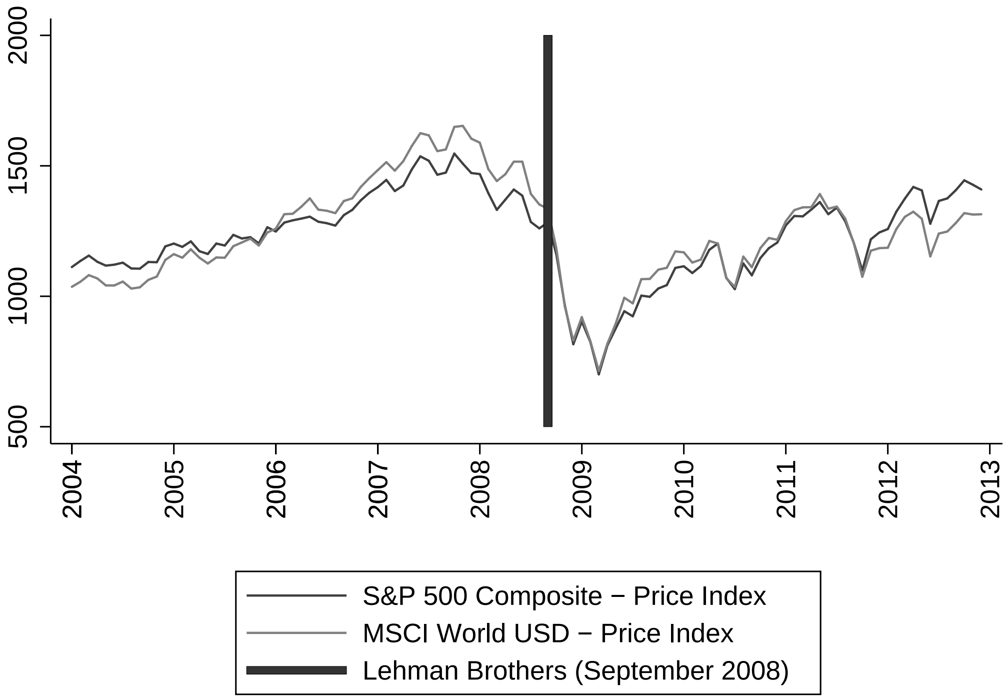


FIGURE 2.5: Adapted from Datastream and SEC (2008): Lehman Brothers and the US equity market.

The bottom left hand graph in Table 2.7 on page 34 displays the ratio of domestic credit to GDP over time. To understand the time series depicted, it is useful to examine numerator and denominator separately. This is intended not only to indicate the change in the individual variables, but also to examine whether they fall into the same period or whether one magnitude reacts with time to the other variable. Banking crises are usually preceded by credit booms (Schularick and Taylor, 2012, Reinhart and Rogoff, 2013, among others). These booms are favoured by looser lending standards (Van der Veer and Hoeberichts, 2016). Linked to output, aggregated performance measured by

GDP should fall below an averaged level (Kaminsky and Reinhart, 1999). Following Demirgüç-Kunt and Detragiache (1998), "[...] low GDP growth is clearly associated with a higher probability of a banking crisis [...]" (Demirgüç-Kunt and Detragiache, 1998, 98). Demirgüç-Kunt and Detragiache (2005) find similar results. Crises should lead to tighter lending standards and therefore stronger credit rationing (Lang and Nakamura, 1995, Bernanke et al., 1996, Lown and Morgan, 2006). A decline in new credit during a crisis is consistent with Ivashina and Scharfstein (2010), Campello et al. (2011) and Kahle and Stulz (2013). They find empirical evidence based on firm-level and loan-level data. To provide some visual evidence for the US economy, see Figure 2.6 on page 38. The black line denotes a time series of real GDP and the grey line denotes total bank credit of all commercial banks in the US. Both time series are based on quarterly data and displayed as percentage change from the preceding year. Again, the black bar marks the bankruptcy of Lehman Brothers. The data is retrieved from FRED Economic data.[31] Figure 2.6 shows visual evidence for one particular crisis and its real effects on one single country. This evidence is consistent with Kaminsky and Reinhart (1999). Up until the third quarter of 2008, growth is declining but positive. Growth in total loans is still positive and slowly decreasing after the first quarter of 2009, which is consistent with a decline in new debt (Ivashina and Scharfstein, 2010). Noticeably, the intersection at the horizontal axis is about one year lagged for total credit to real GDP, which would be in line with Morris and Sellon (1995). They find that "[...] business lending tends to lag economic activity as measured by industrial production" (Morris and Sellon, 1995, 70).

Real Effects on Corporations

Campello et al. (2010) investigate the real effects of financing constraints in the context of the financial crisis of 2008 on survey data. To distinguish between constrained and unconstrained firms, they use proxies for size, ownership structure, credit rating profitability, dividend payments, and growth opportunities. The survey is conducted by sending 10,000 questionnaires via email to chief financial officers (or similar job titles) of non-financial firms from US, Europe and Asia. The respondents are predominantly

[31] FRED Economic Data gathers data for bank credit of all commercial banks from Board of Governors of the Federal Reserve System (2016) and for Real Gross Domestic Product from US. Bureau of Economic Analysis (2016).

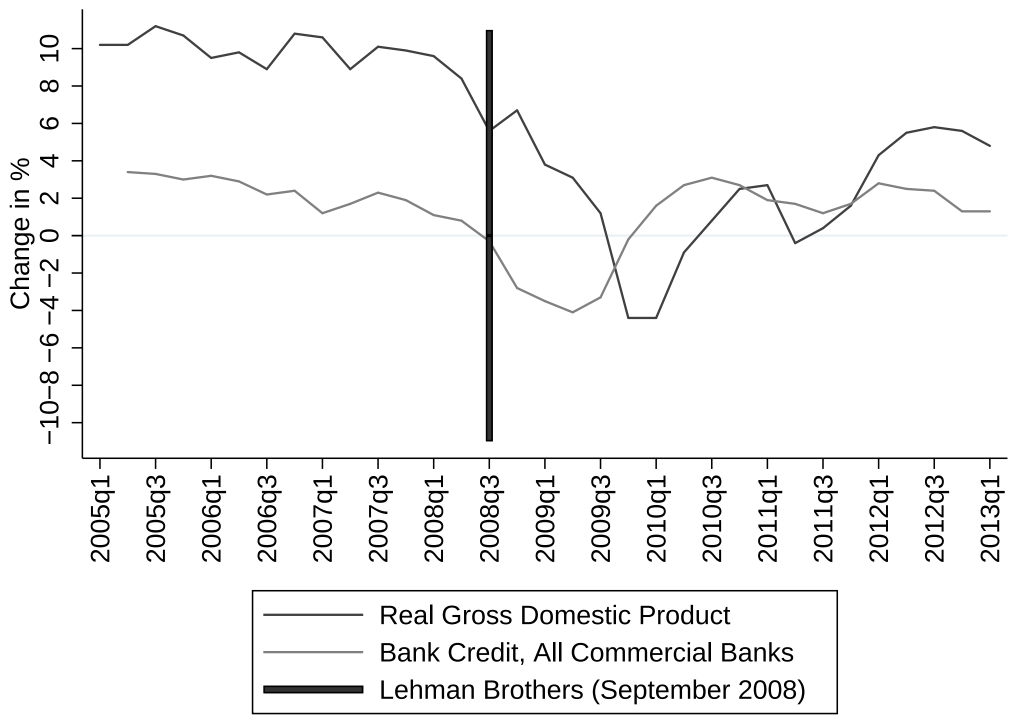


FIGURE 2.6: Adapted from FRED Economic data: Real GDP and total credit in the US.

subscribers of CFO magazine, CFO Europe and CFO Asia. In addition, data is gathered from previous surveys from Duke University. Aggregated to firm-level data, the final sample consists of 1,050 firms. The companies are geographically distributed as follows: 55 % US firms, 18 % European firms, and 27 % Asian firms. Figure 2.7 on page 39 displays the plans for investments, dividend payments and cash holdings based on the respondents answer for the fourth quarter of 2008. The bars for every geographical region are from left to right: tech expenditures, capital expenditures, marketing expenditures, dividend payments and cash holdings. Their plans indicate a severe cut in investments and dividend payments. Further, it seems that the respondents from Europe expect a stronger reduction of internal resources as a consequence of the financial crisis. Focusing only on US firms, Campello et al. (2010) also find that reductions are higher for constrained firms compared to unconstrained firms.

Duchin et al. (2010) support these results. Based on quarterly data of public non-financial and non-utility firms, Duchin et al. (2010) report a decline in investments of 6.4 % (quarterly decline: 0.109 %) compared to a period prior to the peak of the crisis.

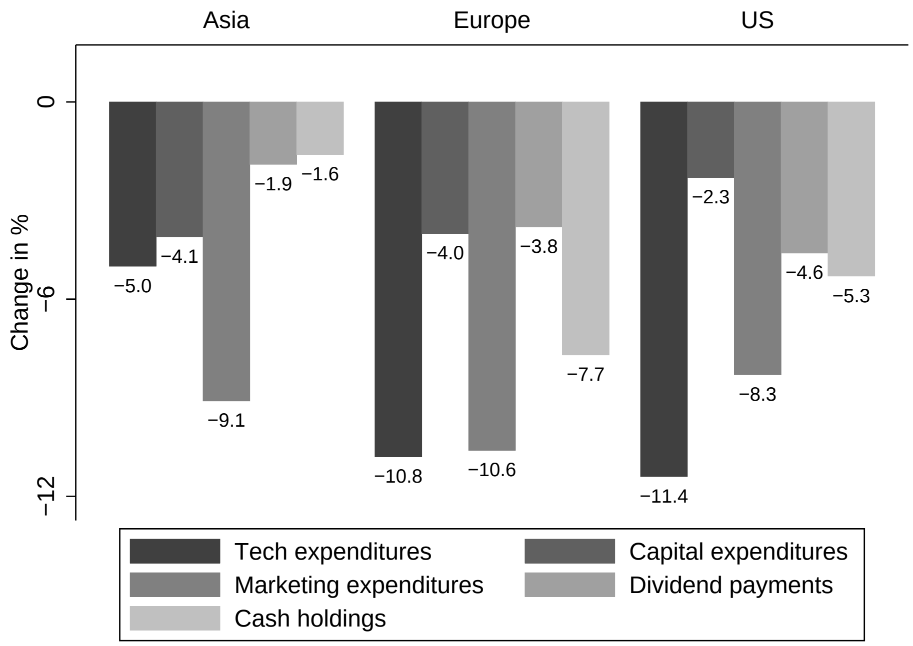


FIGURE 2.7: Adapted from Campello et al. (2010), 475: Plans of firms across geographical regions.

They choose July, 1st of 2007 as the beginning of the crisis. According to Cingano et al. (2016) and based on loan-level data of Italian firms, tightened credit supply lead to a decline in capital expenditures for the years 2007 to 2010. Estimates indicate that aggregated investments would have been 24 % higher for the observed three years without the occurrence of the crisis. Kahle and Stulz (2013) partially support these results. They find weaker evidence for a decline in capital expenditures for small and bank dependent firms. Bliss et al. (2015) study corporate payout policy along with cash retention and the supply of credit. Their sample consists of all listed non-financial and non-utility firms from the Compustat database from 1990 to 2010. See Figure 2.8 on page 40. US firms reduce payouts in the form of share repurchases after the peak of the financial crisis in 2008. Dividend payments seem to be relatively stable over time, which is consistent with the literature on the signalling effect of dividends (Aharony and Swary, 1980, Miller and Rock, 1985, among others).[32] Floyd et al. (2015) note a decline in dividends per share from 2006 to 2008 followed by an increase in 2009. Share repurchases drop sharply in 2008 for the subsequent two years. Consistent with Fama

[32]These results are robust after normalization for earnings.

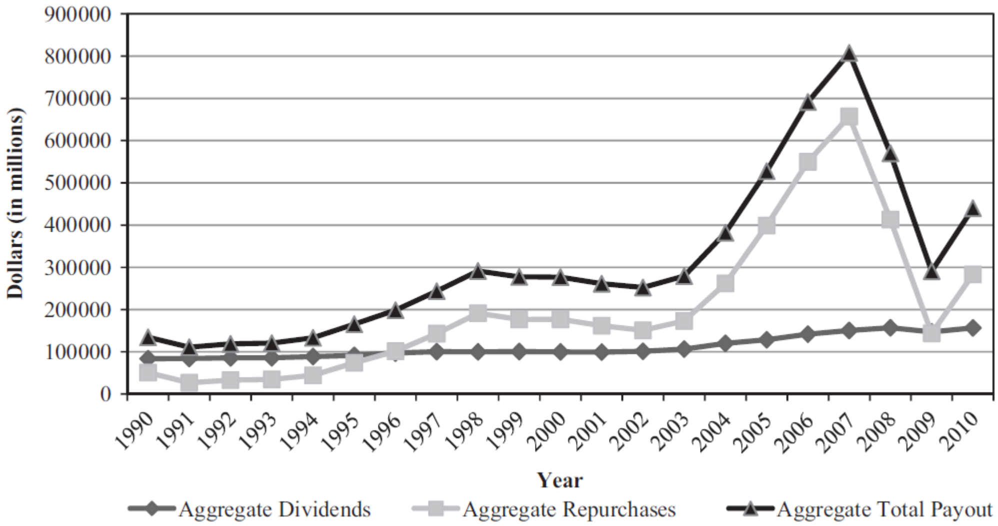


FIGURE 2.8: Bliss et al. (2015), 527: Aggregated dividends, repurchases, and total payout (median).

and French (2001), Bliss et al. (2015) and Floyd et al. (2015) show a decline in dividend paying firms. Fewer firms pay a higher level of dividends.

Campello et al. (2010) provide evidence for the utilization of credit lines during the crisis. See the left graph in Figure 2.9 on page 41. They compare the peak of the crisis, which is marked at the end of the fourth quarter of 2008 with one year prior to this date. Although differences in groups are not tested, it is noticeable that constrained firms tend to utilise credit lines more than unconstrained firms. Further, European constrained firms seem to use credit lines more during a crisis. According to Campello et al. (2011) and consistent with Campello et al. (2010), the use is higher for "[...] small, private, non-investment grade, and unprofitable had significantly higher lines-to-asset ratios than their larger, public, investment-grade, profitable counterparts, both in 2008 and in 2009" (Campello et al., 2011, 1946). These results are also consistent with Acharya et al. (2014) and Harford et al. (2014).

The right graph in Figure 2.9 shows cash holding as a percentage of total assets. As a reminder, Campello et al. (2010) compare the fourth quarters of 2007 and 2008 of constrained and unconstrained firms. The results are contrary to the existing literature on financing constraints and cash holdings. Cash holdings should be higher for constrained firms than for unconstrained firms.[33] However, the right graph indicates a decline in

[33]See Subsection 2.1.2 on page 12.

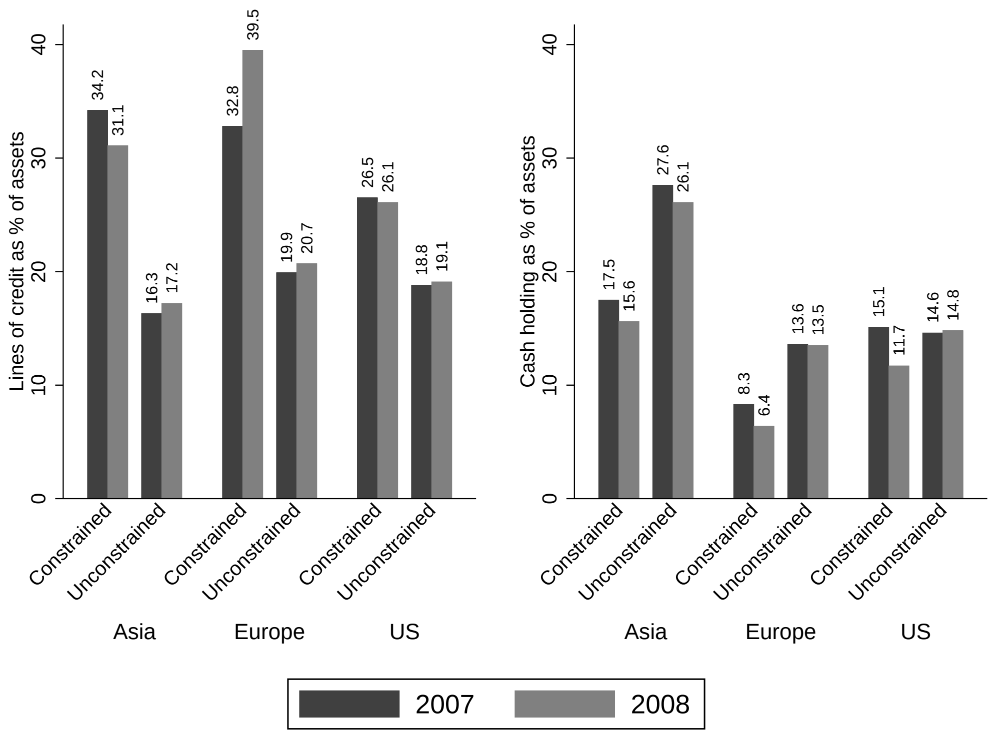


Figure 2.9: Campello et al. (2010), 482: Lines of credit and cash holdings: 2007 vs. 2008.

liquidity for constrained firms. Companies with difficult access to external financing tend to use internal resources to realise potential investments. This is also consistent with the flight to quality argument. Chen et al. (2018) argue that financially constrained firms which already increased their cash holdings after an economic downturn tend to increase their cash holdings during a follow-up crisis.[34]

The cash-level of unconstrained firms seem rather stable a crisis. Kahle and Stulz (2013) also find evidence for a reduction of internal resources using quarterly data. In this case the pre-crisis period is defined from the third quarter of 2006 until the second quarter of 2007. The comparative period (or the first year of the crisis) is defined from the third quarter of 2007 to the second quarter in 2008. The effect seems to persist for companies with no debt or high cash reserves only. The results are inconclusive for both bank dependent firms, firms with high leverage, and small, bank dependent firms. Kahle and Stulz (2013) also compare the periods post- and pre-Lehman Brothers. The cash reserve tends to increase for the whole sample. This holds true for bank dependent

[34]Chen et al. (2018) analyse cash holdings for the 2000 dot-com crisis and the 2008 sub-prime crisis.

firms and firms without debt. A signal such as the default of Lehman Brothers could have impacted the liquidity management of corporates ahead of deteriorated economic conditions. This could have lead to an increase in precautionary savings.

The previous chapter can be summarised as follows. Empirical literature on corporate cash holdings may be divided into three different categories: (1) literature on firm-specific determinants of corporate cash holdings, such as Kim et al. (1998), Opler et al. (1999) and Bates et al. (2009); (2) literature on country-specific determinants of corporate cash holdings, such as Dittmar et al. (2003), Pinkowitz et al. (2006) and Kalcheva and Lins (2007); and (3) literature on how listing affects corporate cash holdings, such Faulkender (2002) and Brav (2009). This literature directly or indirectly studies a firm's ability to generate internal resources, by retaining earnings and accessing external financing (Almeida et al., 2004). The former can be done by reducing or cutting payments to shareholders or by reducing expenditures in tangible or intangible assets; the latter by issuing debt or equity titles. Note, the ability to do so is not only restricted to a firm. Due to their structure, some industries are more dependent on certain sources of financing than others (Rajan and Zingales, 1998).

Banking crises are usually preceded by an indication in form of a signal, such as a peak in stock markets or real estate markets (Kaminsky and Reinhart, 1999, Borio and Drehmann, 2009). Not every signal is followed by a banking crisis, i. e. some signals are informative and some are uninformative (Kaminsky et al., 1998, Kaminsky and Reinhart, 1999). A possible transmission channel for an observed signal that also leads to a banking crisis can be the excessive withdrawal of deposits in form of multiple bank runs (Diamond and Dybvig, 1983). However, it is difficult to determine a point in time in which a series of bank runs form a banking crisis. In literature, there are several definitions to identify the occurrence of a banking crisis that are used by the scientific community and also by supra-national organisations. These definitions may be divided in event-based approaches and index-based (or single indicator) approaches. Event-based approaches are used by Kaminsky and Reinhart (1999) and by Laeven and Valencia (2013b) among others. An index-based approach is used by Von Hagen and

Ho (2007) among others. The first tend to date the occurrence of a banking crisis later than the second.

A banking crisis can be transmitted to an economy in several ways. I focus on supply-side of funding. As discussed in Lang and Nakamura (1995) and Giannetti and Laeven (2012) among others, banks tend to reallocate funding to domestic borrowers and to borrowers of higher quality. This reallocation has possible real effects at a firm-level, including a change in investments, dividend policies and corporate cash holdings (Duchin et al., 2010, Campello et al., 2010, Kahle and Stulz, 2013, Bliss et al., 2015). Further, the effects - especially on corporate cash holdings - seem to affect constrained firms differently than their unconstrained counterparts (Campello et al., 2010, Kahle and Stulz, 2013), and therefore seem to be interesting to investigate in a broader context.

Chapter 3

Early Warning Signals, Banking Crises and Corporate Liquidity

3.1 Methodology

This section provides the theoretical framework of the subsequent results and is further structured in three subsections. In the first subsection, I will construct a theoretical framework to identify testable predictions: Two types of firms can observe two types of signals. The second subsection will discuss the different data sources. This includes sample adjustments, variable definitions and identification strategies. The last subsection is going to focus on potential and existing limitations.

3.1.1 Conceptional Framework

Based on the literature reviewed in Chapter 2, the following subsection will discuss to what extent a banking crisis and the ensuing potential liquidity shortage affect corporate cash holdings. For this purpose, I develop a conceptional framework and derive testable predictions from it.

Consider two types of companies: firms with good access to external funding resources and firms that are less flexible or restricted in their financing options, i. e. they rely more on banks and internal resources. The first group is denoted by the index u (financially unconstrained) and the second group by the index c (financially constrained). This is the only difference between both groups. Both groups are only interested in generating future cash flows by investing in positive NPV-projects. To do so, they can retain profits or cut dividends. In addition, companies from group u can access external resources more easily than companies from group c, e. g. through the issuance of equity shares for a higher price, or corporate bonds to the capital market, or through the raising of bank debt at more favourable conditions (Loughran and Ritter, 1995, Lang and Nakamura, 1995, Bernanke et al., 1996, DeYoung et al., 2015).

It is assumed that there are two types of signals.

Figure 3.1: Timeline of events.

Signal 1 indicates that a banking crisis is likely to occur in t. Assuming that future investment opportunities will continue to be realised and banking crises are often preceded by a deterioration of economic conditions, companies (c and u) react to negative signals by changing their liquidity management to secure future cash flows and therefore going concern (Kim et al., 1998, Opler et al., 1999, Claessens et al., 2012).[1] The conditional probability for *Signal 2* (t) increases in case *Signal 1* ($t-1$) is observed. A signal at time t indicates that funding from banks is more restricted from this point onwards, creating four information scenarios: (1) No signals are observed, (2) *Signal 1* is observed but not followed by *Signal 2*, (3) *Signal 1* is not observed but followed by *Signal 2*, and (4) Both signals are observed. The different cases have the following testable implications:

Case (1): Due to higher restrictions in their financing options, companies from group c value cash more than companies from group u and on average, should have higher levels of cash holdings (Almeida et al., 2004, Faulkender and Wang, 2006, Acharya et al., 2007):

On average, financially constrained firms hold higher amounts of cash than their unconstrained counterparts.

[1]See Subsection 2.2.1 on pages 23-27.

Case (2): In $t-1$, both groups increase their cash holdings due to higher uncertainty of future cash flows (Kim et al., 1998, Opler et al., 1999). In addition, companies from group c expect higher restrictions to external funding and therefore have less funding possibilities, i. e. higher levels of cash holdings (Fazzari et al., 1988, Kaplan and Zingales, 1997, Cleary, 1999, Adjei, 2013):

A signal that indicates that the realisation of future investments is more uncertain leads to an increase in precautionary cash holdings.

Case (3): A banking crisis occurs in t without an early warning. Due to a higher degree of information asymmetry during a banking crisis between management and shareholders and a decline in equity prices prior to a crisis, generating liquidity through the issuance of equity shares is no longer considered as an option by both groups (Loughran and Ritter, 1995, Kaminsky and Reinhart, 1999, Boyd et al., 2005). Further, during crises, banks tend to reduce funding to borrowers with higher creditworthiness (Lang and Nakamura, 1995, Bernanke et al., 1996, DeYoung et al., 2015). This predominantly affects companies within group c. Companies from group u are still able to issue bonds and are therefore not affected (Whited, 1992, Calomiris et al., 1995). Group c is only able to finance positive NPV-projects by cutting or reducing payments to existing shareholders[2], or the use of existing internal resources. Hence, companies from group c are expected to decrease cash holdings in times of crises (Campello et al., 2010). I hypothesise that the level of cash holdings of less restricted firms remains unaffected due to the additional access to external debt:

Cash holdings of financially constrained firms decline during banking crises.

Case (4): A signal is observed in $t-1$ followed by a banking crisis in t. Case (4) is a combination of (2) and (3):

Financially constrained and unconstrained firms increase their cash holdings before crises, and only financially constrained firms reduce cash holdings during crises.

[2] The assumption that low dividend payers are financially constrained is consistent with Fazzari et al. (1988), Kaplan and Zingales (1997), Cleary (1999).

From now on, I will use the terms *Case (1)*, *Case (2)*, *Case (3)* and *Case (4)* for the remainder of this chapter. To be consistent, the notation for both groups remains unchanged. Hereinafter, the terms *Signal 1* and EWS are used interchangeably. Further, *Case (1)* has already been studied extensively and will only be tested for the sake of completeness and as a robustness check.[3]

3.1.2 Data

The data is gathered from different sources. Accounting and firm-level market data is obtained from Bloomberg for larger parts of Europe and from Compustat North America (henceforth: Compustat) for the US. To check for robustness and to control for certain macroeconomic effects, I use data provided by the World Bank, FRED Economic Data, European Central Bank and Datastream.[4] For crises identification, I focus on more recent data sets provided by Reinhart and Rogoff (2009) and their updates in Reinhart (2010) and Reinhart and Rogoff (2014). To be consistent with the terminology used in Subsection 3.1.1, this subsection will be structured as follows: *Firm-level data* will cover firm-specific characteristics, including criteria to classify companies into group c or u; and *EWS and Banking Crises* will cover data needed to identify *Signal 1* and *Signal 2*. Variables will be defined within this subsection.

Firm-level data

Firm-level data is obtained from two different sources, but both sources are adjusted in the same manner. Financial and utility companies are excluded from both raw samples. This adjustment is common in empirical capital structure theory when focusing on US data. Financial firms have different balance sheet structures than e. g. manufacturing companies. Further, financial firms are highly regulated. This means they are somehow restricted in their investment and financing behaviour.[5] "[Bates et al.] exclude financial firms [...] because these firms hold cash to maintain reserve requirements. [Bates et al.] also exclude utilities [...] because these firms are subject to regulatory oversight" (Bates et al., 2017, 6). To be consistent, this is also assumed for European utility companies.

[3]See Subsection 2.1.2 on page 12.
[4]A detailed list of the different data samples can be found in Appendix C on pages 210-211.
[5]See for adjustments in US Samples Denis and Sibilkov (2010) and Duchin et al. (2010) among others

To cover multiple EWS and banking crises, both raw samples cover a broader period: The Compustat sample consists of yearly data of all listed North American companies from 1995 to 2015; and the Bloomberg sample contains annual accounting data from 1988 to 2012. The companies are located in Western Europe and Eastern Europe, in case they were members of the European Union in 2012. In addition, the companies had to be publicly traded in 2012. Further, both samples consist of parent companies and their immediate subsidiaries where these subsidiaries are also public. Similar to Almeida et al. (2004), I assume that parent companies dictate their cash holding policy to their immediate subsidiaries.[6]

Bloomberg and Compustat use accounting definitions which are closely based on IFRS or US-GAAP. Tables C.2 and C.3 on pages 213-214 display items here. The definitions are shown in column 4. In addition to the accounting and market items, the Bloomberg sample contains information about the country in which a company's headquarters is located and in which it earns the majority of its revenues. Note, this information is not available for North America. Further, industry classifications are available for both data sets: the Industry Classification Benchmark (ICB) for Bloomberg, and the Global Industry Classification Standard (GICS) for Compustat.[7]

The samples are adjusted as follows:

(1) Duplicates and observations with `#N/A Invalid Security`, `#NAME?`, or `#N/A #N/A` as company name are deleted.

(2) Firm years with missing industry classification or `#NV`, `#N/A`, or `#N/A #N/A` as industry name are excluded from the sample.

(3) Only firm years with positive sales figures are included.

(4) Firm years with an asset or a sales growth of 100 % in one year are also excluded from the sample.

(5) The observation period is truncated to: 1997 to 2012 respectively 1997 to 2014.

[6]As a robustness check, Almeida et al. (2004) eliminate the effect of financial subsidiaries in their sample. The results are not affected by this sampling restriction.

[7]GICS and ICB group companies primarily by their main source of income.

(6) American Depositary Receipts (ADR) are excluded from the samples (Opler et al., 1999).

(7) Firm years with negative cash holdings or cash holdings which exceed the book value of total assets are removed from the sample (Almeida et al., 2004, Duchin et al., 2010, Denis and Sibilkov, 2010). In addition, missing values are excluded.

(8) Firm years with a book value of total assets of zero; a missing book value of total assets; or in case the total amount of total liability exceeds the book value of total assets are excluded (Bates et al., 2009, Dittmar and Duchin, 2012, Bates et al., 2017).

(9) Bloomberg: Only firm years with a positive market capitalization and positive book value of equity are included.

(10) Compustat: Only firm years with a positive book value of equity are included.

(11) Bloomberg: Firm years with missing country information are excluded from the sample.

(12) Bloomberg: Countries with no more than 400 observations in total are also excluded.

The first adjustment is necessary to isolate possible effects from duplicates. Further, the deletion of unidentifiable companies allows me to assign a panel variable. Otherwise, there would be a repeating time variable for companies named `#N/A Invalid Security`, `#NAME?`, or `#N/A #N/A`. The same applies to companies with unidentifiable industry classifications. Similar to Almeida et al. (2004), I try to exclude non-operational companies from the sample. To be more specific, results should not be influenced by financial subsidiaries or other shelf companies, i. e. firms that are not founded or created for the purpose of being operational on their own. I therefore focus on firm years with positive sales figures. In (4), firm years displaying a high asset or sales growth are eliminated (Almeida and Campello, 2007, Chang et al., 2014). With this adjustment, I try to mitigate the effect of mergers and acquisitions. Targets or acquiring firms tend to hold higher levels of excess cash.[8] The adjustment in item (5) is due to a relatively small number of observations in years prior to 1997. This affects the European sample. Although this adjustment shortens the observation period by several years, it still allows me to analyse *Case (2)*, *Case (3)* and *Case (4)* on both samples. Item (9) ensures a focus on publicly traded companies. Information on the market values of equity for North American companies is not available. Thus, an adjustment is only feasible for book values. The exclusion of firm years with negative equity allows me to analyse firms that are not over-indebted (Acharya et al., 2007, Almeida et al., 2004). To assign banking crises to a country and to use country fixed effects later on, firm years with missing country information are excluded from the sample (Mundlak, 1978, Hausman and Taylor, 1981). Further, countries consisting of less than 400 firm year observations are going to be neglected. This threshold is based upon my own discretion, aiming to obtain more valid results when testing the different cases at a country-level.

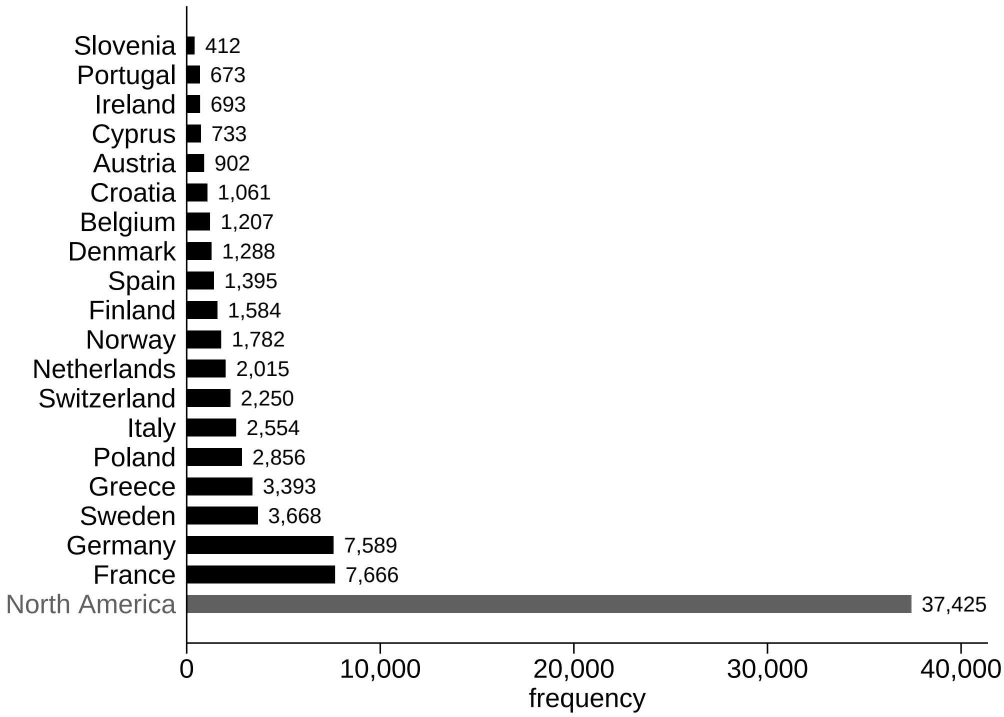


FIGURE 3.2: Observations per country/region.

The geographical distribution is displayed in Figure 3.2. The European sample has 43,721 firm year observations. About 17 % are attributable to France and Germany,

[8] For a more detailed discussion on cash holdings and acquisitions, see Harford (1999) and Faleye (2004).

and the remaining countries with less than 10 % each. Note, firms located in the United Kingdom are excluded after applying the adjustments mentioned before. Specifically, there is no information in the Bloomberg sample for the item `cash`. Therefore, by excluding missing values for this item from the sample, firms from the United Kingdom are also excluded. Due to further adjustments of variables, the number of observations will decline further, i. e. matching of three different samples, sample splits and missing values for certain accounting items.

All values are deflated to the 1997 domestic currencies using the consumer price inflation rate (Almeida and Campello, 2007, Duchin et al., 2010). Further, to avoid effects from outliers, numeric variables are winsorised at the 1 %/99 %-levels (Chava and Purnanandam, 2011, Dittmar and Duchin, 2012).

Location-specific or business-specific effects that are not directly observable are controlled for by using country, industry, and company fixed effects (Mundlak, 1978, Hausman and Taylor, 1981). Country fixed effects are only used for the European sample, since this information North American sample was not at my disposal. For North American firms, industries are clustered using the first four digits of GICS[9]; and for European firms, industries are clustered at supersector-level.[10]

Following Bates et al. (2009) and Campello et al. (2011), cash holdings (`casHOL`) is used as endogenous variable and is defined as cash and near cash items (`cash`) divided by total assets (`totAST`). Note, the definitions for the item `cash` differ in across samples. The selection of exogenous variables is among other things conditional to the quality of the data sets. In order to create sufficient comparability, the most common variables are used for both data sets. Firm size (`size`) is measured by the natural logarithm of the book value of total assets (Opler et al., 1999). Net working capital (`netWOC`) is defined as current assets (`curAST`) minus current liabilities (`curLIA`) minus cash normalised with the book value of total assets (Fazzari and Petersen, 1993, Bates et al., 2009). Capital expenditures for non-current assets (`capETA`) are measured by the cash outflow

[9]Bhojraj et al. (2003) find evidence that GICS is superior in explaining several company-specific factors, such as "[...] stock return comovements, [...] cross-sectional variations in valuation multiples, forecasted and realised growth rates, research and development expenditures, and various key financial ratios[.]" compared to SIC and NAICS (Bhojraj et al., 2003, 745).

[10]GICS at a four digit level consists of 24 industry groups. The ICB at supersector-level consists of 19 supersectors.

for tangible fixed assets (`capEXP`) divided by the book value of total assets (Bates et al., 2009, Kusnadi and Wei, 2011). `netWOC` and `capETA` are used as proxies for expenditures for current and non-current assets. Opler et al. (1999) use `netWOC` to proxy for assets that can be more easily transferred into liquidity. The indebtedness (`totLEV`) of a company is defined as the book value of total liabilities (`totLIA`) to the book value of total assets (Opler et al., 1999, Faleye, 2004, Acharya et al., 2012). Instead of interest bearing debt, I use total liabilities because the number of observations is much higher. Performance and efficiency are measured by two different ratios: return on assets (`retAST`) and return on sales (`retSAL`). The first ratio follows the literature and is defined as net income (`netINC`) over the book value of total assets (Mikkelson and Partch, 2003). To the best of my knowledge, there is no study that uses the second ratio as a measure for efficiency. `retSAL` is calculated as net income over `sales`. Using net income instead of EBITDA is driven by data restrictions, i. e. a high number of missing values. Table 3.1 on page 53 provides a summary of each variable of both samples. Note, the ratios are based on the full samples without controlling for industry and country fixed effects.

Companies from group c and group u differ in their access to external funding. Following Almeida et al. (2004), Han and Qiu (2007) and Acharya et al. (2007) among others, companies are more likely to be financially constrained when one of the following criteria are met:[11]

(1) *Dividend payments*: The top three deciles of cash dividend payments (`divPCA`) classify a company as not financially constrained ($u:$ `fcDIV` $= 0$) and the bottom three decile as financially constrained ($c:$ `fcDIV` $= 1$). Note, companies that never paid any dividends are by this definition classified as financially constrained (Fazzari et al., 1988).

(2) *Bond rating*: The existence of a bond rating (`ratDLT`) classifies a company as not financially constrained ($u:$ `fcLTR` $= 0$) and the absence as financially constrained ($c:$ `fcLTR` $= 1$) (Whited, 1992).

[11] The selection of different criteria is restricted to quality of the data sets. However, it is possible to create variables that are common in literature on financing constraints and bank dependence. See Subsection 2.1.2 on pages 12-15 and 2.2.2 on pages 32-34.

(3) *Commercial paper rating*: The existence of a commercial paper rating (`ratDST`) classifies a company as not financially constrained ($u:$ `fcSTR` $= 0$) and the absence as financially constrained ($c:$ `fcSTR` $= 1$) (Calomiris et al., 1995).

(4) *Company size*: The top three deciles of `totAST` are assumed to be not financially constrained ($u:$ `fcSIZ` $= 0$) and the bottom three deciles are assumed to be financially constrained ($c:$ `fcSIZ` $= 1$) (Gilchrist and Himmelberg, 1995).

Table 3.1: Descriptive statistics: Europe and North America.

Variables	Region	Mean	SD	p25	Median	p75	N
`casHOL`	Europe	0.098	0.120	0.022	0.055	0.122	43,721
	US	0.180	0.199	0.032	0.102	0.257	37,425
`size`	Europe	4.834	2.047	3.421	4.639	6.057	43,721
	US	5.838	2.192	4.267	5.913	7.370	37,425
`netWOC`	Europe	0.075	0.187	-0.044	0.066	0.190	43,443
	US	0.080	0.173	-0.028	0.065	0.183	36,380
`totLEV`	Europe	0.544	0.199	0.406	0.565	0.691	43,721
	US	0.471	0.219	0.298	0.474	0.629	37,425
`retAST`	Europe	0.012	0.120	-0.003	0.030	0.065	43,710
	US	0.003	0.166	-0.012	0.040	0.082	37,418
`retSAL`	Europe	-0.038	0.417	-0.004	0.029	0.069	43,710
	US	-0.119	0.836	-0.013	0.037	0.086	37,418
`capETA`	Europe	0.052	0.054	0.017	0.036	0.067	36,889
	US	0.055	0.062	0.017	0.034	0.066	37,201

Remark: SD is shorthand for standard deviation. p25 and p75 are defined as the 25 %-percentile and the 75 %-percentile. N is the number of observations.

EWS and Banking Crises

Signal 1 is represented by the stock market and the real estate market. This selection is due to restricted access to data and its coverage. To the best of my knowledge, signals as described in Section 2.4 on page 25 are not accessible to me and might not provide sufficient coverage for most of the countries over the given time frame. Stock markets are approximated by domestic stock market indices, and the real estate market by two indices: MSCI International United States Real Estate Price Index (henceforth: MSCI US) for the North American sample and MSCI International Europe Industry Group - Real Estate (henceforth: MSCI Europe) for the European sample. To be able to match several data samples later on and to avoid a higher number of missing values, an index should cover the full observation period, and should also be comparable to indices from different countries. Therefore, I select indices based on two criteria, data availability and their number of constituents. The stock market data is available on a monthly basis and the real estate indices are available on a quarterly basis. For clarification, consider Table 3.2. Full coverage is given in case the starting date is February 1997 or first quarter 1997.

TABLE 3.2: Signal 1: Stock market and real estate market.

Signal 1	Country/Region	Name	Observation period		N
			Start	End	
Stock market	Austria	ATX	February 1997	December 2014	215
	Belgium	BEL20	February 1997	December 2014	215
	Croatia	CROBEX	January 1998	December 2014	204
	Cyprus	CYFT	December 2000	December 2014	169
	Denmark	OMXC20	February 1997	December 2014	215
	Finland	OMXH25	February 1997	December 2014	215
	France	CAC40	November 1998	December 2014	193
	Germany	DAX	February 1997	December 2014	215
	Greece	ATHEX	February 1997	December 2014	215
	Ireland	ISEQ20	March 2005	December 2014	118
	Italy	FTSE MIB	December 1997	December 2014	205
	Netherlands	AEX	February 1997	December 2014	215
	Norway	OBX	February 1997	December 2014	215
	Poland	WIG	February 1997	December 2014	215
	Portugal	PSI20	February 1997	December 2014	215
	Romania	BETI	September 1997	December 2014	208
	Sweden	OMXS30	February 1997	December 2014	215
	Slovenia	SBITOP	April 2006	December 2014	105
	Spain	IBEX35	February 1997	December 2014	215
	Switzerland	SMI	February 1997	December 2014	215
	United States	S&P500	February 1997	December 2014	215
Real Estate	Europe	MSCI US	first quarter 1997	fourth quarter 2014	72
	United States	MSCI Europe	first quarter 1997	fourth quarter 2014	72

Remark: The data is obtained from Datastream. The data access is limited to 20 years of historical data. By the number of constituents, the indices are roughly the same size, except for FTSE100 and S&P500. N is the number of observations.

Banking crises are often preceded by stronger run-ups in stock prices and real estate prices (Kaminsky and Reinhart, 1999, Borio and Drehmann, 2009). In order to avoid the risk of identifying every local peak as a turning point of a run-up, a proper definition is needed. I define a signal as the peak of a price movement that deviates from its trend by a certain threshold.

I deliberately decided against a fixed numeric threshold and use a figure that reflects the volatility of the underlying data. Thus, I define the threshold as one constant standard deviation of an index (e. g. `SMI`) over the whole observation period. The deviation of a price movement is defined as the difference (`gap`) between an index and its trend. The trend component of an index is extracted by using the method proposed by Hodrick and Prescott (1997) and the adjustments for monthly data proposed by Ravn and Uhlig (2002).[12]

Alternatively, the gap variable could be defined as the difference between a time series and its mean or its median over the full observation period. I deliberately decided against this approach for two reasons: First, it would ignore long-term market movements by setting a time-invariant fixed threshold, i. e. the threshold remains constant for every point in time. The trend component of a time series would incorporate long-term market movements. Second, it would overestimate short-term fluctuations, i. e. cyclical movements appear more severe.

The variation of the `gap` variable is further smoothed by using a five period moving average. In case of several peaks within one year, a signal will only be assigned once to that year. For clarification, consider Figure 3.3. For illustrative purposes, I used the Norwegian stock index `OBX`. The remaining indices can be found in Appendix A.1 on page 151.

The graphs on the left hand side display the realisation of the index and its trend over time. The difference between index and trend is displayed on the right hand side. Note, the graph is already smoothed by a five period moving average. The dashed line denotes the threshold of one standard deviation. *Signal 1* is observed in 2007 (May 2007 and August 2007). Thus, a dummy variable is set to one for the year 2007 (`s1STM` = 1) for every Norwegian company, and otherwise zero (`s1STM` = 0). However, one might argue that the peak of a stock or real estate market is not considered by corporations or other insiders as a sign for an upcoming crisis. A different approach would be to mark the steepest point of a decline after a peak as a signal. In Figure 3.3, this would be in late 2007 instead of May and August, but still in the same year. Thus, when comparing both approaches, there would only be a difference in case a peak is e. g. in November or December and the strongest decline in January of the following year.

[12] Hodrick and Prescott (1997) present a method to split a time series in two different components: a smoothened trend and a cyclical component.

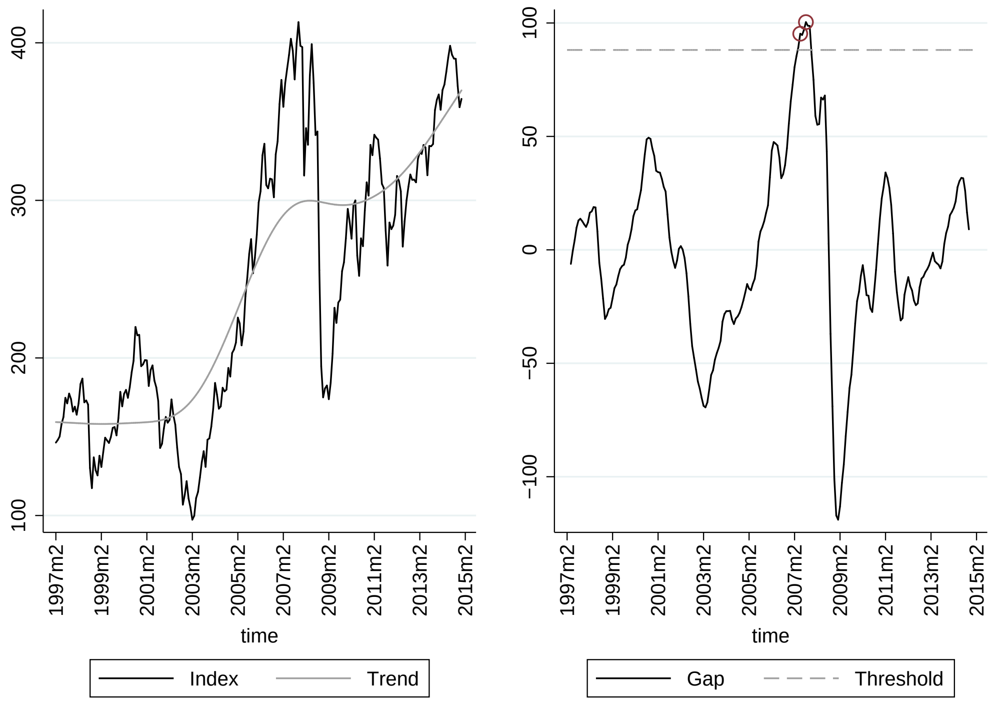


FIGURE 3.3: Adapted from Datastream: Norway: OBX - monthly data.

The aforementioned approach is applied to every index that reflects the stock and real estate market. Since data on the real estate market is only available at an aggregated level, real estate prices are only used as a robustness check: `s1REM` = 1 in case a signal is observed, and `s1REM` = 0 otherwise.

Signal 2 is represented by an event-based approach to identify banking crises based on the definition provided by Kaminsky and Reinhart (1999):

> "[...] (1) bank runs that lead to the closure, merging, or takeover by the public sector of one or more financial institutions [...]; and (2) if there are no runs, the closure, merging, takeover, or large-scale government assistance of an important financial institution (or group of institutions) that marks the start of a string of similar outcomes for other financial institutions [...]" (Kaminsky and Reinhart, 1999, 476).

The data is predominantly obtained from Reinhart and Rogoff (2009) and the updated sample from Reinhart (2010) and Reinhart and Rogoff (2014). They use virtually the same definition as Kaminsky and Reinhart (1999). This data is available on an annual basis until 2010. The remaining sample is adjusted according to the definition mentioned above for the years 2011 to 2012 for Europe (and to 2014 for the US). In case an event in the sense of Kaminsky and Reinhart (1999) takes place, a dummy variable is set to one (`bcRR`= 1), and otherwise to zero (`bcRR`= 0). In case there is a country year without coverage, it is marked as missing value. The geographical distribution of crisis episodes is displayed in Table 3.3 on page 57. The number of firm year observations with `bcRR`= 1 amounts to 6,071, and to 36,197 firm years with `bcRR`= 0 for Europe. As before, the largest share of banking crises in the European sample is attributed to France and Germany.

TABLE 3.3: Adapted from Reinhart and Rogoff (2009), Reinhart (2010) and Reinhart and Rogoff (2014): Signal 2: Banking Crises.

Country	Banking Crisis		N
	YES	NO	
Austria	189	713	902
Belgium	279	928	1,207
Croatia	120	221	341
Denmark	285	1,003	1,288
Finland	0	1,584	1,584
France	1,560	6,106	7,666
Germany	1,661	5,928	7,589
Greece	684	2,709	3,393
Ireland	202	491	693
Italy	0	2,554	2,554
Netherlands	349	1,666	2,015
Norway	0	1,782	1,782
Poland	0	2,856	2,856
Portugal	113	560	673
Slovenia	0	412	412
Spain	281	1,114	1,395
Sweden	0	3,668	3,668
Switzerland	348	1,902	2,250
United States	9,453	27,046	36,499

Remark: The data is obtained from Reinhart and Rogoff (2009), Reinhart (2010) and Reinhart and Rogoff (2014). YES/NO is the number of country years with/without a banking crisis. N is the sum of these observations per country.

The use of an event-based approach instead of a more quantitative one is motivated by several reasons. First and foremost, the access to bank data is limited. To be more specific, I am not able to obtain stock prices or data of a bank's portfolio quality. Following the argument of Kaminsky and Reinhart (1999), not all banks are listed. Therefore, even with good access to data, it would not be possible to gather enough information on stock prices for every bank in every country for the observed time frame. As discussed in Subsection 2.2.1, the excessive withdrawals of bank deposits in the form of a bank run could mark the beginning of a banking crisis (Kaminsky and Reinhart, 1999, among others). However, following Reinhart and Rogoff (2009), bank problems are not driven by the liabilities side but from a prolonged decline in asset quality. In addition, banks hardly ever disclose information about the true quality of their portfolio. To still ensure the validity of the results later on, robustness is checked with two different indices which measure financial stress at an aggregated level: (1) Composite Indicator of Systemic Stress (CISS) and (2) St. Louis Fed Financial Stress Index (STLFSI).[13]

CISS is provided by the European Central Bank, and is limited to an observation period from January 1999 to December 2014 (Holló et al., 2012). STLFSI is provided by the Federal Reserve Bank of St. Louis. STLFSI covers the full observation period from January 1997 to December 2014. Although both indices are available on a more frequent basis, it is sufficient here to gather the indices on an annual basis because the aforementioned information on banking crises consists of annual data only. Both indices use indicators for the money market, the bond market, and the stock market. CISS also includes indicators for financial intermediation and the foreign exchange market.[14]

As mentioned in Subsection 2.2.1 on page 29, event-based approaches might indicate the beginning of a crisis too late, while a stress index might react too early that corporations do not adjust their liquidity as a precautionary measure. To control for this issue and to check for robustness, I include the indices as a single variable: For the European sample, `finSTR` is proxied by CISS, and for the US sample by STLFSI.

[13]To the best of my knowledge, there is no study on corporate cash holdings that uses this proxy as measure for financial stress.

[14]For more information on the composition of both indices, see Holló et al. (2012) for CISS and Federal Reserve Bank of St. Louis (2017) for STLFSI.

So far, I examined the data to determine *Case (1)*, *Case (2)*, and *Case (3)*. To cover *Case (4)*, it is necessary to define a variable that covers the interaction between two staggered variables. To be more specific, the variables `s1STM` (or `s1REM`) and `bcRR` cover the occurrence of either *Signal 1* or *Signal 2*, but not the occurrence of a crisis preceded by *Signal 1*. I therefore define this case as `s1STM` × `bcRR` = 1 (or `s1REM` × `bcRR` = 1) when *Signal 2* is observed and preceded by *Signal 1* in $t-1$ or $t-2$.

3.1.3 Limitations

The restrictions of this study may be divided into three parts: (1) sample restrictions, (2) identification strategy and (3) model specifications. (2) and (3) are rather common in the empirical literature, and (1) is specific to the data samples obtained. The latter can be handled to a certain extent, the first one cannot.

Sample Restrictions

Both samples are obtained from external sources, to which I have no access any more. Any potential recording error leads to a more narrow choice of variables, estimations and other tests. Results have to be interpreted with caution for the following sample related restrictions:

1. The variable `casHOL` is defined differently in both samples.
2. For the Compustat sample, there is no information on the country in which a firm earns the majority of its revenues.
3. The observation periods differ in their length.
4. Stock market data cannot be matched to the Compustat sample because there is no fitting criterion or item.

In the Compustat sample, the item `cash` does not include short-term investments with a maturity of less than 90 days. Further, the item definition from Bloomberg excludes restricted cash, i. e. liquidity that is not freely available. I assume that this does not affect the full sample but rather firms that face higher levels of financing or investment constraints due to e. g. industry characteristics. This is controlled for to a certain extent by excluding highly regulated firms from the sample, such as financials and utilities.

The Compustat sample consists of firms from North America. Missing country information makes them indistinguishable from each other with respect to their country of incorporation. Thus, a country-specific event, like a peak in the Canadian stock market, is not marked as *Signal 1*. The same is true for *Signal 2*. However, by assuming that a smaller economy is more affected by a banking crisis than vice versa, I can control for this issue by choosing the largest economy as the country of a firm's incorporation. According to World Bank data, there are more firms listed in the US than in Canada and Mexico combined. This is true for every year except 2012.[15] Further, GDP of the US is by far higher in every year of the observation period.[16] I therefore assume that the later results are more driven by firms from the US.

The length of the observation periods differ by two years. This is due to the fact that the Bloomberg sample was obtained in 2013 and the Compustat sample roughly two years after that. Following the identification strategy for *Signal 1* and *Signal 2*, there are no crises years after 2011 and also no EWS. Further, due to the different separation criteria and signals, the analysis of the different cases leads to the creation of subsamples which consist of a fewer number of observations. This can be caused by matching different samples or by sample splitting. I therefore do not shorten the observation period in the Compustat sample. Hence, the implicit intention is to increase the degrees of freedom for the different estimations in these subsamples and therefore the accuracy of the estimations.

The only information on stock prices is in the Bloomberg sample. Due to a recording error, this is not true for the Compustat sample. Further, there is no fitting criterion or item to assign stock price information from a third source to single firm-years in the North American or US sample. I forego the inclusion of a variable, such as Tobin's Q.

[15]See Appendix C.1 on page 210 for reference.
[16]See Appendix C.1 on page 211 for reference.

Identification Strategy

The identification of financially constrained firms is potentially problematic. The classification into groups is performed using four different criteria: (1) top/bottom three deciles of total assets[17], (2)/(3) the existence of a bond/ commercial paper rating, and (4) the top/bottom three deciles of dividend payments. The choice of these specific criteria is based on existing literature, such as Almeida et al. (2004).

Only the first criterion is applicable to both samples. Thus, it is not possible to check for robustness in the European sample using e. g. bond ratings. However, for the US sample, the correlation between size, ratings and dividend payments is positive. This is true over the full sample period and for every single year. Consider Table 3.4 for the years 1997 to 2014.

TABLE 3.4: Correlation (US).

	fcSIZ	fcLTR	fcSTR	fcDIV
fcSIZ	1.00			
fcLTR	0.76	1.00		
fcSTR	0.40	0.51	1.00	
fcDIV	0.63	0.56	0.49	1.00

Remark: The variable definition can be found on page 52. The table is based on 20,431 firm year observations.

Similar to the size criterion, high and low dividend payers are identified using a certain threshold over the whole sample and observation period. This threshold is somewhat arbitrary. High dividend payers could have also been identified using the top two (or four) deciles of `divPCA`. Further, the bottom three deciles of dividend payments include firm years with payout ratios equal to zero. Thus, a firm that never distributes its profits in the form of cash dividends to its shareholders is marked as financially constrained. These firms cannot be isolated form the group of financially constrained firms. In addition, I only have information on dividend payments for the observation period 1995 to 2014. Therefore, firms that only paid dividends before 1997 are classified as financially constrained.

[17]The threshold that classifies a firm year as financially constrained is somewhat arbitrary. In consequence, a company is classified as large if its total assets exceed the threshold of the 70 %-quantile of total assets over every firm year.

Although the existence of a bond rating indicates that a firm had access to a capital market in the past, it does not necessarily reflect today's financial performance. To give an example, a firm obtained an investment grade rating and issued a debt security to the capital market one year ago, but is downgraded to non-investment grade the following year. According to my strategy, this firm is marked as financially unconstrained, but now faces higher difficulties accessing the capital market due to its current rating. This argument is consistent with Khieu and Pyles (2012) who find evidence that downgraded firms tend to increase their cash holdings, which is associated with higher financing constraints (Almeida et al., 2004).

Model Specifications

This part refers to more general problems with panel regressions, such as the functional form of a regression model, autocorrelation and heteroscedasticity. These issues lead to systematically biased and/or inefficient estimations and can only be controlled for to a certain extent. I therefore run a series of tests and adjustments: All estimations are performed using heteroscedasticity-consistent and autocorrelation-consistent standard errors. Multicollinearity is checked using the variance inflation factor. Whether to use pooled regressions, random effects or fixed effects is determined by the approaches of Mundlak (1978) and Hausman and Taylor (1981).[18] A better statistical fit of one model compared to another is determined by using the Akaike information criterion (hereafter: AIC) and the Bayesian information criterion (hereafter: BIC) (Akaike, 1973, Schwarz, 1978). Further, to the extent necessary, additional robustness checks are performed by altering the functional form of single regressions.

Lastly, the issue of endogeneity is to address. This issue concerns the parts *Identification Strategy* and *Model Specifications*. Substantially, there are two potential sources of endogeneity. The first one is due to the origin of a banking crisis, i. e. the identification of *Signal 2*. The second is due to the nature of accounting figures. The first source is already discussed in Subsection 2.2.1 on page 30 and in Subsection 3.1.2 on page 58. A banking crisis is caused by a deterioration of economic conditions and therefore an increase of defaulting loans, or an economy is affected by a banking crisis. This is

[18]For more research on panel data and unobservable effects, see Mundlak (1978) and Hausman and Taylor (1981) among others.

partially controlled for by the addition of *Signal 1* and a (phased) interaction term in subsequent analyses.

For the second source, there might be interdependencies between accounting figures that are caused by a confounding factor. More specifically, there might be a third variable that potentially affects both the endogenous and an exogenous variable. This could lead to an omitted variable bias. An addition of variables, however, is not possible due to a lack of data. A more complex model, such as vector autoregressions, would require a higher number of observations per year or a longer observation period to provide robust results. Thus, I decided against the use of more complex econometric models in order to focus on methods that allow for an analysis of the results in a broader economic context.

3.2 Empirical Strategy and Results

This section is divided into three subsections. In the first subsection, I study the four cases separately in rather simplified setting by testing difference in means. The second and third subsection consist of multivariate statistics and robustness checks, such as the use of the real estate market instead of the stock market for *Signal 1* and the inclusion of a metric financial stress variable. Additional tests or regressions are included in Appendix A.1 on pages 152-167.

3.2.1 Univariate Statistics

To analyse the cases isolated from each other, I use a two-sample t-test adjusted for unequal variances (Welch, 1947). Besides focusing on corporate cash holdings (`casHOL`), the analyses are extended for the variables `netWOC`, `capETA` and `totLEV`. As a reminder, the definitions of `casHOL` are different between both samples. The groups are formed using the criteria mentioned on page 52. Since only the criterion size is applicable to both samples, the top and bottom three deciles of total assets (`fcSIZ`) are selected as the main separation criterion within this subsection. The top and bottom deciles are calculated separately for each sample. For the US sample, tables are included in Appendix A.1 on pages 152-159 for bond ratings (`fcLTR`), commercial paper ratings (`fcSTR`) and dividend payments (`fcDIV`).

The full sample and *Case (1)* are displayed in Table 3.5 on page 67. Differences in means between samples are not tested. Further, the means (medians) are covering the full observation period in both samples without controlling for e. g. banking crises or other effects. Thus, any analyses are to be interpret with due care.

European firms hold on average 9.8 % (median: 5.5 %) of their total assets in cash and short-term investments. Although the definition for the item `cash`[19] from Compustat does not include short-term investments, this ratio is almost twice as high for US firms: mean 18.0 % and median 10.2 %. Based on 45 different countries, Dittmar et al. (2003) find that the overall median is 6.6 % of cash to total net assets (total assets minus cash)

[19]See Table C.2 and Table C.3 on pages 213-214.

for the year 1998. Further, the median is 7.3 % for Germany, 11.1 % for France and 6.4 % for US (Dittmar et al., 2003). It is not surprising that these ratios are higher as total net assets are lower than total assets. Pinkowitz et al. (2006) find similar evidence for an observation period from 1988 to 1998. US firms tend to hold on average 4.4 % of their total assets in cash.[20] Although the figures for the US seem to deviate from the results presented in Table 3.5, they are based on accounting data from 1998 respectively from 1988 to 1998. Bates et al. (2009) record a positive trend and find that "[...] the average cash ratio more than doubles over [their] sample period, from 10.5 % in 1980 to 23.2 % in 2006" (Bates et al., 2009, 1985). This would imply that the median cash ratios calculated in Dittmar et al. (2003) and Pinkowitz et al. (2006) would be higher for a more recent observation period. Overall, the results for Europe seem rather similar and are also in line with the results presented in Table 3.5.

Expenditures for current (`netWOC`) and non-current assets (`capETA`) are virtually at the same level for both samples. `netWOC` is on average at 7.5 % (median: 6.6 %) for the European sample and at 8.0 % (median: 6.4 %) for the US sample. Kalcheva and Lins (2007) and Drobetz et al. (2010) record a lower average ratio with 3.0 % respectively 6.1 %.[21] There is no detailed information on the different countries in Drobetz et al. (2010) for the average net working capital ratio. However, the average ratio in Kalcheva and Lins (2007) seems to be lower as their sample includes companies from non-European countries. As mentioned before, Germany and France represent the largest fraction in the European sample. Their average ratios are 15.0 % for Germany and 6.0 % for France. For the US, the ratios show a larger difference: Opler et al. (1999) find that the average ratio of net working capital to total assets is 17.6 % (median: 19.2 %) for the years 1971 to 1994; Dittmar et al. (2003) record that the median of net working capital to total net assets is 5.9 %; and Acharya et al. (2012) find that the average working capital as a fraction of total assets is 11.5 % (median: 8.7 %) for the years 1996 to 2010. Despite the fact that studies like Opler et al. (1999), Dittmar et al. (2003) and Acharya et al. (2012) use different definitions for their ratios and different observation periods, the ratios seem

[20] The median is 5.6 % for Germany and 8.5 % for France (Pinkowitz et al., 2006).
[21] The sample from Drobetz et al. (2010) covers 45 countries from 1995 to 2005.

to vary greatly. It is therefore difficult to find a benchmark for results obtained for the US.

The variable `capETA` is on average 5.2 % for Europe and 5.5 % for the US. The difference is slightly lower for the median of `capETA`: 3.6 % for Europe and 3.4 % for the US. Other empirical findings on capital structure record higher capital expenditures. For example, Dittmar et al. (2003) find that the median of capital expenditures to total net assets is 8.3 % for the US. Again, this ratio should be lower for total assets. For the years 1982 to 2004, Foley et al. (2007) record that the average capital expenditures as a fraction of total assets is about 7.2 % (median: about 5.2 %). Brav (2009) documents a similar ratio for the years 1993 to 2003. Based on two different data sources, he records a mean of 7.0 % (median: 4.2 %), and respectively 7.7 % (median: 4.3 %). These ratios seem to decline for observation periods that are closer to or that include crisis years. For example, Duchin (2010) records an average ratio of 7.0 % (median: 4.6 %) for the years 1990 to 2006 and Acharya et al. (2014) a ratio of 5.4 % (median: 3.3 %) for 2002 to 2011. A decline in investments would be consistent with the relatively lower ratios I obtained for the US. For Europe, a comparison of more recent data is rather difficult because of a lack of empirical studies that explicitly report average ratios on capital expenditures. However, older studies that focus on a larger number of countries also report higher ratios.[22]

`totLEV` seems to be higher for companies from Europe compared to their US counterpart. The average level of indebtedness is 54.4 % (median: 56.5 %) of total assets for companies from the Bloomberg sample, and 47.1 % (median: 47.4 %) for companies from the Compustat sample. The ratios used in comparable literature follow a slightly different definition. However, to ensure a large coverage, I am urged to use a broader definition for debt, which covers the entirety of current and non-current assets, i. e. no adjustments for e. g. deferred taxes. A benchmark is given by DeAngelo and Roll (2015). They study the consistency of debt to total asset ratios over time. Their sample consists of US industrial firms over a 58 year period until 2008. DeAngelo and Roll record that firms that are listed for more than 20 years have a median leverage of 39.1 %. This figure

[22]Dittmar et al. (2003) report an overall median of 7.3 % of total net assets. Kalcheva and Lins (2007) record a mean of 6.0 % of total assets, and Drobetz et al. (2010) a mean of 7.4 % (median: 5.5 %).

is lower for more recently listed companies.[23] Further, a ratio of 50.0 % only seems to be exceeded by a fewer number of companies for a longer period of time. Thus, my results still display higher leverage ratios than the vast majority of the literature.

TABLE 3.5: Case (1): Europe and US (size).

Variable	Group →	(Europe) u	c		(US) u	c	
	Signal 1 →	NO	NO		NO	NO	
↓	*Signal 2* →	NO	NO	**full**	NO	NO	**full**
`casHOL`	Mean	0.077	0.125	**0.098**	0.104	0.260	**0.180**
	Diff.	-0.048***			-0.156***		
	t-value	-31.98			-61.20		
	Median	0.052	0.063	**0.055**	0.065	0.184	**0.102**
	N	13,117	13,117	**43,721**	11,228	11,228	**37,425**
`netWOC`	Mean	0.038	0.103	**0.075**	0.040	0.095	**0.080**
	Diff.	-0.065***			-0.055***		
	t-value	-28.08			-23.15		
	Median	0.029	0.096	**0.066**	0.029	0.084	**0.064**
	N	13,055	12,986	**43,443**	10,598	11,155	**36,380**
`capETA`	Mean	0.055	0.046	**0.052**	0.058	0.044	**0.055**
	Diff.	0.009***			0.015***		
	t-value	12.40			18.70		
	Median	0.043	0.025	**0.036**	0.039	0.023	**0.034**
	N	11,982	10,124	**36,889**	11,155	11,165	**37,201**
`totLEV`	Mean	0.615	0.473	**0.544**	0.580	0.384	**0.471**
	Diff.	0.141***			0.196***		
	t-value	59.76			73.18		
	Median	0.627	0.469	**0.565**	0.585	0.347	**0.474**
	N	13,117	13,117	**43,721**	11,228	11,228	**37,425**

Remark: Groups are assigned by using the top/bottom three deciles of `totAST`. For every sample separately, Diff. $=\text{Mean}_u - \text{Mean}_c \neq 0$ is tested using a two-sample t-test with unequal variances (Welch, 1947). As mentioned before, item `cash` is defined differently in both samples. Therefore, the levels of `casHOL` are not directly comparable.
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Case (1)

The results for *Case (1)* are displayed in Table 3.5 for the separation criterion `totAST` for both Europe and the US. The analysis for the criteria bond rating, commercial paper rating and dividends are displayed in Table A.1 on page 152 only for the US.

Financially constrained firms have on average higher cash ratios than their financially unconstrained counterparts. Unconstrained firms from Europe hold 7.7 % of total assets

[23] The median for 15 to 19 years is 35.7 %; for for ten to 14 years is 31.4 %; for five to nine years is 24.1 %; and for two to four years is 11.0 % (DeAngelo and Roll, 2015).

in cash (US: 10.4 %). For constrained firms, this figure is 4.8 % higher for European firms and 15.6 % higher for US firms. The differences in means between both groups are statistically and economically significant. This is true for both samples and every other separation criterion. This is in line with the empirical findings from Almeida et al. (2004). The results suggest that the effect is economically larger for US firms. The average (and median) of `casHOL` is more than twice as high for financially constrained firms than for unconstrained. Table 3.6 displays the different means of `casHOL` in comparison with the results from Almeida et al. (2004). Consistent with Bates et al. (2009), for the US, the ratios seem to be higher because of a more recent observation period.

TABLE 3.6: Case (1): Comparison of results.

Criteria	Almeida et al.	US	Europe
(1) `fcDIV`			
c	0.145	0.220	n/a
u	0.090	0.111	n/a
(2) `fcSIZ`			
c	0.178	0.260	0.125
u	0.079	0.104	0.077
(3) `fcLTR`			
c	0.146	0.216	n/a
u	0.081	0.092	n/a
(4) `fcSTR`			
c	0.129	0.189	n/a
u	0.076	0.081	n/a

Remark: Classification: (1) Top/bottom three deciles of dividend payments, (2) top/bottom three deciles of total assets (author's assumption), (3) existence of bond rating, and (4) existence of commercial paper rating.

For both samples, the differences in means of `netWOC` are different from zero and also negative, which is true for every criterion used to form groups. Thus, the ratios are higher for financially constrained firms than for unconstrained firms. The average ratios are more than twice as high for financially constrained firms with 10.3 % for Europe and 9.5 % for the US. Due to a more difficult access to external funding, financially constrained companies could have increased short-term assets over time to generate cash inflows in times of a liquidity shortage.[24] This would be consistent with Fazzari and Petersen (1993).

Expenditures in non-current assets tend to be higher for European firms and US firms. For Europe, financially constrained firms invest on average about 1.0 % of assets less than financially unconstrained firms. The difference is 1.5 % for US firms. Kaplan and Zingales (1997) and Cleary (1999) find similar evidence. Although, the results suggest that the differences between both groups are larger in their sample.[25] Based on the median and on a more recent data set (1985 to 2006), Denis and Sibilkov (2010) record a higher median for financially unconstrained firms. This is true for firms assigned by dividends, size and commercial paper ratings to a certain group. For bond rating as a separation criterion, the median is slightly lower for financially unconstrained firms. Chang et al. (2014) find similar evidence. Firms allocate higher levels of cash flows to investments in case they are less financially constrained.

Similar to the overall mean and median of `totLEV`, financially constrained European firms tend to hold more debt as a fraction of total assets than US firms. This is also true for financially unconstrained firms. The differences in means within the samples are significantly different from zero. For Europe, unconstrained firms hold on average 14.1 % of assets more debt as a percentage of total assets as their constrained counterparts. This difference is even larger for US firms (19.6 %). A more detailed distribution of `totLEV` at a country-level is displayed in Figure 3.4 on page 70. Based on the assumption that financially unconstrained firms are able to obtain debt easier and are therefore less restricted, one would expect a wider range between the 25 %-percentile and the 75 %-percentile. However, the opposite seems to be the case for these firms for most of the countries examined. Except for companies from Croatia and Poland, financially unconstrained firms seem to choose more similar levels of debt.[26] For the US, the mean is

[24]Note, I assume that working capital is an imperfect substitute for cash.

[25]As a reminder and to be exact, Kaplan and Zingales (1997) distinguish between five different groups: (1) not financially constrained, (2) likely not financially constrained, (3) possibly financially constrained, (4) likely financially constrained, and (5) financially constrained. With the exception of possibly financially constrained firms, investments seem to decline for higher levels of financing constraints. Cleary (1999) uses virtually the same methodology as Kaplan and Zingales (1997) on a larger sample. See Subsection 2.1.2.

[26]Croatia's fraction in this subset (u) is about 1.4 % and Poland's is less than 1.0 %.

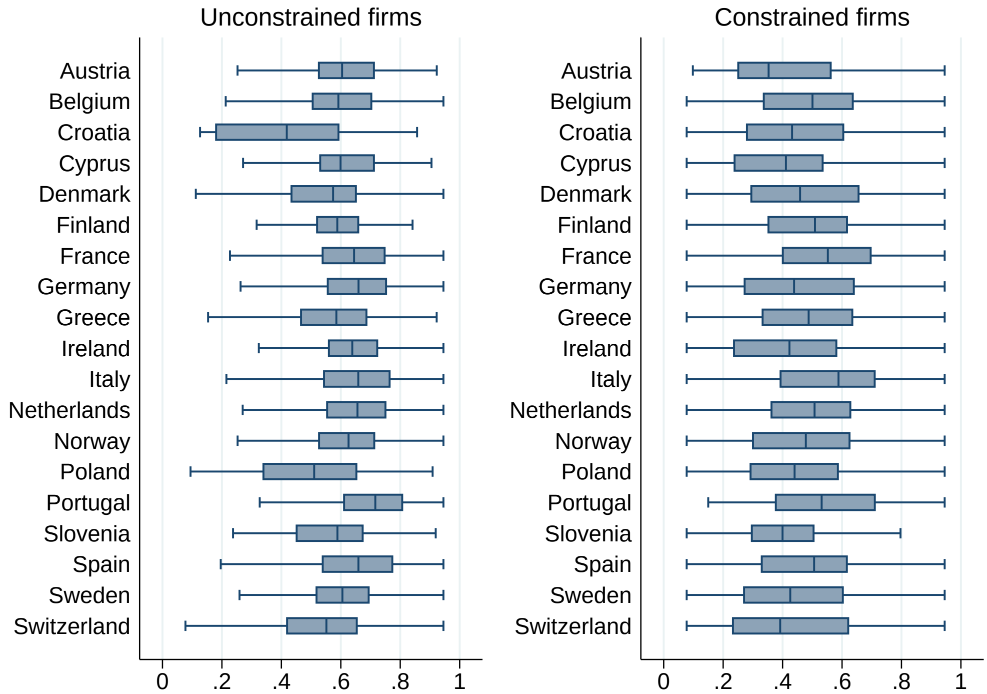


FIGURE 3.4: Distributional plot (without outside values): Leverage per country.

38.4 % for financially constrained firms and 58.0 % for financially unconstrained firms.[27] Further, the average ratios seem to be higher where bond ratings, commercial paper ratings, or dividends are used as a separation criterion. The differences in means are also significantly different from zero and support the results mentioned before.

Case (2)

I use two different observable signals: The first one reflects the stock market at a country-level and the second one reflects the real estate market at an aggregated level (Europe and North America). Note, for the US, given the identification strategy discussed on page 54, stock prices and real estate prices peak within the same year: `s1STM` = `s1REM`. The results are not affected by a different choice of signal. In consequence, I do not perform an additional robustness check for the US sample using real estate prices. *Case (2)* can be tested for the criterion size (u, c), and the stock market or real estate market (*Signal 1*) for European companies. For US firms, *Case (2)* can be tested for the criteria size, bond rating, commercial paper rating, or dividends (u, c), and for either stock

[27]For financially unconstrained firms, p_{25} is 46.6 %, p_{50} is 58.4 % and p_{75} is 70.2 %. For financially constrained firms, p_{25} is 20.4 %, p_{50} is 34.7 % and p_{75} is 53.5 %.

market or real estate market (*Signal 1*). Tests are displayed in Tables A.2 and A.3 on page 153. Different criteria and other robustness checks can be found on pages 154-155.

Based on my theoretical predictions, corporate cash holdings should be higher for companies that observe *Signal 1*, and this should not be exclusive to either one of both groups of firms. Therefore, the differences in means should be significant for each criterion and each *Signal 1*. Further, I predict a stronger increase for financially constrained firms. However, in this test setting, I only test for differences in means in group u or c in each sample. Differences in differences are not tested here. Thus, differences between groups are to be interpreted with due care. To summarise the different tests, the results are not conclusive for every variation. European financially constrained firms have higher cash holdings when observing a run-up in stock prices (+ 1.1 %). When using the real estate market as *Signal 1*, there is now evidence that both financially unconstrained and constrained firms have higher average cash holdings. Little to no change in liquidity for unconstrained firms, however, seems consistent with the evidence that these firms spend additional liquidity on non-current assets and also reduce their leverage (`s1STM`), or on current and non-current assets (`s1REM`).[28]

The tests are summarised in Table 3.7. The numbers represent p-values for a test for differences in means. Higher levels of significance are highlighted by different font styles (bold or/and italic). To find evidence for higher cash holdings in case a company has observed *Signal 1*, I use a one-sided t-test for differences in means with unequal variances (Welch, 1947).

For the US, I find strong evidence that financially constrained firms (ratings and dividends) that have observed *Signal 1* hold higher levels of cash as a fraction of total assets, which is consistent with Kim et al. (1998), Denis and Sibilkov (2010), Bates et al. (2009). However, the results are inconclusive for unconstrained firms and size as a separation criterion. Further, differences in means for `netWOC`, `capETA` and `totLEV` are inconclusive as well.

[28]See Tables A.2 and A.4 on pages 153 and 154.

Table 3.7: Case (2): Comparison of results (casHOL).

	(Europe)				(US)	
	s1STM		s1REM		s1STM/s1REM	
	two-sided	one-sided	two-sided	one-sided	two-sided	one-sided
(1) fcDIV						
c	n/a	n/a	n/a	n/a	***0.002***	***0.001***
u	n/a	n/a	n/a	n/a	0.354	0.823
(2) fcSIZ						
c	0.093	*0.046*	*0.033*	*0.016*	0.102	0.051
u	0.422	0.423	0.059	*0.030*	0.872	0.436
(3) fcLTR						
c	n/a	n/a	n/a	n/a	***0.009***	***0.004***
u	n/a	n/a	n/a	n/a	0.477	0.761
(4) fcSTR						
c	n/a	n/a	n/a	n/a	***0.009***	***0.004***
u	n/a	n/a	n/a	n/a	0.586	0.707

Remark: Values in the table represent p-values for two-sided t-tests (Diff.$\neq$ 0) and one-sided t-tests (Diff.< 0) with unequal variances (Welch, 1947). P-values below 0.05 (**) are highlighted in italic and p-values below 0.01 (***) are highlighted in bold and italic.

Case (3)

As mentioned before, *Signal 2* is event-based. Within this setting, it is not possible to include finSTR as a robustness check. Therefore, the tests are limited to the crisis years obtained from Reinhart and Rogoff (2009), Reinhart (2010) and Reinhart and Rogoff (2014). The sample restrictions regarding the different separation criteria continue to apply. The tests for size are displayed in the appendix in Table A.8 and Table A.9 on page 156. Additional tests can be found on pages 157-158.

According to the hypothesis, cash holdings should remain stable for financially unconstrained firms, i. e. the differences in means should be insignificant. For their constrained counterparts, it is assumed that these firms use their remaining internal liquidity to finance positive NPV-projects. A decline in or a lower level of cash holdings is expected during times of crises. Further, due to restricted access to external funding, the amount of debt in a financially restricted company should remain at about the same level. Due to a deterioration in economic conditions, both types of companies are expected to reduce their capital expenditures. The results for casHOL are summarised in Table 3.8. As before, the numbers in this table represent p-values for a test for differences in means.

TABLE 3.8: Case (3): Comparison of results (casHOL).

	(Europe) two-sided	(Europe) one-sided	(US) two-sided	(US) one-sided
(1) fcDIV				
c	n/a	n/a	***0.000***	***0.000***
u	n/a	n/a	***0.001***	***0.000***
(2) fcSIZ				
c	0.075	*0.038*	***0.000***	***0.000***
u	***0.000***	***0.000***	***0.000***	***0.000***
(3) fcLTR				
c	n/a	n/a	***0.000***	***0.000***
u	n/a	n/a	***0.002***	***0.001***
(4) fcSTR				
c	n/a	n/a	***0.000***	***0.000***
u	n/a	n/a	***0.003***	***0.005***

Remark: Values in the table represent p-values for two-sided t-test (Diff.$\neq$ 0) and one-sided t-test (Diff.$<$ 0) with unequal variances (Welch, 1947). P-values below 0.05 (**) are highlighted in italic and p-values below 0.01 (***) are highlighted in bold and italic.

Except for one case (financially constrained firms from Europe), I find strong evidence that listed firms tend to hold on average higher levels of cash as a fraction of total assets during times of crises. Although these results are not fully in line with my theoretical predictions, they support the precautionary motive of cash holdings. Song and Lee (2012) find similar evidence for the Asian financial crisis of 1998. Further, financially constrained firms seem to reduce net working capital and investments to generate liquidity. A decline in investments is consistent with Duchin (2010). In addition, as predicted, a change in leverage is statistically not evident at a 1 %-level except financially constrained firms from Europe (Table A.8). This result is in line with Ivashina and Scharfstein (2010), but the findings provide only weak support for Halling et al. (2016). Thus, levels of leverage behave counter-cyclically and should be higher during times of crises or in a recession (Halling et al., 2016). The tests for unconstrained firms do not provide any clear evidence, some results are statistically significant from zero in the European sample but not in the US sample.

Case (4)

Case (4) should be tested covering the interaction between two staggered dummy variables: `s1STM/s1REM` and `bcRR`. However, this is only possible to a certain extent within this test setting. This case is included for the sake of completeness and will be analysed briefly in this subsection. The Tables A.13 to A.18 are enclosed in the appendix on pages 158-161.

Consider Table A.17, unconstrained companies from Europe that observe a peak in stock prices or real estate prices prior to a banking crisis tend to hold higher levels of cash relative to total assets. The same is true for unconstrained firms from the US in case `fcLTR` is used as a separation criterion. Both one-sided t-tests (Diff.<0) for differences in means with unequal variances (Welch, 1947) provide stronger evidence for `s1STM` as *Signal 1* (*p-value* < 0.05). This evidence is exclusive to these companies. However, the results are consistent with my theoretical predictions. Other tests provide only inconclusive results.

3.2.2 Multivariate Statistics

In this subsection, I will analyse the different cases in panel regressions. Different than before, I control for company-, industry- and/or country-specific characteristics. Further, in this setting it is possible to analyse the interaction of staggered variables. As a reminder, cash divided by total assets (`casHOL`) is used as the endogenous variable. The exogenous variables are company size represented by the natural logarithm of total assets (`size`), net working capital minus cash divided by total assets (`netWOC`), expenditures in non current assets divided by total assets (`capETA`), debt as a fraction of total assets (`totLEV`), return on assets (`retAST`), return on sales (`retSAL`), and dummy variables that represent the different cases (`bcRR`, `s1STM` and `bcRR`). `s1REM` and `finSTR` are used or included as robustness check. To control for effects that are not fully covered by the exogenous variables mentioned above, I include fixed effects for company- or industry-specific characteristics for the US sample (Mundlak, 1978, Hausman and Taylor, 1981). For the European sample, I include company fixed effects or industry and/or country fixed effects.

The effects of *Signal 1* and *Signal 2* on the different groups are tested in separate regressions by splitting up the main samples, i. e. a regression for subsample u and subsample c. Every regression pair is marked with a number. Consider, for example, the first row of Table 3.9 on page 77. For pair (1), I use `totAST` to assign US firms to a subsample and also control for company fixed effects; *Signal 1* is represented by `s1STM` and *Signal 2* by `bcRR`. The regression formulas (3.1 and 3.2) for this case look as follows:

$$\begin{aligned} \texttt{casHOL}^u_{i,t} =& \beta^u_1 \cdot \texttt{size}^u_{i,t} + \beta^u_2 \cdot \texttt{netWOC}^u_{i,t} + \beta^u_3 \cdot \texttt{capETA}^u_{i,t} + \beta^u_4 \cdot \texttt{totLEV}^u_{i,t} \\ &+ \beta^u_5 \cdot \texttt{retAST}^u_{i,t} + \beta^u_6 \cdot \texttt{retSAL}^u_{i,t} + \beta^u_7 \cdot \texttt{bcRR}^u_{i,t} + \beta^u_8 \cdot \texttt{s1STM}^u_{i,t} \\ &+ \beta^u_9 \cdot \texttt{s1STM}\times\texttt{bcRR}^u_{i,t} + \texttt{cons}^u_{i,t} \end{aligned} \tag{3.1}$$

$$\begin{aligned} \texttt{casHOL}^c_{i,t} =& \beta^c_1 \cdot \texttt{size}^c_{i,t} + \beta^c_2 \cdot \texttt{netWOC}^c_{i,t} + \beta^c_3 \cdot \texttt{capETA}^c_{i,t} + \beta^c_4 \cdot \texttt{totLEV}^c_{i,t} \\ &+ \beta^c_5 \cdot \texttt{retAST}^c_{i,t} + \beta^c_6 \cdot \texttt{retSAL}^c_{i,t} + \beta^c_7 \cdot \texttt{bcRR}^c_{i,t} + \beta^c_8 \cdot \texttt{s1STM}^c_{i,t} \\ &+ \beta^c_9 \cdot \texttt{s1STM}\times\texttt{bcRR}^c_{i,t} + \texttt{cons}^c_{i,t} \end{aligned} \tag{3.2}$$

Subscript i is the identifier for every company and t the identifier for calendar years. Where different fixed effects are in use, the subscript for the intercept (`cons`) changes to iy (industry) or cy (country) (Mundlak, 1978, Hausman and Taylor, 1981).

Tests on endogeneity strongly suggest the use of random effects over a pooled regression for both samples, but also the use of fixed effects rather than random effects (Hausman, 1978, Breusch and Pagan, 1979). I therefore focus on fixed effects for every regression. This is also consistent with the theoretical assumptions made before, i. e. differences in legal systems or higher bank dependency of certain industries. Due to the nature of accounting figures, multicollinearity is checked for every regression separately using the variance inflation factor. The same is true for autocorrelation. Therefore, as mentioned in Subsection 3.1.3, estimations are conducted using heteroscedasticity-consistent and autocorrelation-consistent standard errors. For the sake of completeness, R^2 is displayed for every regression. However, due to its restricted comparability, the AIC and the BIC are included as well (Akaike, 1973, Schwarz, 1978). A lower value of AIC or BIC (here: more negative) indicates a better statistical fit of one model compared to another. To give an example, see Table 3.9 on page 77. The bottom part of the table displays the values of AIC and BIC for (1) and (2). Both regression pairs only differ in the fixed effects used. According to the information criteria, the model that includes company fixed effects provides a better statistical fit.

US

The different regression pairs are displayed in Table 3.9 for size, and for bond ratings, commercial paper ratings and dividends in Table A.19 on page 162. As usual, the following interpretation of single coefficients is done assuming the remaining coefficients remain unchanged, unless it is explicitly mentioned.

Consider (1) on page 77 showing the key results for unconstrained firms. The coefficient for `size` is significantly different from zero for unconstrained firms at a 1 %-level and for constrained firms at a 10 %-level. By controlling for industry effects in (2), the coefficient of `size` is not significant for unconstrained firms. Consistent with the literature on capital structure and on financing constraints, the effect of size on corporate cash holdings is negative, i. e. larger firms tend to hold less cash (Kim et al., 1998, Opler et al., 1999, Almeida et al., 2004). The lower significance levels for constrained firms could have been caused by the separation criterion total assets (`totAST`). In the subset of smaller companies, relative company size might not affect corporate liquidity at all. However, this does not seem to be true for the subset of larger companies. An increase in (relative) size still reduces corporate cash holdings. Nevertheless, these results are not robust for every separation criterion and fixed effects. The coefficients are strongly significantly different from zero for `fcLTR` (u and c), and by controlling for industry characteristics for `fcDIV` (u and c). For unconstrained firms, the coefficients are insignificant in (7) and (8).

The coefficients of `netWOC` are highly significant (p-*value* < 0.01) for both groups, and robust for every criterion and fixed effects, which is in line with Opler et al. (1999), Almeida et al. (2004), Bates et al. (2009). An increase (a decrease) by one unit of `netWOC` leads to a reduction (an increase) of 0.279 units of `casHOL`. This effect seems to be economically larger for constrained firms (0.419). This would be consistent with the notion that net working capital is used to generate internal resources, which is more important for firms that have higher difficulties obtaining external funding, i. e.

Table 3.9: Regression: US (size, stock market and RR).

	(1)		(2)	
casHOL	u	c	u	c
size	-0.019***	-0.011*	-0.012***	0.002
	(-4.52)	(-1.75)	(-12.12)	(0.83)
netWOC	-0.279***	-0.419***	-0.317***	-0.488***
	(-9.67)	(-17.09)	(-28.12)	(-45.13)
capETA	-0.275***	-0.292***	-0.280***	-0.538***
	(-8.48)	(-8.25)	(-15.61)	(-17.15)
totLEV	-0.095***	-0.450***	-0.170***	-0.521***
	(-5.67)	(-23.00)	(-24.17)	(-54.00)
retAST	0.133***	0.072***	0.293***	-0.000
	(4.98)	(5.48)	(10.89)	(-0.01)
retSAL	0.005	-0.014***	-0.034**	-0.018***
	(0.43)	(-3.86)	(-2.54)	(-7.43)
bcRR	0.006***	0.007*	0.011***	0.007
	(3.41)	(1.66)	(3.17)	(1.51)
s1STM	-0.008***	0.002	-0.017***	-0.002
	(-3.65)	(0.33)	(-3.65)	(-0.37)
s1STM × bcRR	-0.001	0.000	-0.005	0.004
	(-0.19)	(0.07)	(-1.17)	(0.41)
cons	0.335***	0.518***	0.313***	0.410***
	(8.84)	(23.82)	(12.78)	(6.29)
Company FE	YES	YES	NO	NO
Industry FE	NO	NO	YES	YES
N	10,267	10,871	10,267	10,871
AIC	-31,056	-19,601	-20,585	-6,896
BIC	-30,991	-19,535	-20,354	-6,662
R^2	0.217	0.373	0.443	0.477

Remark: Groups are assigned by using the top/bottom three deciles of totAST. Note, for the US, s1STM and s1REM mark the same years. The Hausman-test strongly suggests the use of fixed effects ($p < 0.0000$) (Hausman, 1978). Industries are clustered using the first four digits of GICS.
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

financially constrained firms (Fazzari and Petersen, 1993, Almeida et al., 2004). For (1), expenditures in non-current assets (capETA) seem to affect cash holdings at a similar level. Both coefficients are negative and significantly different from zero at a 1 %-level. Thus, a reduction of investments leads to an increase in cash holdings. This is consistent with Kusnadi and Wei (2011), Gao et al. (2013). The results are robust for different fixed effects and for different separation criteria.

Compared to their financially unconstrained counterparts, the results suggest that an increase in debt (relative to total assets) seems to affect cash holdings of financially constrained firms to a larger extent. The coefficients in both regressions are negative and highly significant. The same is true for (2) to (8). The results are robust and in line with Acharya et al. (2007) and Ivashina and Scharfstein (2010). Ivashina and Scharfstein (2010) find that in the US the increase in aggregated corporate lending during the subprime crisis is due to draw downs of existing credit lines instead of newly issued debt. Sufi (2009) finds evidence that firms with low cash flows or more volatile cash flows tend to rely more heavily on cash, but "[...] if a firm has high distress likelihood, then high cash flow is critical to obtaining a line of credit" (Sufi, 2009, 1086). Thus, constrained firms might utilise committed credit lines before these might have been revoked.

The coefficients for return on assets are positive and significantly different from zero at a 1 %-level (Jose et al., 1996) and also robust, except for constrained firms in (2) and (4). Thus, a higher level of productivity (or more performance) generates higher cash holdings. The cash effect seems to be larger for unconstrained firms (Adjei, 2013). Although, similar to Figure 3.4 on page 70, the cash-levels sorted by return on assets show that the unconstrained firms are rather similar. This does not seem to be the case for constrained firms. See Figure 3.5 on page 79. The vertical axis displays the mean of `casHOL` per quantile of `retAST` for both subsamples. The solid line depicts the subsample of financially constrained firms and the dashed line the subsample of financially unconstrained firms based on the criteria `fcSIZ`, `fcLTR`, `fcSTR` and `fcDIV`. The horizontal axis displays the quantiles from one to ten of `retAST`-quantiles. Noticeably, for the subsample of constrained firms, lower levels of return on assets (lower two deciles) and higher levels (upper two deciles) seem to be associated with higher levels of cash holdings. Specifically, less productive firms and firms with higher productivity hold higher levels of cash. However, from a statistical point of view, the shape of these curves indicate a non-monotonic relationship between return on assets and cash holdings in the subsample of constrained firms. I therefore alter the model specification as a robustness check later on by including a non-linear version of `retAST` instead of a linear one. See Subsection 3.2.3.

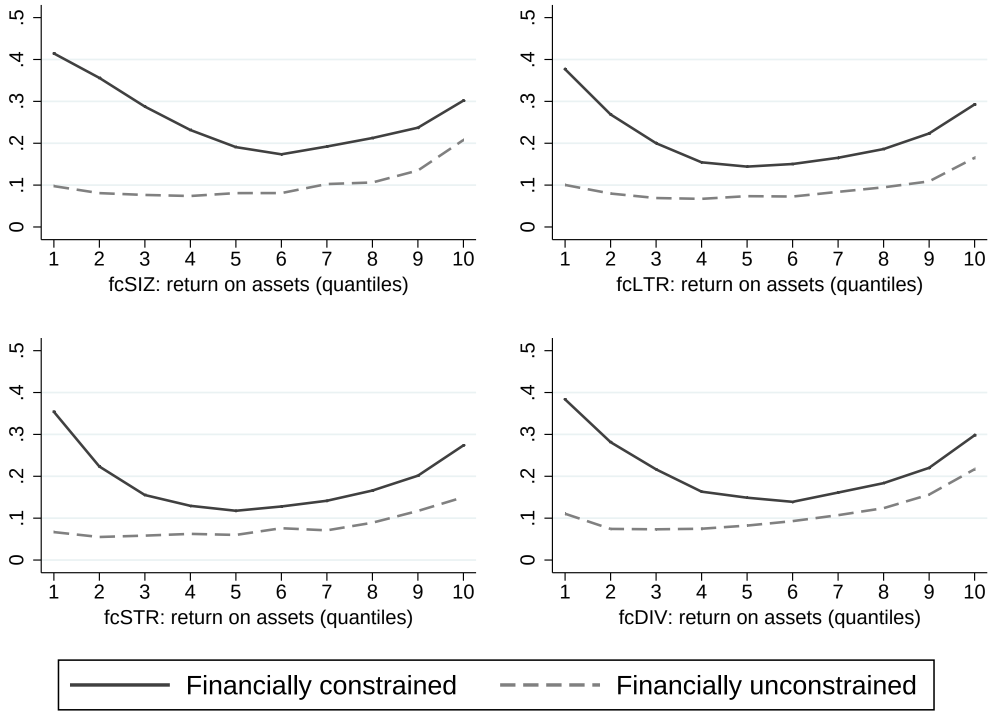


FIGURE 3.5: Cash holdings per quantile of return on assets.

Return on sales is used to measure the efficiency of a firm. For (1), the coefficients of `retSAL` are only significantly different from zero at a 1 %-level for constrained firms, and not significant at all for unconstrained firms. The same is true for (7). In the remaining regressions (2) to (6) and (8), the coefficients are negative and at least significant at a 10 %-level. Therefore, an increase of efficiency seems to reduce the amount of cash in a company. The results suggest that the cash effect is higher for unconstrained firms.

Table 3.10 on page 80 summarises those parts of the regressions (1) to (8) that focus on *Case (2)*, *Case (3)* and *Case (4)*. Except for the first two and the last column, the table consists of p-values. The p-values are obtained from the different regressions and from an additional test. As mentioned in Subsection 3.1.3, the additional test is conducted because of (*Case (3)* and) *Case (4)*. As a reminder, the interaction term `s1STM`×`bcRR` is set to one if a banking crisis (`bcRR`) is preceded by an EWS in $t-1$ and $t-2$. Thus, in case the dummy variable `s1STM`×`bcRR` equals one, by definition, the same is true for `bcRR`. Hence, there is a possibility that the coefficients of these variables might cancel each other out. Although this issue predominantly seems to concern *Case (4)*, *Case (3)* might not be unaffected. Thus, if `bcRR` equals one, so might `s1STM`×`bcRR` be equal to one.

For example, in case the coefficient of `bcRR` is highly significant and positive (+0.05), whereas the coefficient of `s1STM`×`bcRR` is highly significant and negative (−0.05). This issue can only be controlled to a limited extent, by testing for a joint effect. I assume there is (at least weaker) evidence for a cash effect, in case the p-value of the additional test ($\beta_7+\beta_9 = 0$) is below a 5 %-significance level. The direction of this effect is displayed in the last column, i. e. whether the sum of both coefficients is positive or negative.

TABLE 3.10: US: Comparison of results for `s1STM/s1REM` and `bcRR` (Case (2), (3) and (4)).

No.	Group	p-value			Test	
		s1STM	bcRR	s1STM×bcRR	p-value	coefficient
(1)	u	***0.000***	***0.001***	0.846	0.105	0.006
	c	0.739	0.098	0.946	0.340	0.007
(2)	u	***0.000***	***0.000***	0.848	0.176	0.007
	c	0.710	0.131	0.680	0.289	0.011
(3)	u	***0.000***	***0.000***	0.518	***0.000***	0.013
	c	0.262	0.163	0.911	0.503	0.003
(4)	u	***0.000***	***0.000***	0.816	0.130	0.008
	c	0.264	0.636	0.997	0.834	0.001
(5)	u	***0.000***	0.078	0.909	0.320	0.006
	c	0.908	*0.026*	0.924	0.245	0.004
(6)	u	***0.001***	*0.022*	0.905	0.242	0.008
	c	0.656	0.419	0.953	0.681	0.002
(7)	u	***0.000***	*0.011*	0.765	0.243	0.004
	c	0.164	0.189	0.845	0.357	0.004
(8)	u	***0.001***	***0.000***	0.313	0.406	0.005
	c	0.284	0.491	0.441	0.627	0.003

Remark: Values in the table represent p-values for regressions (1) to (8). P-values below 0.05 (**) are highlighted in italic and p-values below 0.01 (***) are highlighted in bold and italic. Note, the test in the last two columns is to check whether there is a cash effect ($\beta_7 + \beta_9 = 0$).

Case (2) is reflected in the significance of the variable `s1STM`. For the regressions (1) to (8), only unconstrained firms seem to be affected when observing *Signal 1*. The coefficients are significantly different from zero at a 1 %-level, but also negative, which contradicts the results of Kim et al. (1998), Denis and Sibilkov (2010) and Bates et al. (2009). For constrained firms, the results are inconclusive, i. e. no coefficient is significant at a conventional level. These results contradict my theoretical predictions in which the observance of *Signal 1* leads to an increase in precautionary savings. However, *Signal 1* is identified using two different criteria (stock market and real estate market). Following my identification strategy, a peak in either one of these markets marks a year as *Signal 1*. This indicates an ensuing banking crisis according to a large fraction of literature on EWS. Thus, a deterioration of economic conditions can be expected and companies face higher restrictions obtaining external funding. However, corporate entities might not recognise it as such. Firms which observe a peak in stock prices, for example, could recognise this state of nature as rather optimistic and therefore increase investments and decrease precautionary savings.

In *Case (3)*, `bcRR` is equal to one, but not `s1STM`×`bcRR`. Based on the significance level of the coefficients of `bcRR`, I find at least weak evidence in one case (5) and stronger evidence for (1), (2), and (4) to (8) that financially unconstrained firms increase their cash holdings in times of crises. (3) is a special case because the joint effect of the coefficients of `bcRR` and `s1STM`×`bcRR` is significantly different from zero and positive. (3) provides therefore evidence supporting the theoretical predictions in *Case (4)*. However, this is the only test that provides support for this case. Further, the results for constrained firms are inconclusive. This is true for *Case (3)* and *Case (4)*. To be more specific, the coefficient for `bcRR` is only significant in (5), and otherwise not. In addition, there is no joint effect for the coefficients of `bcRR` and `s1STM`×`bcRR` for constrained firms. This does not necessarily support the savings and spending behaviour of financially constrained firms regarding corporate cash holdings, but is in line with my theoretical predictions. For an increase in cash holdings that is followed by a decrease in cash holdings, the joint effect is likely not significantly different from zero at a conventional level.

Europe

The regression pairs (9) to (12) are displayed in Table 3.11. These regressions only differ in the use of fixed effects, e. g. industry fixed effects in (10) and country fixed effects in (11). `size` is robust in almost every regression except for unconstrained firms in (9). The remaining coefficients are significant at least at a 5 %-level, negative and at a similar level compared to those in the US sample (Opler et al., 1999, Kim et al., 1998, Almeida et al., 2004). However, the significance seems to persist by controlling for industry effects.

Table 3.11: Regression: Europe (size, stock market and RR).

casHOL	(9) *u*	(9) *c*	(10) *u*	(10) *c*	(11) *u*	(11) *c*	(12) *u*	(12) *c*
size	-0.006	-0.017***	-0.005***	-0.004**	-0.006***	-0.013***	-0.005***	-0.011***
	(-1.54)	(-3.08)	(-9.45)	(-2.22)	(-11.69)	(-6.50)	(-10.00)	(-5.78)
netWOC	-0.165***	-0.344***	-0.143***	-0.273***	-0.146***	-0.268***	-0.144***	-0.260***
	(-9.44)	(-16.83)	(-21.33)	(-31.13)	(-22.15)	(-31.11)	(-21.08)	(-29.95)
capETA	-0.169***	-0.106***	-0.280***	-0.296***	-0.259***	-0.284***	-0.262***	-0.262***
	(-7.30)	(-3.77)	(-16.38)	(-13.53)	(-15.42)	(-13.30)	(-15.33)	(-12.44)
totLEV	-0.117***	-0.369***	-0.124***	-0.346***	-0.116***	-0.357***	-0.116***	-0.341***
	(-6.94)	(-16.87)	(-17.14)	(-37.74)	(-16.02)	(-38.91)	(-15.72)	(-36.89)
retAST	0.208***	0.053***	0.285***	0.061***	0.283***	0.075***	0.286***	0.081***
	(5.89)	(3.58)	(11.65)	(4.60)	(11.48)	(5.80)	(11.94)	(6.35)
retSAL	-0.047**	-0.001	-0.066***	-0.018***	-0.068***	-0.016***	-0.065***	-0.014***
	(-2.27)	(-0.12)	(-5.39)	(-4.07)	(-5.38)	(-3.73)	(-5.34)	(-3.33)
bcRR	0.003*	-0.002	0.008***	0.004	0.006***	0.002	0.006***	0.001
	(1.93)	(-0.60)	(3.70)	(0.93)	(2.77)	(0.45)	(2.64)	(0.67)
s1STM	-0.000	0.011***	0.001	0.010**	-0.001	0.016***	-0.001	0.015***
	(-0.32)	(3.55)	(0.21)	(2.33)	(-0.33)	(3.74)	(-0.46)	(3.46)
s1STM × bcRR	-0.003	0.006	-0.000	-0.011	-0.003	-0.010	-0.003	-0.012
	(-2.24)	(1.24)	(-0.63)	(-1.29)	(-0.66)	(-1.21)	(-0.62)	(-1.40)
cons	0.202***	0.398***	0.212***	0.314***	0.161***	0.309***	0.172***	0.275***
	(6.53)	(20.03)	(25.54)	(22.91)	(14.44)	(25.23)	(14.54)	(16.03)
Company FE	YES	YES	NO	NO	NO	NO	NO	NO
Industry FE	NO	NO	YES	YES	NO	NO	YES	YES
Country FE	NO	NO	NO	NO	YES	YES	YES	YES
N	11,539	9,266	11,539	9,266	11,539	9,266	11,539	9,266
AIC	-38,459	-21,972	-27,339	-11,002	27,591	11,657	-28,049	-11,813
BIC	-38,392	-21,907	-27,170	-10,838	27,393	11,464	-27,755	-11,534
R^2	0.123	0.235	0.173	0.293	0.192	0.129	0.225	0.356

Remark: Groups are assigned by using the top/bottom three deciles of totAST. The Hausman-test strongly suggests the use of fixed effects ($p < 0.0000$) (Hausman, 1978). Industries are clustered at supersector-level.
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

The results for netWOC and capETA are robust and significant at a 1 %-level (Opler et al., 1999, Bates et al., 2009, Kusnadi and Wei, 2011, Gao et al., 2013). For netWOC, the results suggest that the effect on cash of financially constrained firms appears to be larger compared to their unconstrained counterpart. This is also true for a different combination of fixed effects. Unlike US firms, the coefficients of capETA seem to differ less between both groups of firms.

Consistent with the US sample, the coefficients of totLEV are highly significant and also negative for (9) to (12) (Bates et al., 2009). Further and also in line with previous results, an increase in debt as a fraction of total assets affects casHOL to a higher extent in case a company is financially constrained.

The variable casHOL reacts positively to an increase in the performance (retAST) of a company (Jose et al., 1996). This evidence is statistically significant (*p-value* < 0.01)

and also robust for every group and fixed effects. Although this is not tested, an increase in performance seems to have a larger cash effect on financially unconstrained firms (Adjei, 2013), which is consistent with previous results. In contrast to the other sample, the coefficient of return of sales is robust to changes in fixed effects. Further, the results present strong evidence that higher efficiency negatively affects corporate cash holdings. Out of eight different estimations, seven provide coefficients that are significantly different from zero at a 1 %-level, and one at a 5 %-level. The effect on cash holdings appears to be stronger for financially unconstrained firms.

TABLE 3.12: Europe: Comparison of results for `s1STM` and `bcRR` (Case (2), (3) and (4)).

No.	Group	p-value			Test	
		`s1STM`	`bcRR`	`s1STM`×`bcRR`	p-value	coefficient
(9)	*u*	0.751	0.054	0.846	0.136	0.004
	c	***0.000***	0.550	0.215	0.452	0.004
(10)	*u*	0.830	***0.000***	0.898	0.051	0.007
	c	*0.019*	0.773	0.831	0.692	0.003
(11)	*u*	0.744	*0.011*	0.947	0.137	0.005
	c	***0.000***	0.818	0.615	0.685	0.003
(12)	*u*	0.648	*0.014*	0.890	0.173	0.005
	c	***0.001***	0.894	0.533	0.552	0.005

Remark: Values in the table represent p-values regressions (9) to (12). P-values below 0.05 (**) are highlighted in italic and p-values below 0.01 (***) are highlighted in bold and italic. Note, the test in the last two columns is to check whether there is a cash effect ($\beta_7 + \beta_9 = 0$).

To remain consistent, I use the same procedure to analyse *Case (2)*, *Case (3)* and *Case (4)*. P-values and test coefficients are displayed in Table 3.12. In the US sample, the observation of *Signal 1* and *Signal 2* only seems to affect the liquidity of financially unconstrained firms. This does not seem to be the case for the European sample. *Case (2)* is only evident for the group of constrained firms. The coefficients are highly significant and positive (Kim et al., 1998, Denis and Sibilkov, 2010, Bates et al., 2009). Therefore, financially constrained firms that observe a peak in stock prices increase their cash holdings. The same is not true for financially unconstrained firms, which is partially in line with the results presented in Table 3.10. Unconstrained firms might not identify a run-up in stock prices as signal for an upcoming banking crisis.

Case (3) is evident at a conventional significance-level for (9) to (12) for the group of unconstrained firms. The coefficients are statistically significantly different from zero at a 5 %-level for (10) to (12), and at a 10 %-level for (9). Only financially unrestricted firms seem to be able to increase their liquidity during times of crises. Fitting my theoretical predictions, I would have expected insignificant results for unconstrained firms instead of an increase in precautionary cash holdings. There is no statistical evidence that provides support for *Case (4)*.

3.2.3 Robustness

This subsection is divided into three parts. In the first part, `s1STM` (stock market) is exchanged by `s1REM` (real estate market) as *Signal 1* for the European sample. In the second part, `bcRR` is supplemented by a variable for financial stress (`fcSTR`). Lastly, I alter the specifications of certain regression models in order to find a better statistical fit, which is determined by the values of AIC and BIC.

Signal 1

According to the identification strategy, the real estate market peaks once in the second quarter of 2007. Therefore, the year 2007 is marked as *Signal 1* (`s1REM`= 1). As mentioned before, for the US, the stock market and the real estate market peak in the same year, i. e. `s1STM` = `s1REM` = 1 and `s1STM` = `s1REM` = 0. Therefore, there is no additional robustness check conducted using `s1REM` for the US. The regressions for Europe are displayed in the appendix in Table A.20 on page 163.

The coefficients for `size` are fairly robust for the different fixed effects and both *Signal 1*. This is true except for (13). The coefficient is now significantly different from zero at a 10 %-level. The results for `netWOC`, `capETA`, `totLEV` and `retAST` are robust. The coefficient of `retSAL` is insignificant in one case (13), but robust in the remaining. Thus, a change neither seems to affect the direction nor the magnitude of the coefficients.

The p-values for the three different cases are displayed in Table 3.13. Comparing (13) to (9), *Case (2)* seems less evident using `s1REM` as *Signal 1*. However, for constrained firms, the coefficient is still significant on a 10 %-level and also positive, and still insignificant

Table 3.13: Europe: Comparison of results for `s1REM` and `bcRR` (Case (2), (3) and (4)).

No.	Group	p-value			Test	
		`s1REM`	`bcRR`	`s1REM`×`bcRR`	p-value	coefficient
(13)	u	0.409	*0.035*	0.953	0.281	0.004
	c	0.088	0.398	0.412	0.787	0.002
(14)	u	0.826	***0.000***	0.725	0.231	0.006
	c	0.753	0.470	0.106	0.164	-0.012
(15)	u	0.715	***0.004***	0.396	0.633	0.002
	c	*0.020*	0.864	0.949	0.875	-0.001
(16)	u	0.754	***0.006***	0.428	0.666	0.002
	c	*0.032*	0.928	0.936	0.970	0.000

Remark: Values in the table represent p-values for regressions (13) to (16). P-values below 0.05 (**) are highlighted in italic and p-values below 0.01 (***) are highlighted in bold and italic. Note, the test in the last two columns is to check whether there is a cash effect ($\beta_7 + \beta_9 = 0$).

for financially unconstrained firms. The effect of `bcRR` on `casHOL` is still statistically significant, now at a 5 %-level. As mentioned before, this is not in line with my theoretical predictions, but robust to results obtained when using `s1STM`. Comparing (15) to (11) and (16) to (12), the results are consistent. However, in (14), *Case (2)* is not evident at a conventional level. There is no support for *Case (4)* for financially unconstrained firms.

Signal 2

I now include `finSTR` to the aforementioned regressions. Europe and US are treated and discussed using separate tables: The tables for Europe can be found on pages 164 and 165, and for the US on pages 166 and 167. Among other things, this is due to the issue that the scale of both indices differ. To be more specific, values of STLFSI can be below zero, but values of CISS cannot. For clarification, consider Figure 3.6. The data is obtained on a monthly basis from January 1999 to June 2017 for CISS and from February 1996 to June 2017 for STLFSI. Further, for the sake of clarity, this subsection only discusses the cash effects of financial stress and the different cases in detail. Exogenous variables used before are mentioned briefly, in case they are not robust or otherwise noteworthy.

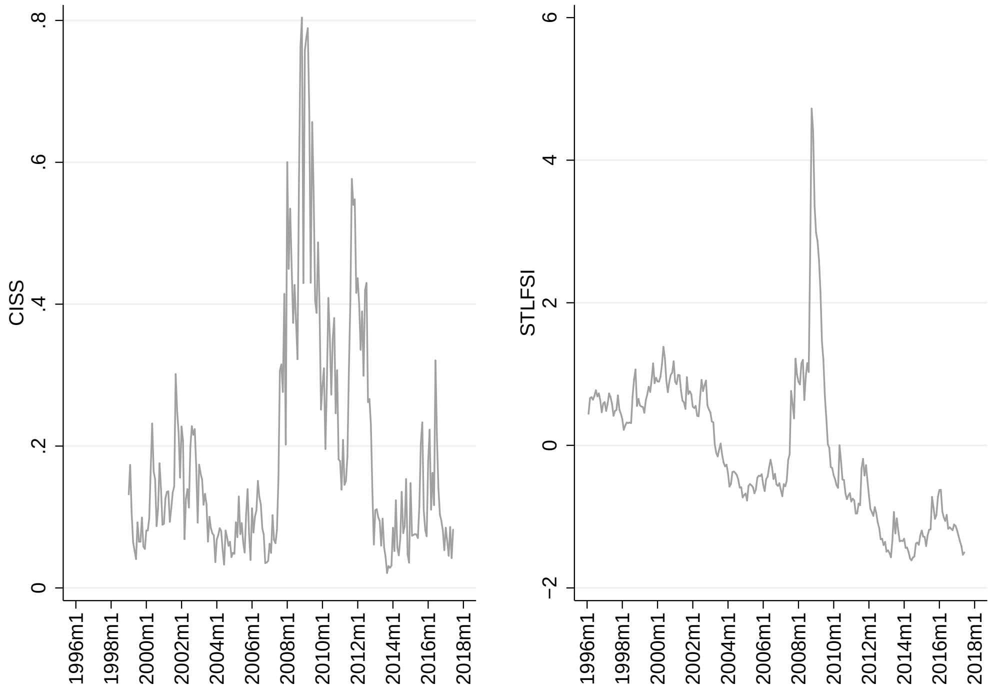


Figure 3.6: Financial stress indices: CISS (left) and STLFSI (right).

Comparing the company-specific coefficients in Tables 3.11 to A.21 and A.20 to A.22, the results remain robust. Noticeably, the indicator for financial stress affects financially constrained firms negatively for increasing levels of financial stress. This is consistent with my theoretical predictions that constrained firms use internal liquidity to secure going concern during times of crises. The results are robust for every fixed effects and *Signal 1* and are also significant at least at a 10 %-level.

The results for the different cases are summarised in Table 3.14. Even after controlling for financial stress, *Case (2)* is evident for financially constrained firms except in one regression. In combination with the aforementioned, constrained firms increase their liquid assets when observing *Signal 1* and decrease to finance their operations during times of higher financial stress, e. g. an upcoming banking crisis. Thus, the results are fully in line with my theoretical predictions. Further, there is no empirical evidence at a conventional level for *Case (2)* that financially unconstrained firms increase their cash holdings.

TABLE 3.14: Europe: Comparison of results for s1STM, s1REM, bcRR and finSTR (Case (2), (3) and (4)).

No.	Group	p-value			Test	
		s1STM	bcRR	s1STM×bcRR	p-value	coefficient
(17)	u	0.920	***0.002***	0.082	0.785	0.001
	c	***0.000***	0.544	0.924	0.593	0.002
(18)	u	0.637	***0.001***	0.767	0.073	0.007
	c	***0.004***	*0.037*	0.415	0.620	0.004
(19)	u	0.779	*0.028*	0.589	0.405	0.003
	c	***0.001***	0.376	0.651	0.901	0.001
(20)	u	0.709	*0.029*	0.566	0.437	0.002
	c	***0.000***	0.305	0.749	0.713	0.003
		s1REM	bcRR	s1REM×bcRR	p-value	coefficient
(21)	u	0.315	*0.012*	0.996	0.176	0.004
	c	*0.029*	0.995	0.438	0.430	0.005
(22)	u	0.730	***0.001***	0.722	0.199	0.006
	c	0.743	*0.039*	0.089	0.481	-0.006
(23)	u	0.778	*0.017*	0.404	0.696	0.002
	c	***0.008***	0.513	0.915	0.798	0.002
(24)	u	0.773	*0.019*	0.433	0.691	0.002
	c	*0.012*	0.429	0.965	0.618	0.004

Remark: Values in the table represent p-values for regressions (17) to (24). P-values below 0.05 (**) are highlighted in italic and p-values below 0.01 (***) are highlighted in bold and italic. Note, the test in the last two columns is to check whether there is a cash effect ($\beta_7 + \beta_9 = 0$).

As before, financially unconstrained firms increase their cash holdings during crises, but show virtually no reaction to an increasing level of financial stress. There is only weaker evidence that constrained firms do so, too. The joint effect is not statistically evident.

For the US, the company-specific coefficients are robust except for the variable size. The coefficient of size is inconclusive for constrained firms in (29) but are now evident at a conventional level in (30) and (31).

In comparison to the European sample, financial stress seems to affect both groups of companies negatively in the US. Thus, an increase in financial stress leads to a decrease in cash holdings. However, after controlling for financial stress, *Signal 1* is statistically insignificant for the regression pairs (25) and (32). The evidence for *Case (2)* provided before is therefore not robust to changes. The results for bcRR are fairly robust for unconstrained firms comparing (1) to (8) with (25) to (32). Thus, unconstrained firms increase their cash holdings when observing *Signal 2*. For constrained firms, the p-values

Table 3.15: US: Comparison of results for s1STM/s1REM, bcRR and finSTR (Case (2), (3) and (4)).

No.	Group	p-value			Test	
		s1STM	bcRR	s1STM×bcRR	p-value	coefficient
(25)	u	0.397	***0.000***	***0.000***	***0.000***	0.028
	c	0.894	*0.015*	0.840	*0.015*	0.012
(26)	u	0.450	***0.001***	***0.001***	***0.000***	0.024
	c	0.836	*0.042*	0.467	***0.000***	0.020
(27)	u	0.590	***0.000***	***0.000***	***0.000***	0.032
	c	0.629	***0.004***	0.474	0.083	0.006
(28)	u	0.502	***0.001***	***0.001***	***0.000***	0.025
	c	0.110	0.353	0.299	*0.017*	0.009
(29)	u	0.378	***0.000***	0.378	***0.000***	0.029
	c	0.369	***0.001***	0.229	***0.000***	0.010
(30)	u	0.623	*0.019*	*0.019*	***0.000***	0.033
	c	0.161	0.275	0.108	***0.001***	0.010
(31)	u	0.590	*0.017*	0.404	0.696	0.002
	c	0.303	*0.030*	0.881	0.102	0.006
(32)	u	0.399	***0.000***	***0.007***	***0.000***	0.029
	c	0.244	0.693	0.750	0.396	0.003

Remark: Values in the table represent p-values for regressions (25) to (32). P-values below 0.05 (**) are highlighted in italic and p-values below 0.01 (***) are highlighted in bold and italic. Note, the test in the last two columns is to check whether there is a cash effect ($\beta_7 + \beta_9 = 0$).

are lower than before. This is true except for (32). Further, the coefficients of bcRR in (25) to (27), (29) and (30) are now significantly different from zero at a 5 %-level.

Consider Table 3.15. In contrast to previous results, *Case (4)* is now evident in seven out of eight regression pairs for unconstrained firms (*p-value* < 0.01), and in five out of seven pairs for constrained firms (*p-value* < 0.05). The joint effect of the coefficients is positive, providing strong evidence for my theoretical predictions regarding financially unconstrained firms. However, with respect to the given assumptions on variable definitions and the restricted comparability of both data samples, the results are only robust for unconstrained firms over both samples for firms observing *Signal 2*.

Model Specification

Robustness checks are only conducted for the regression pairs with the lowest AIC and BIC. An alteration of one variable would affect 32 regressions, i. e. every change leads to the addition of 32 new regressions. I therefore restrict this analysis even further to regressions with the separation criterion size, because this criterion is applicable for both samples. Further, the variable `size` is already a logarithmic transformation of the item `totAST`. Because of this, only the variables `netWOC`, `capETA`, `totLEV`, `retAST`, `netSAL` and/or `finSTR` are altered if necessary.

To still be able to discuss or analyse the regression models in an economic context, I will only alter the functional form of single variables. The functional form is derived from a graphical context. This is done based on visual evidence. To give an example, a rather u-shaped quantile plot for the variables `casHOL` and `netWOC` would indicate a quadratic relationship.

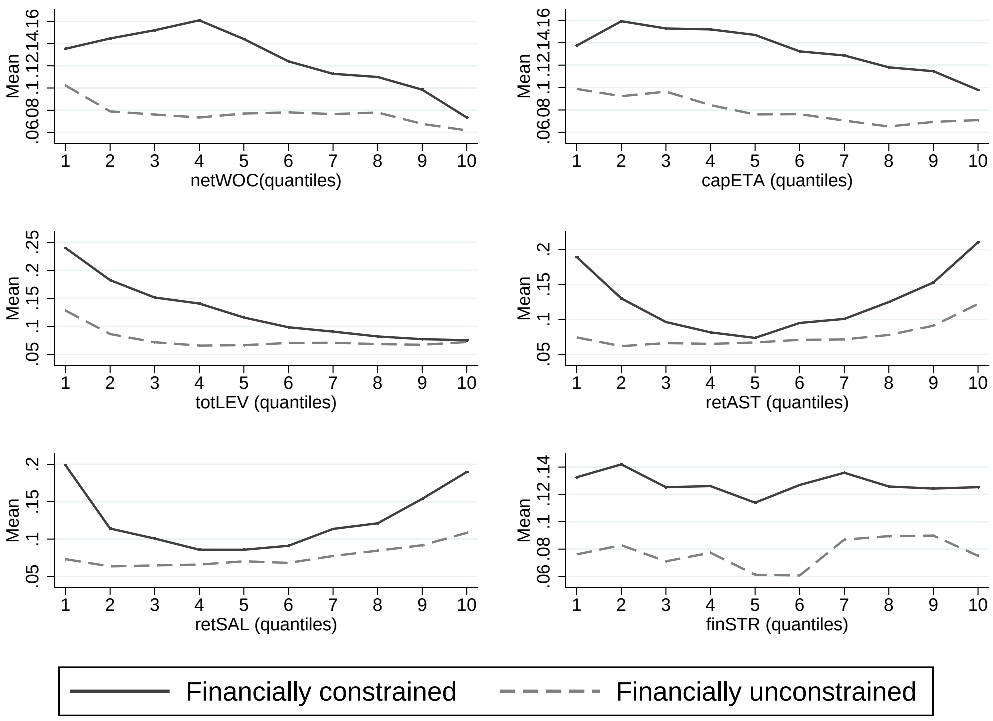


FIGURE 3.7: Europe: Cash holdings per quantile of exogenous variables.

Consider Figure 3.7 on page 89 for Europe. The vertical axis displays the mean of `casHOL` per decile of the variables `netWOC`, `capETA`, `totLEV`, `retAST`, `netSAL` and `finSTR`. The deciles are displayed on the horizontal axis. The solid line denotes the subsample of financially constrained firms and the dashed line the subsample of financially unconstrained firms. Except for the variable `finSTR`, the shape of the different graphs seems to be rather linear or even flat for unconstrained firms. Although `totLEV` is in a somewhat logarithmic shape, an adjustment for the variables `netWOC`, `retAST` and `retSAL` seems to be more sensible. This is only true for constrained firms. For `netWOC`, I add a negative quadratic term to the regression, i. e. $-(\texttt{netWOC}^2)$. `retAST` and `retSAL` are substituted by a quadratic version. Thus, based on the regression with the lowest AIC/BIC until here (13), the adjusted regression corresponds to Formula 3.3. For the sake of clarity, the new coefficients are displayed using the Greek letter γ.

$$\begin{aligned}\texttt{casHOL}^c_{i,t} =&\beta^c_1 \cdot \texttt{size}^c_{i,t} + \beta^c_2 \cdot \texttt{netWOC}^c_{i,t} - \gamma^c_1 \cdot (\texttt{netWOC}^c_{i,t})^2 + \beta^c_3 \cdot \texttt{capETA}^c_{i,t} \\ &+ \beta^c_4 \cdot \texttt{totLEV}^c_{i,t} + \gamma^c_2 \cdot (\texttt{retAST}^c_{i,t})^2 + \gamma^c_3 \cdot (\texttt{retSAL}^c_{i,t})^2 + \beta^c_7 \cdot \texttt{bcRR}^c_{i,t} \\ &+ \beta^c_8 \cdot \texttt{s1REM}^c_{i,t} + \beta^c_9 \cdot \texttt{s1REM}{\times}\texttt{bcRR}^c_{i,t} + \texttt{cons}^c_{i,t}\end{aligned} \quad (3.3)$$

The regression results for the newly specified model are displayed in Appendix A.25 on page 168. Regression pair (13) is included in this table as well. After the adjustments, comparing (13) to (33), the latter provides a better statistical fit for the subsample of constrained firms. However, the coefficients of the initial variables and also other test results are robust to these changes. `netWOC` still affects `casHOL` negatively, even after the inclusion of a negative quadratic term. Similar as `retAST`, $\texttt{retAST}^2$ is significantly different from zero and affects corporate cash holdings positively. The results for $\texttt{retSAL}^2$ are inconclusive, but so are the results for the linear term in (13). Further, the evidence for different cases is virtually unchanged.[29]

Next, consider Figure 3.8 on page 91 for the US. The shapes of the graphs are broadly similar to the graphs in Figure 3.7. Based on visual evidence, the variables in the subset of unconstrained firms need little to no adjustments. As before, the adjustments seem to be sensible for constrained firms for the variables `netWOC`, `retAST` and `retSAL`. Thus, I include $-\texttt{netWOC}^2$ and substitute $\texttt{retAST}^2$ and $\texttt{retSAL}^2$. The results are displayed in the appendix in Table A.26 on page 169. (25) represents the regression pair with the lowest AIC/BIC for both regressions.

In this case the AIC/BIC value is lower for the initial model. The results are robust with the exception of `retAST` and `retSAL`. Both coefficients point in the opposite direction and are significantly different from zero at a 5 %-level. For the first variable, a possible interpretation could be that higher levels of productivity are not necessarily associated

[29]For (33), the p-value for the joint effect of β_7 and β_9 is 0.732.

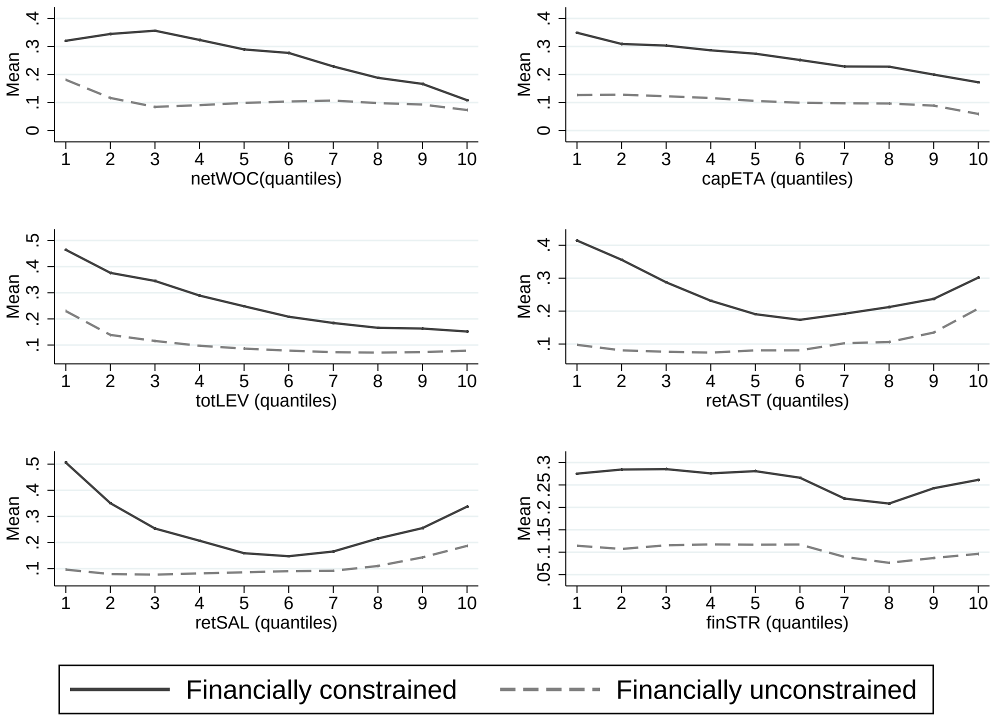


FIGURE 3.8: US: Cash holdings per quantile of exogenous variables.

with higher liquidity. For `retSAL`^{2}, a stronger increase in efficiency leads to a (relatively) lower increase in corporate cash holdings. Despite these inconsistency the results for the coefficients of these variables are still plausible in an economic context. Further, the results for the different signals are still robust. *Signal 1* does not seem to affect corporate cash holdings at all, while *Signal 2* is now evident at a higher significance-level (*p-value* < 0.01). The joint effect is still not statistically significant.[30]

[30] For (34), the p-value for the joint effect of β_7 and β_9 is 0.253.

3.3 Discussion

The main objective of this study is to analyse corporate cash holdings of listed firms before and during a crisis. To the best of my knowledge, there are no studies on the interaction of an EWS and the actual occurrence of a banking crisis on corporate liquidity. Thus, my study contributes to the literature by analysing the effect of indicators of a potential crisis and the occurrence of crisis events on corporate cash holdings, using multiple EWS and multiple crisis events.

To do so, I developed a theoretical framework. Listed firms can observe two types of signals. *Signal 1* gives a strong indication of an ensuing liquidity shortage in form of a banking crisis, which is defined as *Signal 2*. Both signals can be observed separately or staggered, i. e. the first signal precedes the second. Based on these different combinations, I identify four different cases: (1) Both signals are not observed; (2) only *Signal 1* is observed; (3) only *Signal 2* is observed; or (4) *Signal 1* is succeeded by *Signal 2*. Based on the aforementioned cases, I conduct a series of tests. This is done in two ways using a univariate approach by testing the different cases separately, and by analysing the cases simultaneously in panel regressions.

For *Case (1)*, the prediction is that financially constrained firms have on average higher cash holdings compared to their unconstrained counterparts. This was tested in Subsection 3.2.1. These tests provide strong support for the theoretical predications made in *Case (1)*. This is true for both samples, which is fully in line with Almeida et al. (2004), Han and Qiu (2007), Acharya et al. (2007) among others.

For *Case (2)*, *a signal that indicates that the realisation of future investments is more uncertain leads to an increase in precautionary cash holdings.* Thus, both groups should be affected by the observation of *Signal 1*. The effect should be economically larger for constrained firms. I find evidence that predominantly financially constrained firms from Europe are affected by this. To be precise, the results are only conclusive in case the real estate market is used as *Signal 1* when I control for financial stress. Han and Qiu (2007) find that an increase in cash flow volatility only leads to an increase in cash holdings if a firm is also financially constrained, which is in line with the results I obtained for European firms.[31] Hence, financially constrained firms react more sensitive to changes in future cash flows and therefore increase precautionary cash holdings (Kim et al., 1998, Opler et al., 1999, Claessens et al., 2012). A different explanation could be that financially constrained firms specifically use favourable economic conditions to increase their cash holdings. As mentioned before, a peak in stock prices would indicate such conditions. Both explanations would be in line with my theoretical predictions, but they are not mutually exclusive: Firms increase their cash holdings in favourable times to hedge against future liquidity shortages. However, the aforementioned logic does not seem to apply to the US. For the US, there is only evidence by testing differences in means for the criteria dividends and ratings. The panel regressions only provide significant results for unconstrained firms. This effect vanishes when controlling for financial stress. Thus, the results for the US are rather inconclusive and also not robust regarding *Signal 1*.

In *Case (3)*, it is assumed that financially constrained firms use their internal resources to finance positive NPV-projects. As mentioned before, the effect of a crisis on financially unconstrained firms should not be visible in the regressions, i. e. the coefficient of `bcRR` should not be significant at a conventional level. This is, however, not the case. The univariate statistics provide strong evidence for the US that both types of firms hold on average a higher fraction of their total assets in cash when observing *Signal 2*. These results are similar for the EU, but the evidence is weaker for constrained firms. As previously mentioned, this results from a comparison of groups and therefore does not necessarily indicate the direction of an effect. The results from the panel regressions are fairly robust over both samples, which is in line with the results provided by Campello et al. (2010). In contrast to the univariate tests, almost exclusively unconstrained firms are (positively) affected by a banking crisis. To be exact, after controlling for financial stress, the effect is also visible for financially constrained US firms. Drobetz et al. (2017) argue that there is a positive relationship between financing constraints and a liquidity crisis, i. e. formerly unconstrained firms are now financially constrained. This would support the results I obtained.

[31] Their sample consists of quarterly data of publicly traded firms from 1997 to 2002. Han and Qiu also use dividend payments, firm size, bond ratings and commercial paper ratings as separation criteria.

The evidence derived here contradicts my theoretical predictions on *Case (3)*, but nevertheless provides additional insights. Even firms that are less restricted in their financing options increase precautionary cash holdings during a banking crisis (Drobetz et al., 2017). This is particularly true for Europe. The results for financially constrained firms are mostly inconclusive. A different explanation could be that this might be due to the heterogeneity within group *c*. In case of a banking crisis, the effects of precautionary saving and investing might cancel each other out over the subsample. This would be consistent with the results seen so far.[32] Thus, there are firms within this group that are somewhat less financially constrained than others, and therefore behave like unconstrained firms. Yet, this train of thought is not based on tested evidence. A more selective criterion, such as proposed in Kaplan and Zingales (1997), would allow testing for differences in the group of financially constrained firms. A direct adaptation is, due to a lack of specific company information, not feasible for the data set at hand.

Case (4) is a combination of *Case (2)* and *(3)*: *Financially constrained and unconstrained firms increase their cash holdings before crises, and only financially constrained firms reduce cash holdings during crises.* The joint effect should be positive for financially unconstrained firms. For constrained firms, the effect is expected to be insignificant or significant and positive, but economically small when assuming precautionary savings are followed by a more prudent spending behaviour. The empirical evidence is not robust in both samples. Only when controlling for financial stress in the US sample, the joint effect is positive and strongly significant for unconstrained US firms. Similar as in *Case (2)*, a detailed discussion of inconclusive and not robust results would not be purposeful.

A sensible extension of the results and tests discussed so far would be the inclusion of more selective separation criteria. This is not necessarily restricted to company-specific data, but also to industry regulations and different legal systems. Further, a different choice of proxies as Signal 1 could provide more robust results. This is especially true for less ambiguous proxies. A single crisis event, such as the insolvency of Lehman Brothers, might help to make the effect of EWS on corporate liquidity more visible.

[32]See, for example, Figure 3.4 on page 70.

Lastly, a broader definition of liquidity that includes credit lines or an isolated analysis of credit lines could provide additional insights on corporate savings behaviour. The following chapter partially incorporates these issues, but also focuses on a specialised industry that is already due to its business model more affected by liquidity shortages.

Chapter 4

Regulated Industries, Banking Crises and Capital Structure Decisions

4.1 Methodology

This section is divided into three subsections in the same way as the previous section. The first subsections will present a theoretical framework, which is derived from Subsection 3.1.1 to identify testable predictions: There are now up to three types of firms, which still can observe two types of signals. As before, I will discuss the data used in the second subsection. This includes sample adjustments, variable definitions and identification strategies. Lastly, I am going to analyse potential limitations of this study.

4.1.1 Conceptional Framework

In this chapter, the theoretical framework is slightly altered to at least partially account for the problems mentioned in Section 3.3.[1] To do so, I now use a broader definition of

[1]Problems: (1) binary separation criteria and (2) proxies for *Signal 1* that sent ambiguous information.

financing constraints. Financial restrictions now result from federal regulations.[2] These regulations directly (or indirectly) influence different sources of funding, i. e. mandatory distributions of earnings, certain shareholder requirements or restrictions to indebtedness. Further, the regulations differ in their degree of intensity. To give an example, a company located in a country with tighter regulations has to distribute 90 % of its earnings to shareholders, their level of indebtedness is restricted to 50 % of its total assets, and/or a certain amount of shares has to be in free float. Companies that comply to these regulations pay hardly any income taxes. Violations can lead to the loss of this tax benefit among others. At this point, I am going to introduce a new notation for financing constraints: l (low), m (medium), h (high); and the severity of a punishment is marked by the same letters, where h indicates a harsh punishment, l hardly any punishment and m a state inbetween.

FIGURE 4.1: Timeline of events.

As in the previous chapter, two signals can be observed by a company. The first signal ($t-1$) indicates that credit supply is going to be restricted at a certain point in time (t). This manifestation of a liquidity shortage is the occurrence the second signal. Note, the first signal can precede the second one, but does not necessarily have to. To be consistent and for the sake of clarity, the nomenclature remains unchanged from Chapter 3. As a result, there will be four cases: (1) No signals are observed, (2) *Signal 1* is observed but not followed by *Signal 2* (3) *Signal 1* is not observed but followed by *Signal 2*, and (4) *Signal 1* is observed and followed by *Signal 2*. The different cases and the resulting hypotheses are in need of alteration as well.[3] Changes are highlighted in the colour grey and the font style bold.[4]

Case (1): Due to **different regulation, companies located in countries with tighter regulations value cash more than less strictly regulated companies** and

[2] The terms (higher) financing restrictions, (higher) financing constraints and (tighter) regulations are now used interchangeably.

[3] See Subsection 3.1.1 on pages 44-47 for the initial version.

[4] Any references to or mentions of the terms *Case (1)*, *Case (2)*, *Case (3)* and *Case (4)* are linked to the alterations made in this chapter.

on average, should have higher levels of cash holdings (Almeida et al., 2004, Faulkender and Wang, 2006, Acharya et al., 2007):

On average, ***firms that face tighter regulations hold higher amounts of cash than their less restricted counterparts.***

Case (2): In $t-1$, both groups increase their cash holdings due to higher uncertainty of future cash flows (Kim et al., 1998, Opler et al., 1999, Sun et al., 2015).[5] In addition, companies **that face tighter regulations are expected to react more strongly to changes concerning future investments**, i. e. maintain higher levels of cash holdings (Fazzari et al., 1988, Kaplan and Zingales, 1997, Cleary, 1999):

A signal that indicates that the realisation of future investments is more uncertain leads to an increase in precautionary cash holdings ***and this increase is more pronounced for more strongly regulated firms.***

Case (3): Due to a higher degree of information asymmetry during and a decline in equity prices prior to a crisis, liquidity through the issuance of equity share is no longer considered as an option by **each group** (Loughran and Ritter, 1995, Kaminsky and Reinhart, 1999, Boyd et al., 2005). During crises, banks tend to reallocate fundings to borrowers with higher creditworthiness (Lang and Nakamura, 1995, Bernanke et al., 1996, DeYoung et al., 2015). This predominantly affects companies **located in countries with tighter regulations. Less regulated companies** are still able to **use different sources of external financing, such as the issuance of bonds**. **Companies from group h, for instance, are only able to finance positive NPV-projects using internal resources** (Fazzari et al., 1988, Kaplan and Zingales, 1997, Cleary, 1999). In consequence, companies from **countries with tighter regulations** are expected to decrease their cash holdings in times of crises (Campello et al., 2010). Cash holdings of their less restricted counterparts, however, should remain constant due to **higher flexibility in their financing choices**:

Cash holdings of ***more tightly regulated*** *firms decline during banking crises.*

[5] Sun et al. (2015) record an increase in Beta prior to a crisis.

Case (4): A signal is observed in $t-1$ followed by a banking crisis in t. Case (4) is a combination of (1), (2) and (3):

***All types of firms** increase their cash holdings before crises and only **firms that face higher financing constraints** reduce cash holdings during crises.*

4.1.2 Data

Similar to the previous chapter, the data is gathered from different sources.[6] Firm-level financial data is obtained from Compustat. Information on country-level regulations is collected by hand from annual reportings of the European Public Real Estate Association (henceforth: EPRA). For the identification strategy and to adjust for macroeconomic effects, such as inflation, I use data from World Bank, Federal Reserve Bank of St. Louis and Datastream.

The content of this subsection will be further structured in firm-level data, EWS and banking crises, and regulations. Regulations will cover discussion the on the data collection process as well as the separation of companies in groups. Firm-level data will include any adjustments to the Compustat sample[7]. Analogous to Subsection 3.1.2, the last part will discuss the identification of both signals. As before, variables will be defined within this subsection.

Firm-level data

Companies are selected based on their industry. I will focus on a single highly regulated industry: REITs. REITs are corporate-like entities that invest in commercial and non-commercial real estate, e. g. shopping centres or residential real estate. Their main objective is investing in real estate and letting sites to third parties. Different from other corporates, REITs enjoy a certain tax status (or REIT status), i. e. they pay hardly any corporate or income tax. This status is linked to a set of country-specific regulations. A violation of these regulations can lead to the loss of the REIT status and

[6] A detailed list can be found in Appendix C on pages 211-212.

[7] Any onward references of *Compustat* or the *Compustat sample* are linked to this chapter only, and are not to be confused with the sample described in Subsection 3.1.2.

therefore the loss of the tax benefit. Further, REITs are mostly listed and are, apart from their tax regulation, obliged to provide the public with company information.

The raw sample consists of 19,514 observations over a period of 15 years from 2000 to 2015. This data is obtained from Compustat with the main selection criterion that the firm is classified as a REIT (SIC code: 6798). Similar to the previous chapter, the sample was obtained in January 2015 from a third party and can therefore not be extended or can only be adjusted to a certain degree. I am therefore restricted in the choice of variables and fixed effects. Without any prior adjustments, the sample consists of companies from 35 different countries. Firms from the US contribute the largest share of firm years to the sample with roughly 43 % followed by Australia with 8 %. Some countries contribute hardly any firm year observations to the sample (<1 %).

The adjustment process is similar to the previous chapter: (1) I exclude duplicates and observations with ambiguous company names (Almeida et al., 2004). (2) Firm years with an asset growth of 100 % in one year are excluded from the sample (Harford, 1999, Faleye, 2004). (3) Due to the availability of the EPRA reporting, the observation period is truncated from 2003 to 2014. Although some data might have been available in January 2015 for the year 2015, I also exclude the year 2015 as a precautionary measure. I obtained the data at the beginning of 2015, and at this early stage the figures could have been preliminary and not been tested by an external auditor. (4) To reduce a potential bias of cross-listing but also to have only US firms in the US subsample, ADR are excluded as well. (5) I only include firm years with positive cash holdings. In addition, firm years with cash holdings which exceed the book value of total assets are removed from the sample. (6) Again, to control for government involvement, I exclude firm year observations with a book value of total assets of zero, a missing book value of total assets, or firm years with a book value of total assets below the book value of total liabilities. (7) Only firm years with a positive book value of equity are included (Acharya et al., 2007, Almeida et al., 2004). (8) Lastly, countries with 40 or less observations in total are also excluded. This threshold of observations per country is based on my own discretion. It is chosen to still include smaller countries with a low number of REITs due to their country size, but exclude larger countries with hardly any observations (e. g. Netherlands with 46 firm years vs. Brazil with seven firm years).

The geographical distribution after these adjustments is displayed in Figure 4.2. The share of the US, Australia and France is about 30 %, 9.5 % and 8.6 %. In total, the sample consists of 3,480 firm year observations. Compared to the raw sample this figure seems rather low. This could be caused by a recording error. In the raw sample, the years 2000 to 2005 consist of a high number of duplicates that are excluded after the aforementioned adjustments.

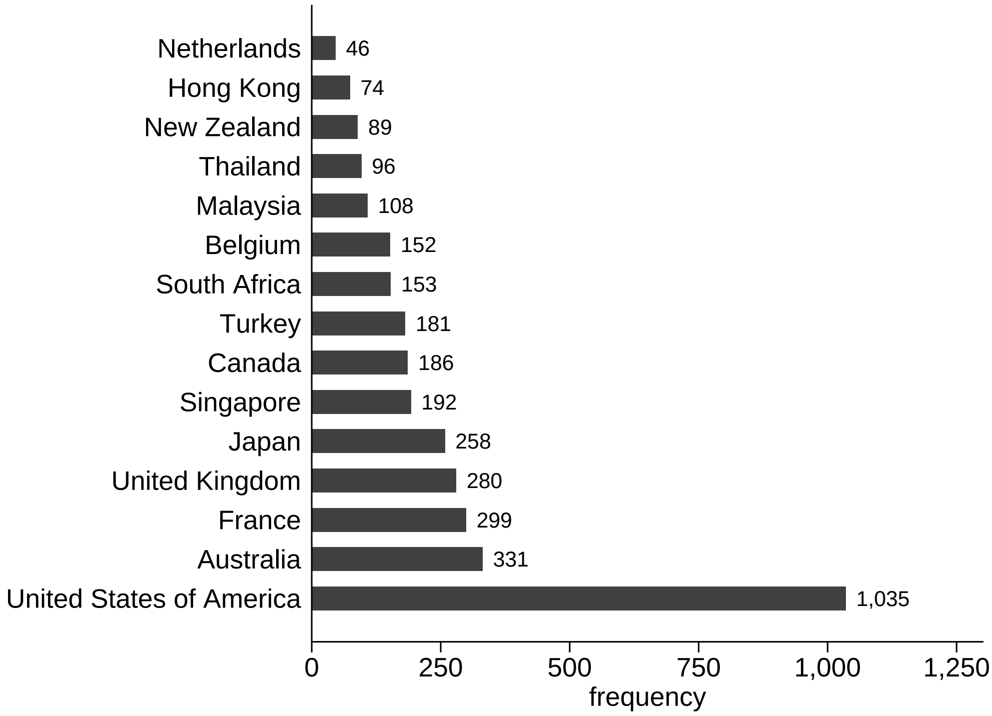


FIGURE 4.2: Observations per country/region.

All values are deflated to the 2003 domestic currencies using consumer price inflation rates (Almeida and Campello, 2007, Duchin et al., 2010). Variables are winsorised at a 1 % and a 99 %-level (Chava and Purnanandam, 2011, Dittmar and Duchin, 2012). To stay consistent, the definitions for variables remain unchanged:[8] `casHOL` is used as an endogenous variable and is defined as `cash` over the book value of total assets (`totAST`) (Bates et al., 2009, Campello et al., 2011). The exogenous variables are defined as follows: For company size (`size`), I use the natural logarithm of the book value of total assets

[8]The item definitions can be found in Table C.3 on page 214.

(Opler et al., 1999). The leverage or indebtedness (`totLEV`) of a company is defined as the book value of total liabilities (`totLIA`) over total assets (Opler et al., 1999, Faleye, 2004, Acharya et al., 2012). Net working capital is neglected. Due to the nature of their business, on average, there is hardly any working capital in REITs. In addition, the data on net working capital would only cover 118 firm year observations. A proxy for capital expenditures is also left out, because of a high number of missing values in the Compustat sample: 3,298 missing values out of 3,480 firm year observations. This mainly affects multivariate tests. For the efficiency and effectiveness of a company, I use return on assets (`retAST`) and return on sales (`retSAL`)[9] (Mikkelson and Partch, 2003). `retAST` is the ratio of net income (`netINC`) over total assets and `retSAL` the ratio of net income over `sales`. Lastly and similar to the previous chapter, location-specific or business-specific effects that are not directly observable, are controlled for by using country and company fixed effects (Mundlak, 1978, Hausman and Taylor, 1981).

EWS and Banking Crises

Signal 1 is represented by two different proxies: (1) the real estate market and (2) residential property prices (Borio and Drehmann, 2009). The first one is used for the main analysis and the second as a robustness check. This choice is mainly driven by data availability and data quality. The gathered information is summarised in Table 4.1 on page 104. The upper half displays the real estate market. As before, information on the real estate market is obtained from Datastream. The observations are on a quarterly basis. For the given licence of Datastream, the highest frequency of observations for the longest period of time is available for quarterly data. However, for this purpose, some of the given indices do not provide a sufficient length, i. e. the starting period is after 2008. Further, the different indices are less homogeneous compared to those used in the previous chapter, as they differ in size and origin among others. I am not able to fully control for this. A possible approach would be to focus on indices that are provided by one firm, such as the MSCI or Thomson Reuters. However, some financial data providers do not cover the real estate market in full. In addition, for the case of MSCI, the access to the industry group real estate is restricted to the available licence

[9] Again, to the best of my knowledge, there is no study that uses this proxy as a measure for efficiency.

of Datastream. Further, not every domestic real estate firm is publicly traded for the given period. As a result, a domestic real estate market might not be sufficiently large to form and record an index. Thus, it is difficult to find a sensible proxy for a broad observation period and for a high number of different countries in a specific industry. To at least partially control for this problem and to cover the largest possible part of the sample, I substitute domestic indices by regional indices in cases where the observation period is too short or there is no domestic data at all. In addition, I do not distinguish between REITs and *normal* real estate firms as constituents. To give an example, for Singapore, I use *Thomson Reuters Asia Pacific Real Estate Index* instead of *SGX Real Estate 20 Index*.

The lower half of Table 4.1 displays indices of residential property prices. Each index represents the price development starting at a certain year (price-level = 100). This year can be found in the fourth column of the table. For most countries, January 1st of 2003 marks the starting point and for the remaining countries, it is set to the beginning of the data history. Again, the data is available in a quarterly frequency and where the length of an index is too short, a substitute is chosen. However, this correction is only possible for Belgium and Turkey but not for Thailand and Japan.[10]

To mark a year as *Signal 1*, I follow the same identification strategy as in the previous chapter on page 53. For every time series, I extract its trend using the HP decomposition proposed by Hodrick and Prescott (1997) and the adjustments for quarterly data proposed by Ravn and Uhlig (2002). Thereafter, I subtract the time series by its trend (`gap`). Every peak of the `gap` variable over a certain threshold or *normal* level is marked as *Signal 1*. For real estate prices, the `gap` variable is further smoothed by a five-period moving average. The threshold is set to one constant standard deviation over the full observation period for the real estate market. For residential property prices, the threshold is set to 75 % of one standard deviation based on my own discretion. Due to the impact of the global financial crisis in 2007/08, I assume that a threshold of one standard deviation over the full observation period would not mark a *normal* level, but rather an upwards

[10]Total country matching for the real estate market: 1) Middle East & Africa for South Africa, 2) Asia Pacific for Japan, 3) Europe for Turkey, 4) Asia Pacific for Malaysia, 5) Asia Pacific for New Zealand and 6) Asia Pacific for Thailand; and for residential property prices: Euro Area for Turkey. There is no substitute for residential property prices for Japan.

TABLE 4.1: Signal 1: Real estate market and residential property prices.

Signal 1	Country/Region	Name	Observation period Start	End	N
Real estate market	Asia Pacific	Thomson Reuters Asia Pacific Real Estate Index	fourth quarter 2002	fourth quarter 2014	49
	Australia	MSCI International Australia Industry Group - Real Estate Price	fourth quarter 2002	fourth quarter 2014	49
	Belgium	FTSE EPRA/NAREIT Belgium/Luxembourg Index	fourth quarter 2002	fourth quarter 2014	49
	Canada	S&P/TSX Canadian Real Estate Index	fourth quarter 2002	fourth quarter 2014	49
	Europe	MSCI International Europe Real Estate Price	fourth quarter 2002	fourth quarter 2014	49
	France	FTSE EPRA/NAREIT France Index	fourth quarter 2002	fourth quarter 2014	49
	Hong Kong	Hang Seng REIT Index	fourth quarter 2005	fourth quarter 2014	37
	Malaysia	S&P Malaysia REIT Index	first quarter 2007	fourth quarter 2014	32
	Middle East & Africa	Dow Jones Middle East & Africa Select REIT Index	second quarter 2006	fourth quarter 2014	35
	Netherlands	FTSE EPRA/NAREIT Netherlands Index	fourth quarter 2002	fourth quarter 2014	49
	Singapore	SGX Real Estate 20 Index	third quarter 2010	fourth quarter 2014	18
	South Africa	Thomson Reuters South Africa Real Estate Index	second quarter 2008	fourth quarter 2014	27
	Thailand	Thomson Reuters Thailand Commercial REITs Index	second quarter 2011	fourth quarter 2014	15
	United Kingdom	FTSE 350 Real Estate Index	fourth quarter 2002	fourth quarter 2014	49
	United States	Dow Jones US Real Estate Index	fourth quarter 2002	fourth quarter 2014	49
Residential property prices	Australia		second quarter 2003	fourth quarter 2014	47
	Belgium		fourth quarter 2005	fourth quarter 2014	37
	Canada		fourth quarter 2002	fourth quarter 2014	49
	Euro Area		fourth quarter 2002	fourth quarter 2014	49
	France		fourth quarter 2002	fourth quarter 2014	49
	Hong Kong		fourth quarter 2002	fourth quarter 2014	49
	Japan		first quarter 2008	fourth quarter 2014	28
	Malaysia		fourth quarter 2002	fourth quarter 2014	49
	Netherlands		fourth quarter 2005	fourth quarter 2014	37
	New Zealand		fourth quarter 2002	fourth quarter 2014	49
	Singapore		fourth quarter 2002	fourth quarter 2014	49
	South Africa		fourth quarter 2002	fourth quarter 2014	49
	Thailand/Bangkok		fourth quarter 2007	fourth quarter 2014	29
	Turkey		fourth quarter 2009	fourth quarter 2014	21
	United Kingdom		fourth quarter 2002	fourth quarter 2014	49
	United States		fourth quarter 2002	fourth quarter 2014	49

Remark: For the upper half, the data is obtained from Datastream. The third column displays the official name of an index. For the lower half, residential property prices (Index) are gathered from Federal Reserve Bank of St. Louis (2017). The start year (Index = 100) is given in the fourth column. N is the number of observations.

biased threshold. For further clarification, consider Figure 4.3. The solid black line denotes the `gap` variable. The short dashed line denotes a threshold of 75 % of one standard deviation and the long dashed lighter line denotes a full standard deviation. The dots mark peaks in property prices. According to the identification strategy mentioned above and in Subsection 3.1.2, the country year 2006 (first and fourth quarter) is marked as *Signal 1* for the US. Thus, in 2006 a dummy variable (`s1RPP`) is set to one and otherwise to zero. For the real estate market, *Signal 1* is represented by the variable `s1REM`. The remaining figures based on Table 4.1 can be found in Appendix B on pages 170-185.

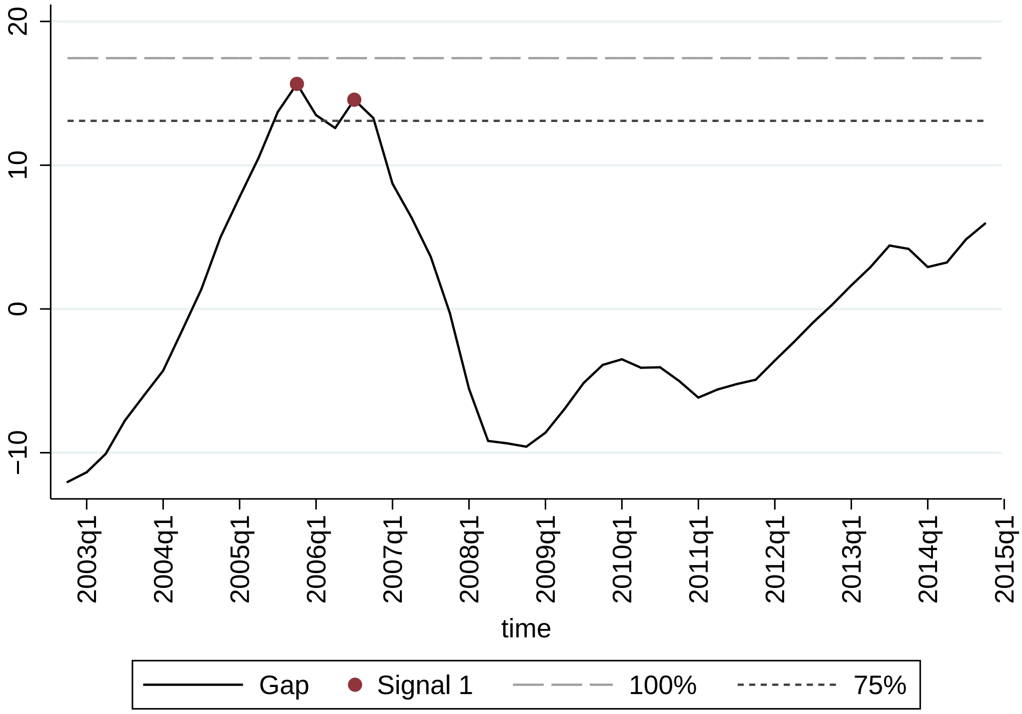


FIGURE 4.3: US: Residential property prices - quarterly data.

The second signal is determined by a single event - the year Lehman Brothers filed for chapter 11 (SEC, 2008). This is true for every country in the Compustat sample. This change is predominantly due to following reasons: First and foremost, there is empirical evidence that the year 2008 marks the lowest point in stock markets, the highest point in financial stress, the steepest decline in real estate markets, and the lowest point of residential property prices over the whole observation period.[11] Second, this adjustment reduces complexity. Further, by setting a dummy variable (`s2LB`) for the year 2008 to one and otherwise to zero, I have full coverage for every country year in the sample and therefore no further reduction due to data restrictions.

Analogue to the previous chapter, in case *Signal 2* is observed and preceded by *Signal 1* in $t-1$ and/or $t-2$, a dummy variable is set to one and otherwise set to zero ($\texttt{s1REM} \times \texttt{s2LB} = 1$ or $\texttt{s1RPP} \times \texttt{s2LB} = 1$).

[11]See the Appendices A and B for clarification.

Regulation

The data on regulation is obtained from a single source. For the years 2003 to 2014, I collect information from EPRA and their annual European or global REIT surveys. The main advantage of this source is that the reports follow a similar structure every year. There is no analysis of country-specific real estate or financial law. However, some reporting is only available in a reduced form. This is true for the years 2003, 2005 and 2006. Further, some REIT regimes have been enacted after the start of the observation period leading to a missing value problem in later analysis. To at least partially control for this issue, I will use three different approaches, which will be applied separately:

1. The first approach is predominantly motivated by the existing accounting data[12] and an adjustment process conducted by Compustat, assuming a firm is now operating in a different industry. Compustat changes this information for the current year, but also applies this change to every preceding firm year. To give an example, the enactment year for REITs in South Africa is 2013, but accounting data on South African REITs is available for the full observation period. Thus, prior to 2013, non-REIT real estate firms are treated as REITs by Compustat. To control for this issue, I exclude every firm year prior to the enactment year. For missing values after the enactment year, I insert the information from the preceding or succeeding year in case there is no material change between these years. In cases with a change, I use the preceding/succeeding information that consists of the more restrictive regulation. The adjustment for missing values implies that changes in regulation occur at most once. In case 2004 and 2007 are marked with l, a different classification, such as h, would indicate that the regulation changed two times within three years, from l to h and back. However, this approach also implies that a change to a stricter regulation is more likely.

2. The second approach differs in one key aspect from the prior. Firms in the sample are treated as REITs for the full observation period. The information at the time of enactment is used for every preceding country year.

[12] I do not have access to historical industry information.

3. Lastly, in case the enactment year is past 2003, firms from these REIT regimes are excluded in full. Other missing values, e. g. a gap of two or three years, are treated as in the first approach.

Every approach is a trade-off between accuracy and coverage: The first adjusts the final sample less than the others, but misses out years prior to the enactment year. This mainly affects years that succeed a possible observation of *Signal 1* but also *Signal 2*. The second version provides the broadest coverage, but is also less accurate. It is assumed that real estate firms face certain restrictions prior to the enactment date which is not necessarily true. The third approach is the most accurate, but shrinks the sample even further.

The main source (global REIT survey) is structured by region, then by country and then by content. The content is divided into five sections. To give an example for Belgium:

1. General introduction: This section consists of general information on size of the sector and the enactment year of the law, accompanied by legal changes.

2. Requirements: Requirements are, among others, the legal form of a REIT, minimum share capital, shareholder/listing requirements, leverage restrictions, restrictions on profit distribution, and sanctions for violations.

3. Tax treatment at BE-REIT (or SICAFI)[13] level: This section contains information on tax benefits on a REIT's operating income and capital gains, as well as transition regulations and registration duties.

4. Tax treatment at the shareholder's-level: This section contains information on the tax treatment of corporate and individual shareholder.

5. Tax treatment of foreign REIT and their domestic shareholder: This section consists of information on the tax treatment in case a non-Belgian REIT has part of its property in Belgium.

[13]SICAFI is shorthand for *société d'investissement en immobilier à capital fixe* and is a notation for the Belgian REIT regime. Since 2014, Belgian REITs are classified as BE-REIT.

Every section consists of a key summary. Consider for instance, Figure 4.4. In a first step, I collect the content of every box with information on share capital, shareholder and listing requirements, leverage, mandatory profit distribution, sanctions and tax treatment. Thereby, I am able to create three variables that directly affect a firm's equity (minimum share capital, shareholder requirements and mandatory listing); one variable that directly affects (leverage threshold) and one that indirectly (income taxation) affects a firm's debt; and also one variable, which restricts a firm's ability to generate cash by profit retention (operative income distribution). To isolate possible effects of inflation, monetary values are deflated to the 2003 domestic currencies using consumer price inflation rates.

Leverage

- LTV ratio limited to 65% of the total assets (under specific conditions loans limited to 33%).
- Interest expenses limited to 80% of the total income.
- Mortgage (or other collateral) is limited to 50% of the global fair value of the "immovable property" and to 75% of the value of one "immovable property".

FIGURE 4.4: EPRA (2017): Excerpt of a Global REIT Survey.

Subsequently, the information is ranked and sorted by the intensity of restriction. For example, a lower leverage threshold restricts a company more in their financing decision than a higher threshold. The same is true for a higher mandatory profit distribution. Finally, I classify each resulting country year into one of three groups (*low, middle, high*). For clarification, consider Table 4.2.

`minSCA` consists of three groups. The upper bound of l is given by the median of minimum share capital; the upper bound of m by the 75 %-percentile; and the upper bound of h is given by the maximum value of minimum share capital. These values are determined using the adjusted monetary values over every country and year. Shareholder requirements include restrictions on blockholding among others. The severity of this regulation is low in case there are no requirements or there is no explicit mentioning of a shareholder requirement in the reporting.

For the operative income distribution (`disOIN`), the thresholds for l are the minimum value (0 %) and the 30 %-percentile of mandatory payout ratios over every country and year. For m, these thresholds are the 30 %-percentile and the 70 %-percentile, and for h,

TABLE 4.2: Regulations: Variable definition.

Variable	Name	Definitions and thresholds
`minSCA`	minimum share capital	l: \$0 to \$1,082,943.79 m: < \$1,082,943.79 to \$12,682,856.53 h: < \$12,682,856.53 to \$182,598,923.22
`shaREQ`	shareholder requirements	l: No restrictions. h: Any regulatory intervention.
`lisMAN`	mandatory listing	l: No. h: Yes.
`totLER`	leverage threshold	l: 100 % to 70 % m: > 70 % to 40 % h: > 40 % to 0 %
`disOIN`	operative income distribution	l: 0 % to 85 % m: < 85 % to 90 % h: < 90 % to 100 %
`incTAX`	income taxation	l: Full tax exemption or rental income is not taxed. m: Reduced tax rate. h: No discrimination between REITs and ordinary corporates.
`sanc`	sanctions	l: No sanctions, no mentioning of any sanctions, or sanctions with no negative effect on the going concern assumption. m: Potential loss of the REIT status, or any punishment that is temporarily. h: Loss of the REIT status including full tax treatment, de-listing, negative material effects on the going concern assumption.

Remark: Minimum share capital is deflated to the 2003 domestic currencies and converted into US dollar using year-end exchange rates.

the 70 %-percentile and maximum value (100 %) of mandatory payout ratios over every country and year. Except for `totLER`, the remaining information does not consist of numerical values and is therefore more difficult to classify. Thus, thresholds are based on own assumptions. To the best of my knowledge, this data has not been used in prior studies on REITs and corporate cash holdings.

The tightest restriction is 0 % for `totLER` and the weakest is 100 %.[14] This indicates that there is no restriction at all. The boundaries inbetween should cover about the

[14]Note, this is not to be interpreted as a leverage ratio.

same range of percentage points. In case a country regulation provides a soft and a hard threshold, I assume the more restrictive one applies. For instance, the leverage threshold for REITs from Singapore is 35 % and can be increased to 60 % under certain conditions. In this case, the hard threshold is 35 %.

Table 4.3: Degree of Regulation per Country (Approach 1).

Country	minSCA	shaREQ	lisMAN	totLER	disOIN	incTAX	sanc
Australia	*l* (12/12)	*l* (12/12)	*l* (12/12)	*l* (12/12)	*h* (12/12)	*l* (12/12)	*l* (10/12)
Belgium	*m* (12/12)	*l* (12/12)	*h* (12/12)	*m* (12/12)	*l* (10/12)	*l* (12/12)	*m* (12/12)
Canada	*l* (12/12)	*h* (12/12)	*l* (12/12)	*l* (12/12)	*h* (12/12)	*m* (12/12)	*h* (8/12)
France	*h* (12/12)	*h* (9/12)	*h* (12/12)	*l* (12/12)	*l* (11/12)	*l* (10/12)	*m* (12/12)
Hong Kong	*l* (12/12)	*l* (12/12)	*h* (12/12)	*m* (8/12)	*m* (12/12)	*m* (12/12)	*h* (8/12)
Japan	*l* (8/12)	*l* (9/12)	*l* (12/12)	*l* (12/12)	*m* (12/12)	*m* (12/12)	*m* (12/12)
Malaysia	*h* (10/10)	*l* (10/10)	*l* (10/10)	*m* (6/10)	*m* (10/10)	*l* (10/10)	*m* (10/10)
Netherlands	*l* (12/12)	*h* (12/12)	*l* (12/12)	*m* (12/12)	*h* (12/12)	*l* (12/12)	*h* (12/12)
New Zealand	*l* (8/8)	*h* (8/8)	*l* (8/8)	*l* (8/8)	*l* (8/8)	*h* (8/8)	*h* (8/8)
Singapore	*m* (9/12)	*h* (12/12)	*l* (8/12)	*h* (12/12)	*m* (12/12)	*l* (12/12)	*h* (12/12)
South Africa	*h* (2/2)	*l* (2/2)	*h* (2/2)	*m* (2/2)	*l* (2/2)	*m* (2/2)	*h* (2/2)
Thailand	*m* (7/8)	*h* (8/8)	*h* (8/8)	*h* (8/8)	*m* (8/8)	*m* (8/8)	*l* (6/8)
Turkey	*m* (12/12)	*h* (12/12)	*h* (12/12)	*l* (12/12)	*l* (12/12)	*l* (12/12)	*h* (12/12)
United Kingdom	*h* (8/8)	*h* (8/8)	*h* (8/8)	*l* (8/8)	*h* (8/8)	*l* (8/8)	*m* (8/8)
United States	*l* (12/12)	*h* (12/12)	*l* (12/12)	*l* (12/12)	*m* (12/12)	*l* (12/12)	*m* (12/12)
Total	**156**	**156**	**156**	**156**	**156**	**156**	**156**

Remark: The values in this table are based on the first approach to control for missing values. Further, the table displays the mode over the full observation period per country. The figures in brackets display the number of observations with the highest occurrence (mode) and the total number of country years. Note, the enactment years for Malaysia, New Zealand, South Africa, Thailand and the United Kingdom are 2005, 2007, 2013, 2007 and 2007 in that order. For the remaining countries, this year is 2003 or prior.

Table 4.3 displays the mode per country over the full observation period for Approach 1. Approach 2 and 3 can be found in the appendix on page 186. As mentioned before, the letters l, m and h are shorthand for low, middle and high. The first column displays a list of the different REIT regimes in the form of the country name. Column two to seven list the aforementioned variables and the last column lists the intensity in case a regulation is violated. The figures reflect the frequency of specific occurrences. The table provides an overview and can only be interpreted with due care. The results suggest that the relationship between regulations and sanctions is not clear. Lower requirements are not necessarily associated with a harder punishment and vice versa. The only pattern that seems to emerge is that stricter regulations affect only one source of funding while at least one different source is less regulated. To give an example, the stocks of Canadian REITs can only be hold by a certain type of shareholders and only in a certain quantity. Further, retained profits are subject to income tax. On the other hand, there are no explicit restrictions for the level of indebtedness (EPRA, 2017).

4.1.3 Limitations

The study is subject to similar limitations as in the previous chapter. To remain consistent, I structure this subsection in a similar manner, but refrain from a detailed analysis of statistical problems, predominantly because I use similar adjustments for the exactly same issues as in the previous. Thus, this subsection is divided into two parts: (1) sample restrictions and (2) identification strategy.

Sample Restrictions

The accounting data for REITs was obtained by a third party in 2015. The sample can only be altered but not extended, which is due to the fact that I am not able to access the original database. Therefore, any recording errors, missing values etc. can only be controlled for by exclusion or alteration, but not by obtaining a new set of data from the original source.

In comparison to the previous chapter, the main sample consists of a lower number of observations, which is mainly due to the focus on a single industry. Thus, applying a similar empirical strategy is only possible to a certain extent because most of the tests are subject to a sample split. This problem is even more severe for a higher number of subsets, i. e. l, m and h instead of l and h. Further, observations are not necessarily evenly distributed among groups. The problem intensifies because of the treatment of industry changes in Compustat. This is partially controlled for by the approaches to adjust for missing values. However, two out of three approaches shrink the sample even further, which exacerbates the sample size problem. In consequence, some results are based on a smaller subsample size. Therefore, I primarily use univariate statistics, and multivariate statistics only as a complement, and explicitly analyse groups with a sensible number of observations only.

The problem of missing values/variables within the accounting sample in this chapter is more severe. Besides missing a fitting criterion to match stock market data to the sample, I am not able to generate variables that reflect a firm's investments in current and non-current assets. Due to the nature of their business, REITs tend to have hardly any net working capital. However, capital expenditures for real estate assets are one of their main drivers for growth. Based on the available data, there is almost no record of cash flows used to finance non-current assets (coverage $<5\,\%$). Thus, an omitted variable problem cannot be ruled out, which specifically concerns the multivariate analysis in the following section.

The regulatory data is collected by hand from a single source. The source is available for most years and is structured in a similar manner. This is predominantly true for the most recent years of the observation period. With the exception of 2004, early reporting focusses on regulatory changes in Europe and the US. Thus, there is a missing value problem for 2003, 2005 and 2006, which is more pronounced in non-European and non-US regimes. To at least partially control for this issue, I replace missing values by using the information from preceding or subsequent years. In cases without a change in regulation between years, the possibility of erroneous classification should be low. However, this is not true for missing values in years where preceding and succeeding regulation differs. So without any further knowledge about the missing values, there is a possibility of overstating or understating the actual regulation.

Identification Strategy

The identification of different regulatory regimes bears two main problems: The information has to be converted into an ordinal scale and ranked by its degree of restriction. Both processes are somewhat arbitrary. Three out of seven criteria consist of numeric values. These figures can be divided into groups based on distributional measures, such as quantiles, or by even-sized thresholds. For minimum share capital and operating income distribution, I rely on distributional measures, and for the leverage threshold, I divide the groups by even-sized thresholds. However, between regimes the definition of the underlying numeric values can differ. Nevertheless, I do not distinguish between different definitions, except for minimum share capital. In this case, I adjust for domestic inflation and convert domestic currency into US Dollar for a better comparison.

I define the remaining non-numeric criteria based upon my own discretion, aiming to find sensible thresholds. This predominantly applies to `sanc` and `incTAX`. For these two criteria, thresholds are set based on how strongly sanctions might affect the going concern assumption of a firm, and how different the tax treatment of REITs compared to *regular* companies is. `lisMAN` and `shaREQ` can only be high or low. For `lisMAN`, this separation is straightforward since listing is either mandatory or it is not. For `shaREQ`, I deliberately decide two distinguish between the presence or absence of a restriction. Some regulations are difficult to compare over different countries. Specifically, some REITs are restricted to a fixed number of domestic or non-domestic shareholders, while others are bound by a relative value of blockholdings or even a combination of both.[15]

[15]For example, in Singapore "[a]t least 25 % of the REIT's capital has to be held by at least 500 public unit holders [...]" (EPRA, 2017, 335).

4.2 Empirical Strategy and Results

As in the previous chapter, this section is divided into three subsections. First, I am going to test differences in means based on predefined groups for each case. I will focus on cash holdings (`casHOL`) only. Second, I will conduct further tests in multivariate regressions by controlling for different regulations and fixed effects, and lastly, I will alter the test settings by using a different *Signal 1* and adjust the functional form of some regression models. Additional approaches and regressions are included in Appendix B.9 on pages 190-208.

4.2.1 Univariate Statistics

Within this subsection, I analyse differences in means between the groups defined on page 109. Each case is tested separately using a two-sample t-test for unequal variances proposed by Welch (1947). Further, I focus on the adjusted data based on the first approach to treat missing values. The remaining approaches can be found in Appendix B.3 on pages 187-197. For the sake of clarity, some of the main tables are also enclosed in the appendix, but discussed within this section to wider extent.

Due to the specific industry and also country-specific regulations, it is difficult to find a sensible benchmark in the empirical literature for the variables in use. With due care, I use the results obtained in the previous chapter to compare variables of regulated and non-regulated industries. For the comparison, I choose variables that are available in each sample (`casHOL`, `totLEV`, `retAST` and `retSAL`). Differences between samples are not tested. Thus, my analysis is based on visual inspection. Mean, median and the number of observations are displayed in Table 4.4. Note that the data is obtained from two different database, but is adjusted in the same manner. As a result, a comparison is only limited to the time frame and the underlying geographic distribution of the data. To control for this, I also extract subsamples from the sample of *regulated* firms. Starting from the left hand side of the table, the third column displays the full sample; fourth and fifth columns, the extracted subsamples; and the last two columns the results obtained in Chapter 3.

TABLE 4.4: Comparison of samples: Regulated vs. unregulated industries.

Variables		Regulated industries			Unregulated industries	
		Full	Europe	North America	Europe	North America
casHOL	Mean	**0.031**	0.041	0.027	0.098	0.180
	Median	**0.015**	0.016	0.013	0.055	0.102
	N	**3,480**	958	1,035	43,721	37,425
totLEV	Mean	**0.466**	0.438	0.567	0.544	0.471
	Median	**0.482**	0.459	0.573	0.565	0.474
	N	**3,480**	958	1,035	43,721	37,425
retAST	Mean	**0.032**	0.029	0.022	0.012	0.003
	Median	**0.030**	0.031	0.021	0.030	0.040
	N	**3,462**	954	1,035	43,710	37,418
retSAL	Mean	**0.322**	0.352	0.145	-0.038	-0.119
	Median	**0.337**	0.467	0.134	0.029	0.037
	N	**3,462**	954	1,035	43,710	37,418

Remark: The subsample for regulated industries from Europe consists of REITs from Belgium, France, the Netherlands, Turkey and the United Kingdom; and the subsample North America consists exclusively of REITs from the US. N denotes the number of firm years per sample (or subsample).

REITs hold 3.1 % (median: 1.5 %) of their total assets in cash. Although the largest fraction of the sample is attributed by US REITs, this figure seems to be upward-shifted by non-US REITs. Compared to the results from *unregulated* industries, I obtained different results. US REITs have lower levels of cash holdings compared to European REITs. From a regulator's point of view, US REITs have no restrictions regarding their leverage ratio, but they are obliged to pay 90 % of taxable income to shareholders. This would be in line with the leverage ratio, which is above the global average: 56.7 % (median: 57.3 %) vs. 46.6 % (median: 48.2 %).

Focusing on return on assets, this variable is measured as net income over total assets. For REITs, this figure is on average 3.2 % (median: 3.0 %). Return on assets appears to be lower for the unregulated sample. However, the median values are virtually at the same level for Europe. For return on sales, the average value for European REITs is 35.2 % (median: 46.7 %). This ratio displays a firm's ability to transform revenues into net income. A higher number indicates higher efficiency. Nevertheless, a comparison is only reasonable within the same industry. This is also true for return on assets. Different industries have different cost structures and are also affected by different extra ordinary events, e. g. impairment as a result of a revaluation of real estate property. Noticeably, return on sales is at 14.5 % (median: 13.4 %) for US REITs but at 35.2 % (median: 46.7 %) for European REITs.[16]

Case (1)

Case (1) is displayed in Tables 4.5 and 4.6. Consider Table 4.5 first. The first column displays separation criteria discussed on page 109. Columns 3 to 5 display the mean, median and the number of observations of `casHOL` within the different subsamples (*low*, *middle* and *high*). Further, tests for differences in means between groups are indicated by the terminology: *Diff.* $l - h$, *Diff.* $l - m$ or *Diff.* $m - h$. As before, these differences are tested using a two-sample t-test with unequal variances (Welch, 1947).

Focusing on criteria concerning equity, more regulated firms seem to have, on average, higher levels of cash holdings. For minimum share capital, there is empirical evidence that this is true for *Diff.* $l - h$ and also *Diff.* $l - m$, but not *Diff.* $m - h$. Further, this association is also evident for shareholder requirements and mandatory listing. Although with this being a rather simplified setting, these results would be in line with Asker et al. (2011), Gao et al. (2013). They find that public firms will hold on average higher levels of cash holdings compared to private firms. This effect seems to persist for most equity related criteria after changing the strategy for missing values. For Approach 2, there is virtually no change except that the relationship for minimum share capital is no longer somewhat monotonic. Specifically, the average cash ratio for low regulated firms is lower than the average ratio of medium and highly regulated firms, but not for medium compared to high regulated firms. This is also true for the third approach. In addition, in the third approach, the difference in means is no longer significant at a conventional level for shareholder requirements. Further, comparing medians of groups, the differences seems to be less evident for shareholder requirements for the first and third approach and for mandatory listing for the third approach.

Based on the total leverage thresholds, the average mean for low, middle and high is 3.4 %, 2.2 % and 2.8 %. The differences in means are significantly different from zero

[16] The difference in return on sales between US REITs and European REITs is not the focus of this study.

TABLE 4.5: Case (1): Cash holdings (equity and debt: Approach 1).

Criterion ↓	Group →	l	m	h
	Signal 1 →	NO	NO	NO
	Signal 2 →	NO	NO	NO
minSCA	Mean	0.028	0.037	0.038
	Diff. $l-h$	-0.010*** (-4.47)		
	Diff. $l-m$	-0.009*** (-4.00)		
	Diff. $m-h$	-0.001 (-0.30)		
	Median	0.013	0.018	0.019
	N	1,876	652	747
shaREQ	Mean	0.029		0.033
	Diff. $l-h$	-0.004** (-2.21)		
	Median	0.015		0.015
	N	987		2,288
lisMAN	Mean	0.028		0.041
	Diff. $l-h$	-0.013*** (-6.16)		
	Median	0.015		0.016
	N	2,202		1,073
totLER	Mean	0.034	0.022	0.028
	Diff. $l-h$	0.006*** (2.98)		
	Diff. $l-m$	0.013*** (5.03)		
	Diff. $m-h$	-0.006** (-2.21)		
	Median	0.016	0.007	0.018
	N	2,573	387	315

Remark: Groups are assigned following the definition(s) on page 109. Diff. = $\text{Mean}_l - \text{Mean}_h \neq 0$ (analogously for $l-m$ and $m-h$) are tested using a two-sample t-test with unequal variances (Welch, 1947). The values in brackets are t-values associated with the respective tests.
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

at a 5 %-level. This relationship is non-monotonic and also not robust for the remaining approaches.[17] Nonetheless, when controlling for mandatory listing, i. e. whether a company is publicly traded, this relationship changes. Consider Figure 4.5 for more information.[18] The horizontal axes denote the variable casHOL and the vertical axes the division into groups. For clarification, a company that is obliged to be listed and also faces strong leverage restrictions has a cash ratio of 1.4 %[19], whereas less regulated

[17] See Appendix B.9 on page 190.
[18] The relationship remains unchanged for the different missing value approaches.
[19] Note, the group of *not mandatory* firms can consist of listed firms, while the other group exclusively include listed firms.

listed firms have on average higher cash holdings as a fraction of total assets.[20] Noticeably, when comparing only strictly (h) and less strictly (l) regulated firms, higher leverage restrictions seem to be associated with higher cash holdings when listing is not mandatory, but for listed firms, it is the other way around.

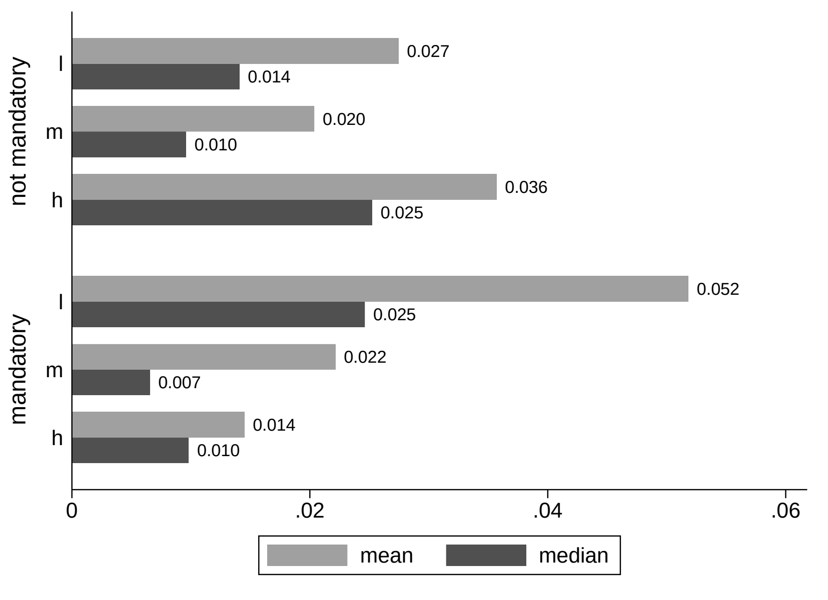


FIGURE 4.5: Cash holdings by mandatory listing by leverage threshold.

Next, consider Table 4.6. REITs which distribute up to 85 % of their income to shareholders hold on average 3.8 % (median: 1.4 %) of total assets in cash. For a payout ratios between 85 % and up to 90 %, the average is 2.8 % (median: 1.6 %); and for ratios larger than 90 %, the average is 3.5 % (median: 1.3 %). This relationship remains non-monotonic, partially inconclusive and not robust enough for the remaining approaches. These results are partially in line with Almeida et al. (2004), Acharya et al. (2007), but contradict Fazzari et al. (1988), i. e. lower levels of dividend payout ratios are associated with lower levels of internal funds.

For `incTAX`, firms that are subject to *ordinary* income taxation have on average lower cash ratios compared to firms that are exempt from taxation. This difference is statistically evident at a 1 %-level. Further, the difference between firms that are fully exempt and firms that are taxed on a reduced tax rate is also significant at a 1 %-level, while

[20]The differences in means are significantly different from zero at a 5 %-level. For listing not mandatory, the t-values are −3.06 for Diff. $l-h$, 2.30 for Diff. $l-m$ and −3.96 for Diff. $m-h$. For listing mandatory, the t-values are 12.52 for Diff. $l-h$, 7.38 for Diff. $l-m$ and 2.24 for Diff. $m-h$.

TABLE 4.6: Case (1): Cash Holdings (income distribution, taxes and sanctions: Approach 1).

Criterion ↓	Group →	l	m	h
	Signal 1 →	NO	NO	NO
	Signal 2 →	NO	NO	NO
`disOIN`	Mean	0.038	0.028	0.035
	Diff. $l-h$	0.002 (0.91)		
	Diff. $l-m$	0.009*** (3.80)		
	Diff. $m-h$	-0.007*** (-3.10)		
	Median	0.014	0.016	0.013
	N	684	1,779	812
`incTAX`	Mean	0.034	0.025	0.019
	Diff. $l-h$	0.016*** (2.92)		
	Diff. $l-m$	0.009*** (5.21)		
	Diff. $m-h$	0.006 (1.19)		
	Median	0.016	0.016	0.003
	N	2,527	652	96
`sanc`	Mean	0.031	0.030	0.039
	Diff. $l-h$	-0.008** (-2.07)		
	Diff. $l-m$	-0.009 (0.48)		
	Diff. $m-h$	-0.009*** (-3.82)		
	Median	0.014	0.015	0.017
	N	316	2,239	720

Remark: Groups are assigned following the definition(s) on page 109. Diff. $=\text{Mean}_l - \text{Mean}_h \neq 0$ (analogously for $l-m$ and $m-h$) are tested using a two-sample t-test with unequal variances (Welch, 1947). The values in brackets are t-values associated with the respective tests.
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

this is not the case for Diff. $m-h$. Thus, it appears to be that there is only a difference when a company is taxed or exempt from taxation.[21] However, for a different missing value strategy, a monotonic structure is more (Approach 2) or less evident (Approach 3). See Appendix B.10 on pages 190 and 194. The latter is mostly driven by a sample size problem.[22]

As a reminder, sanctions for a violation of a regulation are divided into three groups. A sanction is classified as low, if it has no negative effect on the going concern assumption or if there is no punishment at all. Firms that operate in a regime from group l have

[21]When comparing taxed or tax-exempt firms, taxed firms have average cash ratios that are 1 percentage point lower. This difference in means is significantly different from zero at a 1 %-level (t-value: 5.71).
[22]Note, in Approach 3, group h consists of only 32 observations.

average cash ratios of 3.1 % (median: 1.4 %). Firms from group m face a temporarily punishment for a violation, or there is a possibility that the tax status is going to be revoked. Compared to average ratios from group l, the cash ratios in group m are rather similar with 3.0 % (median: 1.5 %) on average, i. e. the differences in means are not significant at a conventional level. For firms from group h, a violation causes a negative material effect on going concern. Cash ratios for these firms are on average 3.9 % (median: 1.7 %). Differences in means are only evident when comparing l to h and m to h. As before, I assume that two groups are rather similar (l and m). Thus, differences are only evident when a violation causes the loss of the REIT status or when it does not. Merging group l and m, the difference in means is significantly different from zero at a 1 %-level (t-value: -3.77). Thus, firms that face tighter sanctions have on average higher levels of cash holdings as a fraction of total assets.

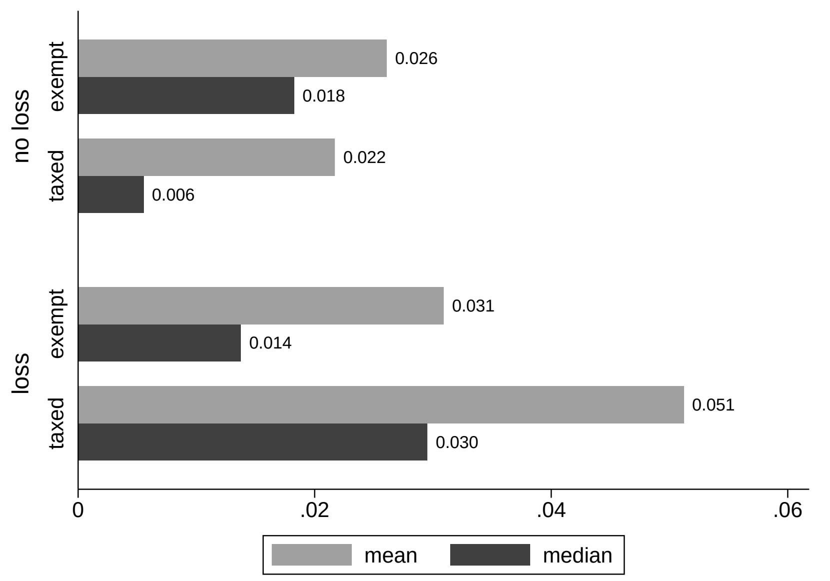


Figure 4.6: Cash holdings by sanction by taxation.

Figure 4.6 displays mean and median of `casHOL` by sanction and by taxation. Groups are assigned using the reduce criteria discussed in the two previous paragraphs. Noticeably, the relationship seems to be reversed between both groups. As Figure 4.6 shows, compared to *ordinarily* taxed REITs, firms hold higher levels of cash holdings when they are exempt from taxes and a violation does not affect the tax status. For regimes with a more severe punishment, taxed firms have higher average cash ratios compared to their from income taxation exempt counterpart.

Case (2)

A summary of the different tests is displayed in Table 4.7.[23] The table consists of every missing value strategy and both *Signal 1*. The first column denotes the different regulation criteria. Columns two to seven display p-values for tests of differences in means (Diff. = $\text{Mean}_{\text{Not obs.}} - \text{Mean}_{\text{Obs.}} \neq 0$) within group l, m and h using a two-sample t-test with unequal variances (Welch, 1947). As before, the values are highlighted based on the different significance-level.

TABLE 4.7: Case (2): Comparison of results (`casHOL`: Approach 1, 2 and 3).

	`s1REM`			`s1RPP`		
	Approach 1	Approach 2	Approach 3	Approach 1	Approach 2	Approach 3
(1) `minSCA`						
l	0.234	0.234	0.234	0.148	0.127	0.204
m	0.232	0.232	0.232	***0.000***	***0.000***	***0.007***
h	0.712	0.596	0.791	0.381	0.781	n/a
(2) `shaREQ`						
l	0.409	0.888	0.436	0.955	0.657	0.768
h	0.885	0.605	0.750	0.737	0.862	0.976
(3) `lisMAN`						
l	0.302	0.302	0.341	0.207	0.207	0.230
h	0.347	0.347	0.293	0.281	0.281	n/a
(4) `totLER`						
l	0.776	0.525	0.911	0.874	0.993	0.970
m	***0.000***	0.927	***0.000***	0.951	0.493	n/a
h	0.190	0.847	n/a	0.309	0.175	0.220
(5) `disOIN`						
l	0.239	0.172	0.293	n/a	0.678	n/a
m	0.201	0.209	0.239	0.604	0.679	0.476
h	0.190	*0.041*	0.641	0.923	0.952	0.436
(6) `incTAX`						
l	0.706	0.488	0.922	0.512	0.515	0.925
m	0.173	0.732	0.130	*0.048*	0.598	n/a
h	n/a	n/a	n/a	n/a	n/a	n/a
(7) `sanc`						
l	0.774	0.774	0.774	0.785	0.785	0.861
m	0.137	0.063	0.474	0.611	0.632	0.274
h	0.284	0.214	0.360	0.063	0.922	*0.011*

Remark: Values in the table represent p-values for two-sided t-test (Diff.$\neq$ 0) with unequal variances (Welch, 1947). P-values below 0.05 (**) are highlighted in italic and p-values below 0.01 (***) are highlighted in bold and italic. The different approaches are defined as written on pages 106. In case a test is marked with n/a, at least one subsample is an empty set.

[23]Descriptive statistics and group-wise t-tests can be found in Appendix B on pages 187-188 (Approach 1), pages 191-192 (Approach 2), and pages 195-196 (Approach 3).

Except for some single tests, there is no statistical evidence that support the theoretical predictions in *Case (1)*, i. e. the observance of *Signal 1* does not lead to higher average cash holdings for different levels of regulations. This is true for `s1REM`, `s1RPP` and every missing value approach.

The results could be caused by several reasons. However, I focus on the following: (1) subsample size, (2) structure of business, (3) choice of signals: (1) As mentioned in *Case (1)*, the number of firms is down by roughly 6 % when matching with the data for regulation. By splitting the sample by criterion and intensity, I obtain two or three smaller subsamples that are not evenly sized. To analyse the effect of *Signal 1*, the subsamples shrink even further. In addition, the matching process for financial and regulation data with the data for *Signal 1* reduces the overall sample size by roughly 19 %.[24] As there is no variation in the data and visible in Table 4.7, certain tests could not be performed, since there are no observations within subsamples (e. g. $h \subset$ `incTAX`). Even in case a mean comparison test could be performed, some groups have less than 30 observations, and are therefore not as reliable as tests with a higher number of observations. Nevertheless, the remaining tests mostly provide insignificant and therefore inconclusive results.

(2) The second reason for inconclusive results might come from the nature of business of a REIT. Specifically, the ability to generate liquidity in the short run as a precautionary measure. Dividend cuts, the issuance of debt and/or equity shares are restricted due to REIT-specific regulation (EPRA, 2017). Further, the asset side of a REIT's balance sheet consists predominantly of non-current assets, which consist almost completely of real estate, i. e. less fungible or short-term assets to liquidate (Lin and Vandell, 2007, Haslam et al., 2015, EPRA, 2017). Thus, short-term liquidity needs would require the liquidation of long-term assets. Finally, due to high mandatory payout ratios, firms are hardly able to retain a fraction of rental income to generate liquidity. One could argue that an alternative source of additional liquidity could be an adjustment of lease contracts. However, lease contracts are usually long-term obligations and can usually only be altered by renewal after maturity (Titman and Twite, 2013).[25]

[24]Both figures are based on the first approach for missing values.

[25]Titman and Twite study lease duration from 2000 to 2010 for over 62 countries. They find that the global average duration is 4.868 years. For US cities, they report a mean of 4.732 years.

(3) Lastly, a peak in either real estate market or residential property prices might still not be recognised as a credible signal for an ensuing liquidity shortage, i. e. market or price peaks might be observed as positive economic conditions. Investment trends support this argument. At a global level, investments in commercial real estates does not decline noticeably until the third quarter of 2007 (JLL, 2017). The same is true for the transaction volume in the US real estate market (Statista, 2017). *Signal 1* is predominantly observed in 2007 and before.[26]

Case (3)

For *Case (3)*, I analyse the effect of a somewhat stronger signal on corporate cash holdings.[27] Thus, based on the results of *Case (2)* and in contrast to the my earlier theoretical predictions, I would have assumed that a stronger signal such as a banking crisis would lead to an increase in precautionary cash holdings at least for companies located in less regulated regimes. Table 4.8 summarises the tests for *Case (3)* and they show rather inconclusive results.

For equity regulations, there is empirical evidence for the criteria `minSCA` and `lisMAN` that less regulated firms (l) have different average cash ratios when observing *Signal 2*. This is true for every missing value approach at least at a 5 %-significance level. For minimum share capital, the average cash ratios for firms-years other than 2008 are at 2.8 % (median: 1.3 %) and for 2008 the ratios are at 2.1 % (median: 0.9 %). In case listing is not mandatory, the cash ratios are at a similar level: 2.8 % (median: 1.5 %) for non-crisis years and 2.2 % (median: 1.1 %) for the year 2008. I argue that group l of `lisMAN` can consist of private firms. Private firms tend to hold lower cash reserves as their publicly traded counterpart (Asker et al., 2011, Gao et al., 2013). Private firms are more restricted in their access to capital markets during a banking crisis and their financing options are more expensive (Brav, 2009, Campello et al., 2011). Thus, significant results in group l are in line with my theoretical predictions. A similar result is given for the different levels of sanctions. The differences in means are significant at a 5 %-level for group l. The average cash ratio is 2.2 % (median: 1.3 %) when observing *Signal 2*

[26]For `s1REM`, all 202 observed *Signal 1* are in 2007 and before. For `s1RPP`, 112 out of 187 observed *Signal 1* are in 2007 and before.

[27]Descriptive statistics and group-wise t-tests can be found in Appendix B on page 189 (Approach 1), page 193 (Approach 2), and page 197 (Approach 3).

TABLE 4.8: Case (3): Comparison of results (casHOL: Approach 1, 2 and 3).

	s2LB		
	Approach 1	Approach 2	Approach 3
(1) minSCA			
l	*0.020*	*0.028*	*0.035*
m	0.084	0.084	0.053
h	0.201	0.221	0.837
(2) shaREQ			
l	0.110	0.066	0.092
h	0.910	0.946	0.203
(3) lisMAN			
l	***0.008***	***0.012***	***0.016***
h	0.356	0.371	0.781
(4) totLER			
l	0.666	0.810	0.098
m	0.675	0.411	0.711
h	0.147	0.168	0.220
(5) disOIN			
l	0.654	0.600	0.660
m	0.983	0.121	0.140
h	0.602	0.502	*0.019*
(6) incTAX			
l	0.615	0.701	0.064
m	0.173	0.680	0.863
h	***0.007***	*0.010*	n/a
(7) sanc			
l	*0.028*	*0.026*	*0.037*
m	0.658	0.597	0.379
h	0.104	0.098	0.094

Remark: Values in the table represent p-values for two-sided t-test (Diff.≠ 0) with unequal variances (Welch, 1947). P-values below 0.05 (**) are highlighted in italic and p-values below 0.01 (***) are highlighted in bold and italic. The different approaches are defined as written on pages 106. In case a test is marked with n/a, at least one subsample is an empty set.

and otherwise 3.2 % (median: 1.5 %). So, *ordinarily* taxed firms hold a lower average cash holdings during times of crises. The remaining results are inconclusive for every criterion and subset. Since the number of observations is too low in group *h* in incTAX, i. e. tests are less reliable, I do not provide an interpretation of the results. For instance, the numbers of observations for group *h* in incTAX are 88 and eight. For the remaining insignificant results, similar restrictions as in *Case (2)* apply: The sample size problem is less severe but still prevalent, because of the data on *Signal 2* covers the full sample. Due to regulations and business structure, it is more difficult to generate short-term liquidity.

Case (4)

As in the previous chapter, *Case (4)* should be tested covering the interaction between two staggered variables, which is only possible to a certain extent. By applying the identification strategy, the sample size problem grows more severe.[28] Thus, it is not possible to test the effect for every degree of regulation in an univariate setting. Without the aforementioned separation, the difference in means does not significantly differ from zero at a conventional level for real estate market (t-value: 0.50) and also for residential property prices (t-value: 0.19) as *Signal 1*.

4.2.2 Multivariate Statistics

In this subsection, I will focus on regressions with `s1REM` as *Signal 1* and `s2LB` as *Signal 2*. Due the existing data, I am fairly restricted in testing my theoretical predictions in an univariate and also a multivariate setting. This is especially true for the choice of exogenous variables and also for dividing the main sample into separately testable subsamples, which is no longer feasible. However, to still be able to control for the effect of regime-specific regulations, I incorporate the different levels of regulations as fixed effects in the different regressions. To create different fixed effects or controls, I will use `minSCA` for equity, `totLER` for debt, `disOIN` for distribution, `incTAX` for taxation and `sanc` for sanctions. In addition, I will account for company and country characteristics that are not fully covered by the aforementioned exogenous variables by including firm fixed and country fixed effects (Mundlak, 1978, Hausman and Taylor, 1981). Cash as a fraction of total assets (`casHOL`) is used as the endogenous variable. The firm-specific exogenous variables are the natural logarithm of total assets (`size`), total debt divided by total assets (`totLEV`), return on assets (`retAST`) and return on sales (`retSAL`). Formula 4.1 provides an example for a regression with controls for equity and sanctions,

[28] See Subsection 4.1.3.

`s1REM` as *Signal 1* and the first approach to treat missing values.

$$\begin{aligned}\texttt{casHOL}_{i,t} =& \beta_1 \cdot \texttt{size}_{i,t} + \beta_2 \cdot \texttt{totLEV}_{i,t} + \beta_3 \cdot \texttt{retAST}_{i,t} + \beta_4 \cdot \texttt{retSAL}_{i,t} \\ &+ \beta_5 \cdot \texttt{s2LB}_{i,t} + \beta_6 \cdot \texttt{s1REM}_{i,t} + \beta_7 \cdot \texttt{s1REM}\times\texttt{bcRR}_{i,t} \\ &+ \sum_{j\in\{l,m,h\}} \texttt{equity}_j + \sum_{g\in\{l,m,h\}} \texttt{sanction}_g\end{aligned} \tag{4.1}$$

As before, tests on endogeneity strongly suggest the use of fixed effects (Hausman, 1978, Breusch and Pagan, 1979). Further, estimations are conducted using heteroscedasticity-consistent and autocorrelation-consistent standard errors. AIC and BIC are used to display the statistical fit of a model (Akaike, 1973, Schwarz, 1978). Models differ by the combination of fixed effects, signals and missing value approaches. For the sake of clarity, every regression is denoted by a consecutive number. Regression (1) to (7) can be seen in Table 4.9. Models (8) to (32) can be found in the appendix on pages 198-202. For example, the estimation results for regression (4.1) are shown in Table B.25 on page 198.

As usual, the interpretation of single coefficients is done under the assumption that everything else remains constant. Company size is negatively related to corporate cash holdings. Thus, an increase in size leads to a decrease in cash holdings, which is in line with the literature on financing constraints and also with the results previously obtained (Kim et al., 1998, Opler et al., 1999, Almeida et al., 2004). The coefficients are significantly different from zero at a 1 %-level and also robust over every combination of controls. Further, the effect appears to be larger when controlling for firm-specific characteristics. The effect size is slightly below the results obtained in the previous chapter. The coefficients for the indebtedness of a company are negative and also highly significant (*p-value* < 0.01). This is true for all regressions. Compared to *ordinary* corporations from Europe and the US, coefficients for `totLEV` are also negative and significantly different from zero at a 1 %-level for all regressions (Acharya et al., 2007). However, REITs seem to be less affected by a change in leverage, i. e. the coefficients for `totLEV` are higher in the regressions in the previous chapter. Return on assets (or productivity) does not seem to affect the liquidity of REITs. The results are predominantly inconclusive. Out of 32 regressions, only two regressions provide weakly

TABLE 4.9: Regression: Real estate market and Lehman Brothers (Approach 1) (panel 1).

casHOL	(1)	(2)	(3)	(4)	(5)	(6)	(7)
size	-0.013***	-0.008***	-0.008***	-0.008***	-0.008***	-0.008***	-0.008***
	(-2.66)	(-7.09)	(-7.31)	(-8.67)	(-8.01)	(-8.46)	(-8.82)
totLEV	-0.059***	-0.029***	-0.036***	-0.041***	-0.036***	-0.035***	-0.033***
	(-3.58)	(-3.54)	(-4.60)	(-5.04)	(-4.56)	(-4.47)	(-4.09)
retAST	0.004	-0.026	0.026	-0.014	-0.028	-0.027	-0.034
	(0.20)	(-1.21)	(-1.15)	(-0.63)	(-1.26)	(-1.23)	(-1.51)
retSAL	-0.002	-0.006***	-0.007***	-0.007***	-0.007***	-0.007***	-0.007***
	(-1.26)	(-3.27)	(-3.55)	(-3.32)	(-3.52)	(-3.57)	(-3.51)
s2LB	0.001	-0.001	0.025	0.001	-0.001	-0.001	-0.002
	(0.33)	(-0.36)	(-0.36)	(-0.15)	(-0.33)	(-0.38)	(-0.49)
s1REM	0.001	0.000	-0.001	-0.002	-0.001	-0.001	-0.001
	(0.29)	(0.10)	(-0.30)	(-0.42)	(-0.32)	(-0.30)	(-0.22)
s1REM × s2LB	-0.011*	-0.002	-0.034	-0.048	-0.005	-0.005	-0.004
	(-1.70)	(-0.19)	(-0.43)	(-0.38)	(-0.47)	(-0.43)	(-0.30)
cons	0.151***	0.135***	0.110***	0.095***	0.111***	0.109***	0.104***
	(4.43)	(8.83)	(12.14)	(12.34)	(13.03)	(11.81)	(12.65)
Controls:							
Company FE	YES	NO	NO	NO	NO	NO	NO
Country FE	NO	YES	NO	NO	NO	NO	NO
Equity	NO	NO	YES	NO	NO	NO	NO
Debt	NO	NO	NO	YES	NO	NO	NO
Distribution	NO	NO	NO	NO	YES	NO	NO
Taxes	NO	NO	NO	NO	NO	YES	NO
Sanctions	NO	NO	NO	NO	NO	NO	YES
N	2,807	2,807	2,654	2,654	2,654	2,654	2,654
AIC	-11,054	-9,094	-8,390	-8,429	-8,390	8,389	-8,405
BIC	-11,012	-8,987	-8,331	-8,370	-8,331	8,330	-8,346
R^2	0.088	0.152	0.102	0.116	0.102	0.102	0.107

Remark: Controls are assigned following the definition(s) on page 109. s1REM is used as *Signal 1* and s2LB as *Signal 2*. The Hausman-test strongly suggests the use of fixed effects ($p < 0.0000$) (Hausman, 1978). Note, regression (1) has the lowest AIC and BIC over every combination of fixed effects and over all approaches with s1REM as *Signal 1*, but also with the lowest R^2. This is due to the fact that the first R^2 is a weighted average of two components: The model can account for a certain percentage of variation between and within the groups/panels. In this case, the between R^2 is 0.138 and within R^2 is 0.075.
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

significant coefficients (*p-value* < 0.1). In contrast, the coefficients are highly significant for non-regulated firms. Except for regression (1), the coefficients of return on sales are negatively related to cash. Thus, a higher degree of efficiency is associated with lower cash holdings. This is also in line with the results obtained in the previous chapter.

Table 4.10 displays p-values which are associated with the coefficients in regressions (1) to (12), i. e. the regressions based on the first missing value approach.[29] Further, column six and seven represent the tests for the joint effect of the coefficients of s2LB

[29] The second and third approach can be found on page 203.

TABLE 4.10: Comparison of results for `s1REM` and `s2LB` in Approach 1 (Case (2), (3) and (4)).

No.	Controls	p-value			Test	
		s1REM	s2LB	s1REM×s2LB	p-value	coefficient
(1)	Firm FE	0.771	0.741	0.090	0.091	-0.011
(2)	Country FE	0.920	0.718	0.850	0.760	-0.003
(3)	Equity	0.764	0.720	0.669	0.588	-0.007
(4)	Debt	0.677	0.878	0.701	0.663	-0.005
(5)	Distribution	0.752	0.742	0.637	0.562	-0.007
(6)	Taxes	0.761	0.704	0.667	0.581	-0.007
(7)	Sanctions	0.829	0.625	0.764	0.651	-0.005
(8)	All, except firm/country	0.760	0.655	0.824	0.720	-0.004
(9)	Equity/Sanctions	0.857	0.600	0.800	0.681	-0.005
(10)	Debt/Sanctions	0.723	0.729	0.816	0.734	-0.004
(11)	Distribution/Sanctions	0.761	0.633	0.743	0.631	-0.006
(12)	Taxes/Sanctions	0.753	0.604	0.741	0.621	0.029

Remark: Values in the table represent p-values of regressions (1) to (12). P-values below 0.05 (**) would be highlighted in italic and p-values below 0.01 (***) are highlighted in bold and italic. Note, the test in the last two columns is to check whether there is a joint cash effect ($\beta_5 + \beta_7 = 0$).

and `s1REM`×`s2LB`. As before, p-values below 0.05 would be highlighted in italic and below 0.01 in italic and bold. There is no empirical evidence that REITs increase their level of cash holdings when observing *Signal 1*. The results are inconclusive for the regressions (1) to (32), which is fully in line with the results obtained in the univariate setting, but contradicting my theoretical predictions. For *Signal 2*, the coefficients are also not significant at a conventional level. To be exact, the coefficients of `s2LB` for regressions (28) and (31) are significantly different from zero at a 5 %-level. Due to the missing separation criterion, the results provide only limited explanatory power. However, based on an univariate test setting, there is hardly any empirical evidence supporting *Case (3)*. The same is true for *Case (4)*. Neither the single coefficient nor the joint effect is statistically significant at a conventional level.

To still be able to test *Case (2), (3) and (4)* in a multivariate setting properly, I will include the separation criterion firm size as a robustness test (Gilchrist and Himmelberg, 1995), and follow the definition on page 52. Similar to the Bloomberg sample, I have no information on dividend payments, bond ratings and/or commercial paper ratings. Therefore, the additional tests are restricted to the criterion firm size.

4.2.3 Robustness

This subsection is divided into three parts. First, residential property prices are used as *Signal 1*. Second, I include the aforementioned separation criterion. Third, the functional form of the regression model is altered. As before, the model with the lowest AIC and BIC provides the better statistical fit. Robustness checks are only conducted for the first missing value approach.

Signal 1

The coefficients of the exogenous firm-specific variables are robust to the change of *Signal 1*.[30] There is no sign change, virtually no change in effect size and significance-level. The main difference is that the data on residential property prices covers a larger number of firm years. Therefore, AIC and BIC are lower when comparing regressions (33) to (44) and (1) to (12).

The results are displayed in Table 4.11. Similar to the previous section, the coefficient for both signals are inconclusive but robust. However, for the phased interaction term and the test of a joint effect, the coefficients are now significantly different from zero at a 1 %-level for the regressions (35) to (44). For regression (34), there is only statistical support for the joint effect of the coefficients β_5 and β_7. Nevertheless, the coefficients of the joint and the single effect are negative. Therefore, the observance of a banking crisis preceded by a peak in residential property prices leads to a decline in cash holdings. As before, the structure of the test does not provide a clear indication whether a different degree of regulation leads to a stronger decline in cash holdings during a banking crisis. However, following my theoretical predictions and despite the fact that the coefficient of `s2LB` is not statistically significant at a conventional level, I would have expected results that support *Case (2)*, i. e. statistically significant positive coefficients of `s1RPP`. This is based on the assumption that all types of firms increase precautionary cash holdings.

Company Size

To create to subsamples, I am going to use total assets as a separation criterion (Gilchrist and Himmelberg, 1995, Almeida et al., 2004). Following the definition on page 52, a

[30]See Tables B.32 and B.33 on pages 204 and 205.

TABLE 4.11: Comparison of results for `s1RPP` and `s2LB` in Approach 1 (Case (2), (3) and (4)).

No.	Controls	p-value			Test	
		`s1RPP`	`s2LB`	`s1RPP`×`s2LB`	p-value	coefficient
(33)	Firm FE	0.305	0.764	0.126	0.082	-0.011
(34)	Country FE	0.920	0.718	0.850	***0.000***	-0.015
(35)	Equity	0.512	0.703	***0.000***	***0.000***	-0.020
(36)	Debt	0.589	0.730	***0.000***	***0.000***	-0.019
(37)	Distribution	0.697	0.738	***0.000***	***0.000***	-0.020
(38)	Taxes	0.786	0.697	***0.000***	***0.000***	-0.020
(39)	Sanctions	0.322	0.626	***0.000***	***0.000***	-0.019
(40)	All, except firm/country	0.776	0.690	***0.000***	***0.000***	-0.018
(41)	Equity/Sanctions	0.297	0.648	***0.000***	***0.000***	-0.018
(42)	Debt/Sanctions	0.271	0.650	***0.001***	***0.000***	-0.017
(43)	Distribution/Sanctions	0.494	0.688	***0.000***	***0.000***	-0.020
(44)	Taxes/Sanctions	0.536	0.536	***0.000***	***0.000***	-0.019

Remark: Values in the table represent p-values of regressions (33) to (44). P-values below 0.05 (**) are highlighted in italic and p-values below 0.01 (***) are highlighted in bold and italic. Note, the test in the last two columns is to check whether there is a cash effect ($\beta_5 + \beta_7 = 0$).

company is financially unconstrained if its total assets are higher or equal to the upper three deciles (u) of total assets over all firms and the whole observation period, and it is considered as financially constrained if its total assets are in the lower three deciles (c). The main regressions can be found on pages 206 and 207. Further, AIC and BIC are lower when using `s1RPP` as *Signal 1*. To analyse the different cases by controlling for regulation, I will focus on regressions with `s1RPP` as *Signal 1*, and with controls for equity, debt, income distribution, taxation and sanctions.

The sample size is reduced to 1,700 (u: 958/ c: 742) observations. Further, R^2 is rather low for the regression pairs: (45) to (49). This is especially true for regressions based on the subsample u. Thus, further analyses are to interpret with due care and subject to this restriction.

The coefficients for the variable `size` are positive for unconstrained firms and negative for constrained firms, and significantly different from zero at a 1 %-level. In consequence, relative size has a positive cash effect for unconstrained firms and a negative cash effect for constrained firms. These results are not consistent with the evidence from the previous chapter (Kim et al., 1998, Opler et al., 1999, Almeida et al., 2004). The size effect for regulated firms should have been negative or inconclusive. The results concerning the indebtedness of a company are also partially inconclusive. For unconstrained firms, the coefficients of `totLEV` are not statistically significant when controlling for equity and debt, and only weakly significant when controlling for sanctions. However, when the coefficients are significant, they are negative for both groups, which is in line with the previous results (Acharya et al., 2007). The effect of a change in return on assets is only evident for unconstrained firms, and for return on sales, it is only evident for constrained firms. Hence, unconstrained firms seem to decrease cash holdings when productivity (`retAST`) increases, whereas constrained firms decrease cash holdings if efficiency (`retSAL`) increases. Note, the results for unregulated firms indicate that increasing levels of productivity are associated with increasing levels of cash holdings.

TABLE 4.12: Comparison of results for size, `s1RPP` and `bcRR` in Approach 1 (Case (2), (3) and (4)).

No.	Group	p-value			Test	
		`s1RPP`	`bcRR`	`s1RPP`×`bcRR`	p-value	coefficient
(45)	u	0.239	0.220	*0.014*	***0.000***	-0.019
	c	0.216	0.530	***0.004***	***0.004***	-0.040
(46)	u	0.127	0.333	***0.005***	***0.000***	-0.019
	c	0.279	0.561	*0.012*	*0.014*	-0.032
(47)	u	0.079	0.235	*0.017*	***0.000***	-0.016
	c	0.133	0.478	***0.006***	***0.007***	-0.038
(48)	u	0.255	0.399	***0.003***	***0.000***	-0.019
	c	0.346	0.425	***0.004***	***0.006***	-0.036
(49)	u	0.075	0.260	0.088	***0.009***	-0.015
	c	0.331	0.597	***0.012***	***0.009***	-0.034
(50)	u	0.186	0.222	0.088	***0.003***	-0.014
	c	0.247	0.330	**0.027**	0.058	-0.026

Remark: Values in the table represent p-values of regressions (45) to (50). P-values below 0.05 (**) are highlighted in italic and p-values below 0.01 (***) are highlighted in bold and italic. Note, the test in the last two columns is to check whether there is a cash effect ($\beta_5 + \beta_7 = 0$).

The results are displayed in Table 4.12. Even after separating by firm size, the results are robust. The coefficients for both signals are statistically not significant. Further, the results on the joint effect are virtually unchanged, when comparing (45) to (50) to (33) to (40). Except for (40) and (50), the coefficient for the joint is statistically significant but also negative. Thus, there is evidence that financially constrained firms seem to decrease cash holdings during a banking crisis that is preceded by an EWS. This would be in line with my theoretical predictions. Nevertheless, I would have expected inconclusive results for financially unconstrained firms.

Model Specification

As before, model alterations are only conducted for regression with the lowest AIC/BIC, i. e. regression (33). I will restrict myself to the change of the functional form of single variables. This will be done based on graphical evidence. For clarification, consider Figure 4.7. The cash holdings are divided by ten quantiles of the variables `totLEV`, `retAST` and `retSAL`.[31] The vertical axis displays the mean of cash holdings per quantile and the horizontal axis the quantiles themselves. In contrast to the previous chapter, there is no distinction between financing constraints. Compared to Figures 3.7 and 3.8, it is even less obvious what shape the graphs in Figure 4.7 have.

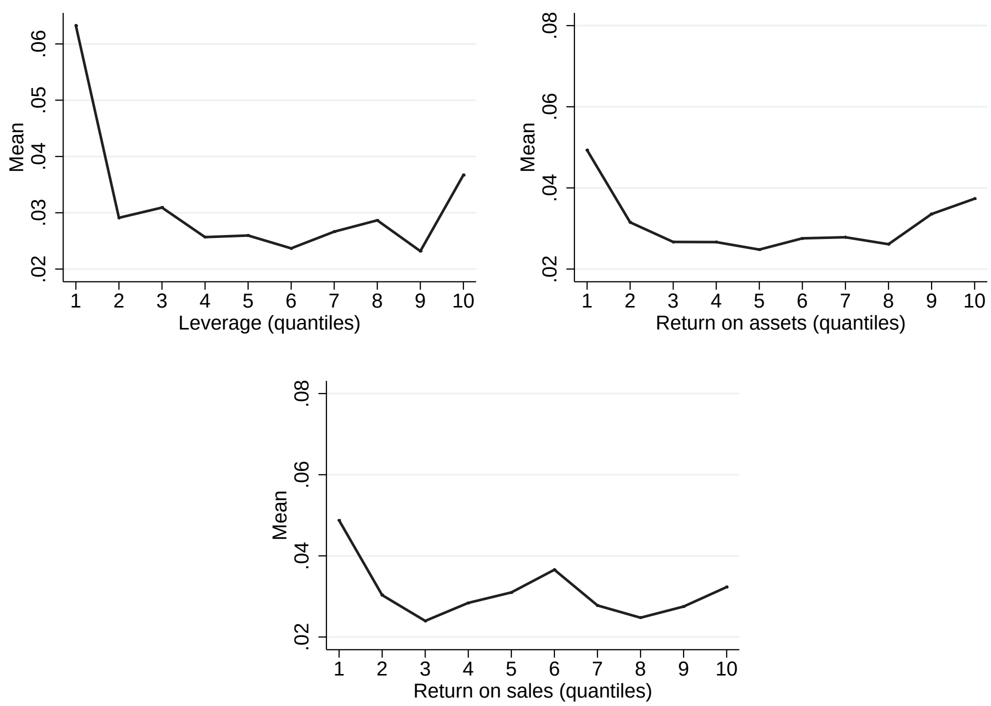


Figure 4.7: REIT: Cash holdings per quantile of exogenous variables.

Focusing on the graph on the upper left hand side of Figure 4.7, although the midsection is rather indistinguishable, the lowest decile as well as the highest display higher means

[31] `size` is already the natural logarithm of total assets and is not going to be analysed.

as the deciles in the middle. Further, the functional shape seems similar for return on assets. Therefore, I am going to apply four different alterations. At first, the variable totLEV is substituted by $\texttt{totLEV}^2$ and retAST by $\texttt{retAST}^2$. Due to the rather flat middle sections, I will conduct a second alteration in a separate regression. The linear terms are now substituted by terms with higher quadratic power, i. e. $\texttt{totLEV}^4$ and $\texttt{retAST}^4$. retSAL is not adjusted. As before, the new coefficients are displayed using the Greek letters γ and λ. The altered regressions look as follows:

$$\begin{aligned}\texttt{casHOL}_{i,t} =&\beta_1 \cdot \texttt{size}_{i,t} + \gamma_1 \cdot (\texttt{totLEV}_{i,t})^2 + \gamma_2 \cdot (\texttt{retAST}_{i,t})^2 + \beta_4 \cdot \texttt{retSAL}_{i,t} \\ &+\beta_5 \cdot \texttt{s2LB}_{i,t} + \beta_6 \cdot \texttt{s1RPP}_{i,t} + \beta_7 \cdot \texttt{s1RPP}{\times}\texttt{bcRR}_{i,t} + \texttt{cons}_{i,t} \qquad (4.2)\\ \texttt{casHOL}_{i,t} =&\beta_1 \cdot \texttt{size}_{i,t} + \lambda_1 \cdot (\texttt{totLEV}_{i,t})^4 + \lambda_2 \cdot (\texttt{retAST}_{i,t})^4 + \beta_4 \cdot \texttt{retSAL}_{i,t} \\ &+\beta_5 \cdot \texttt{s2LB}_{i,t} + \beta_6 \cdot \texttt{s1RPP}_{i,t} + \beta_7 \cdot \texttt{s1RPP}{\times}\texttt{bcRR}_{i,t} + \texttt{cons}_{i,t} \qquad (4.3)\end{aligned}$$

The estimations associate with these expressions can be found in the appendix on page 208. (33) is added to the table for a better comparison. Based on AIC/BIC, the initial model provides the best statistical fit, when comparing (33) to (51) and (52). The results for the company-specific exogenous variables are fairly robust. Further, even after a model alteration, the results seem to be unchanged for both signals. The coefficients are still statistically insignificant (*p-value* > 0.1). The same is true for the joint effect. For (51), the t-value is -1.68 with a coefficient of -0.093 and for (52), the t-value is -1.67 with a coefficient of -0.011.

4.3 Discussion

This chapter follows a similar logic as the previous one and deals with the effect of ensuing banking crises on the liquidity of regulated corporate-like entities. The main body of the empirical literature on corporate cash holdings explicitly exclude regulated industries such as financials and utilities. This study focusses on the effect of regulation as a form of financing constraints. Other than before, financing constraints are now dictated from a macro-level and mainly concern capital structure drivers. A firm that complies with these requirements is partially or fully exempt from income taxes. A violation, however, can lead to the loss of this tax benefit. Thus, my research contributes to the field of empirical capital structure by analysing the effect of different regulation prior and during times of crises. For this purpose, I slightly altered the theoretical framework from the previous chapter. This is also due to some restrictions of the prior study.[32] Information on regulation is gathered and translated into an ordinal scale of two or three items, which indicate the severity of a regulation. As a result, the analyses also differ in the severity of the constraint. Further, multiple crisis events are now reduced to a single point in time, i. e. the year Lehman Brothers filed for Chapter 11. As before, this is tested in an univariate and a multivariate setting.

Following my theoretical predictions made in *Case (1)*, a firm that faces tighter or more restrictive regulations should hold higher amounts of cash. This can only be tested in an univariate setting. The findings suggest that this relationship is only evident in isolated cases and is therefore not robust across all regulations. To be more specific, firms that face tighter restrictions on equity have higher average cash ratios compared to their less restricted counterparts. This could be due to the heterogeneity of the different regulations. Some of these affect cash holdings directly but others do not, such as in the case of income distribution vs. minimum share capital.

The prediction for *Case (2)* is as follows: *A signal that indicates that the realisation of future investments is more uncertain leads to an increase in precautionary cash holdings.* This is not restricted to a certain type of firm, but rather affects the liquidity management of every firm. However, hardly any of the tests provide support for this

[32]See Section 3.3 on page 95.

prediction. This is also true for the results from multivariate regressions. I identified three possible sources for insignificant results: First, the matching process of several different samples reduced the size of the subsample by a wide margin, and thus makes the application of the existing empirical strategy more difficult. However, I used the same strategy to compare the results of regulated and unregulated firms. Second, due to the business structure of REITs, liquidity cannot be generated as easily as compared to *ordinary* corporates, i. e. due to tighter regulations, less fungible assets, and long-term lease obligations (Lin and Vandell, 2007, Titman and Twite, 2013, Haslam et al., 2015, EPRA, 2017). Finally, a peak in real estate markets or residential property prices is not recognised by REITs as negative signals. The last argument is supported by investment trends in the real estate markets (JLL, 2017, Statista, 2017).

For *Case (3)*, more strictly regulated firms use existing internal resources to secure their going concerns, whereas less regulated firms maintain their level of liquidity due to a higher flexibility in securing external financing. The empirical results should indicate that firms from group h decrease their liquidity when observing *Signal 2*. Based on my theoretical predictions, I would have expected inconclusive results for l. Thus, less regulated firms might increase cash as a precautionary measure but also reduce excess cash to maintain going concern. The univariate results are predominantly inconclusive. The differences in means are only statistically significant for two out of three equity controls (`minSCA` and `lisMAN`) and only for a single group of firms (l). However, firms in less regulated regimes have lower average cash ratios when observing *Signal 2*, which is partially contrary to my theoretical predictions. A sensible explanation for these results can only be found for mandatory listing. Firms from group l can consist of private firms, which hold less cash than public firms but are more affected by a liquidity shortage due to restricted access to capital markets (Brav, 2009, Campello et al., 2010, Asker et al., 2011, Gao et al., 2013). *Case (3)* is also not evident in a multivariate setting when controlling for financing constraints.

Case (4) is a combination of the two preceding cases. In theory, all types of firms increase their cash holdings when observing the first signal, and firms with less flexibility are in need to use their existing liquidity to secure going concern. Tests concerning this case are restricted due to a sample size problem and are only feasible to a certain extent. For `s1REM` as *Signal 1* and without conducting a sample split, there is no statistical evidence. However, this is different for `s1RPP`. In virtually any combination of fixed effects, I find that regulated firms tend to decrease cash holdings when observing *Signal 2* if it is also preceded by *Signal 1*. The effect is still evident when controlling for financing constraints by splitting the main sample. Further, the size of the effect appears to be larger for smaller firms. Nonetheless, the interaction term does not seem to absorb the single effects of both signals. I would have expected that at least one of these coefficients is significantly different from zero. On the other hand and consistent with prior analyses, a reaction to a shock on property prices could be lagged due to the structure of a REIT and the empirical strategy. A single point in time might not cover e. g. the full liquidation a of property. Thus, the short-term effect might be negative and the long-term positive.

This study of regulated firms could be extended or improved by focusing on a single event, such as a banking crisis. Although this implies that possible effects of EWS are neglected, it would reduce the sample size problem partially and would also allow me to analyse REIT regimes with a shorter history. In addition, a single event might help to analyse time lagged changes in liquidity management, which help to incorporate the maturity structure of assets. Further, the choice of less heterogeneous regulation criteria could provide robust results. In addition, a wider definition of liquidity, such as the inclusion of lines of credit, could provide additional or different insights. For example, Hardin and Hill (2011) find that REITs rely more on credit lines as a precautionary measure during a financial crisis. Thus, an increase of liquidity during a banking crisis could be visible. Finally, it would be interesting to analyse the long-term effects of a banking crisis on REITs. So far, it is assumed that the observance of a signal and also the reaction of a REIT take place in the same year.

Chapter 5

Conclusion

The main part of this dissertation consists of three chapters. The first chapter provides a brief literature review in two sections. Section one discusses the theoretical and empirical literature on corporate cash holdings. Section two predominantly discusses the literature on EWS, banking crises and their consequences.

The second chapter focusses on cash holdings of unregulated listed firms from Europe and the US. I empirically analyse the effects of financing constraints on cash holdings before and during a banking crisis. To do so, I construct a theoretical framework in which financially constrained and financially unconstrained firms can observe signals in the form of an EWS and a banking crisis. Econometric tests are performed in an univariate (differences in means) and a multivariate (panel regressions) test setting. In the multivariate test setting, I control for effects that are not adequately covered by exogenous variables by including company fixed effects, industry fixed effects and country fixed effects.

The last chapter also presents another empirical study that uses a framework that is closely related to the former chapter. The analysed data consists of firms from a regulated industry (REIT). As before, I analyse the effect of financing constraints on cash holdings before and during times of crisis. The primary analysis is performed by testing for differences in means. Additional tests are performed using panel regressions and controlling for regulatory fixed effects such as mandatory listing or income taxation.

The results for regulated and unregulated firms are mostly inconclusive. I find no convincing evidence that the degree of regulation affects the level of cash holdings for regulated firms before and during a banking crisis. For unregulated firms, I find strong evidence that financially constrained firms have higher cash holdings than unconstrained firms. Further, there is no real evidence that either financially constrained firms or unconstrained firms increase their cash holdings when observing an EWS. In case of a banking crisis, the results differ for univariate tests and in panel regressions. In the univariate setting, I find evidence that both types of firms hold higher levels of cash during a banking crisis. In panel regressions, the effect is only evident for financially unconstrained firms from the US, and when controlling for financial stress, it is also apparent for financially constrained US firms. For firms from Europe, the results are predominantly inconclusive. For banking crises that are preceded by an EWS, there is only evidence for an increase in cash holdings for unconstrained US firms when controlling for financial stress.

Although the results above are mostly inconclusive, the study provides additional insights on corporate cash holdings and liquidity restrictions. The implications of the results are twofold. Firstly, access to external funding seems to affect only unregulated firms, which is in line with Almeida et al. (2004), Han and Qiu (2007), Acharya et al. (2007) among others. Thus, the severity of regulation does not seem to affect cash holdings. Secondly, the results suggest that unregulated US firms tend to increase corporate cash holdings during a crisis. This is in line with Drobetz et al. (2017).

The first part of the presented study has focused on unregulated firms from Europe and the US. Therefore, future work might extend the study by including regions that are affected by multiple crises, such as Latin America and Asia. In addition, a larger sample would allow a comparison of firms from emerging and industrialised countries.

The second part analyses firms from a single regulated industry. Regulations may affect a firm's liquidity directly or indirectly. Not every regulation might cause an immediate (or delayed) effect. Firms that are already affected by high mandatory payout ratios and a low leverage threshold can increase liquidity rather slowly over time. Further, the sample of regulated firms is considerably smaller than the sample of unregulated firms.

Through different sample matching processes, the sample of regulated firms declines further. By focussing on a single event instead of multiple EWS or banking crises, the number of observations would be higher. In short, further research should use a different identification strategy and might also study the lagged effect on corporate cash holdings.

Appendix A

Early Warning Systems, Banking Crises and Corporate Liquidity

A.1 Identification Strategy

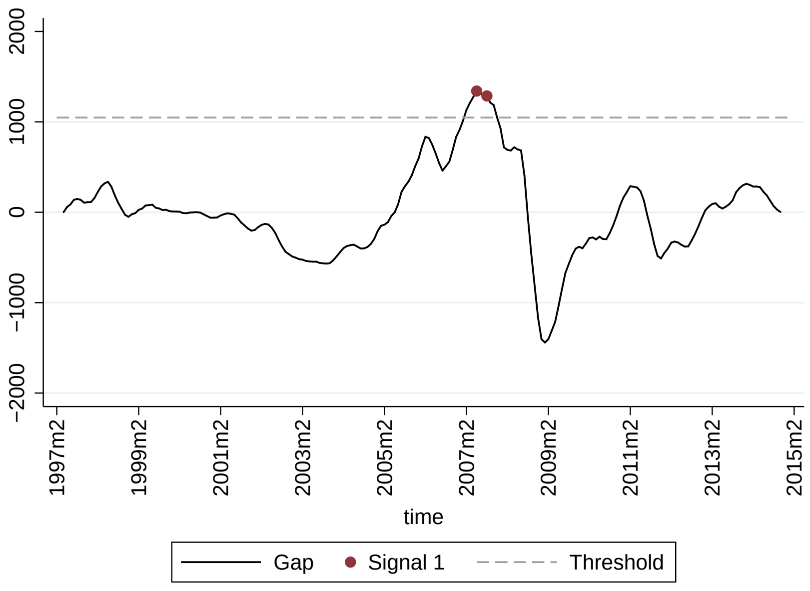


FIGURE A.1: Adapted from Datastream: Austria: ATX - monthly data.

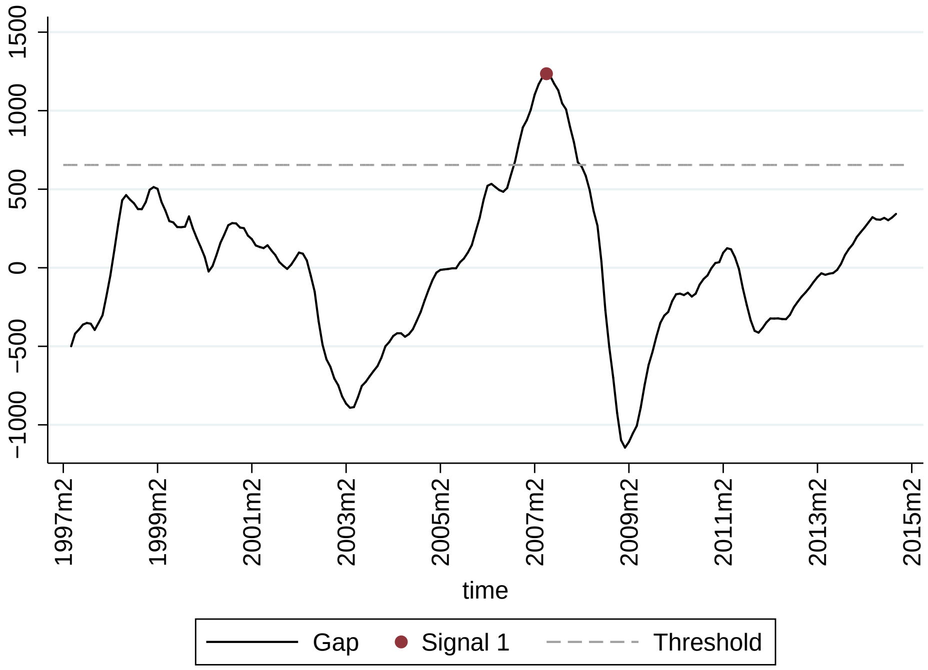


FIGURE A.2: Adapted from Datastream: Belgium: BEL20 - monthly data.

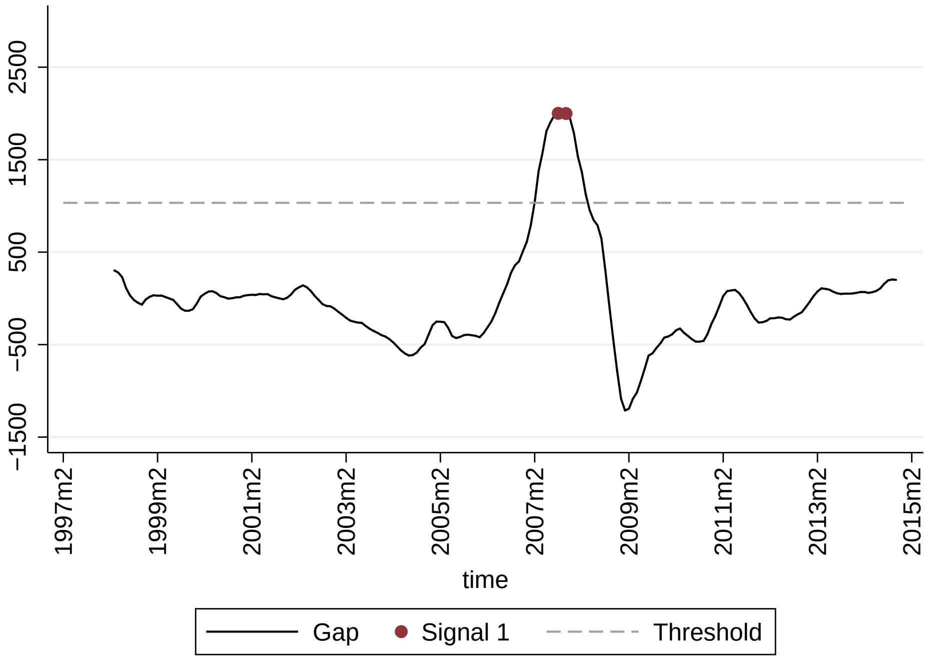


FIGURE A.3: Adapted from Datastream: Croatia: CROBEX - monthly data.

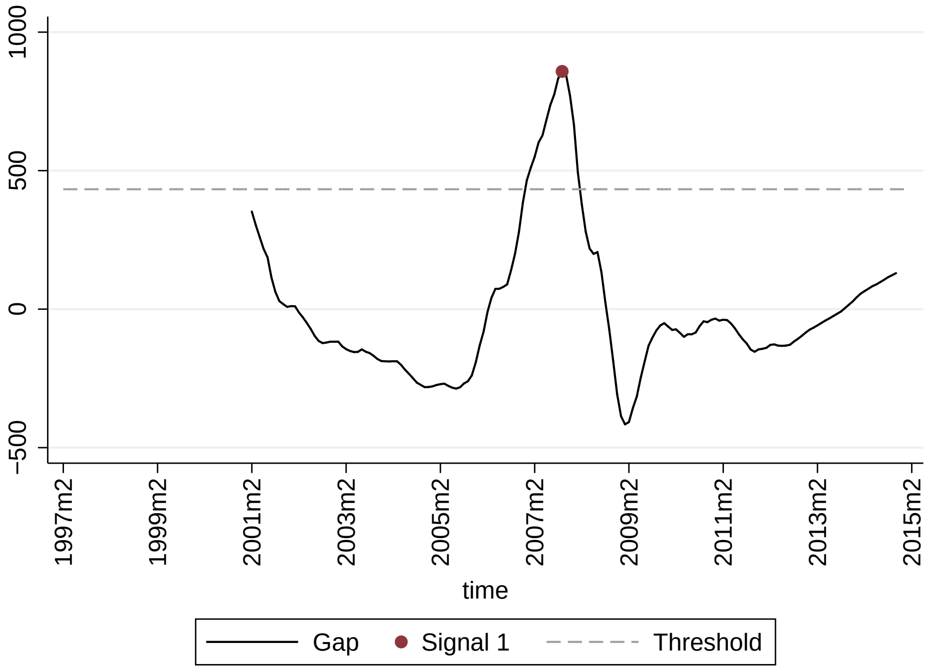


FIGURE A.4: Adapted from Datastream: Cyprus: CYFT - monthly data.

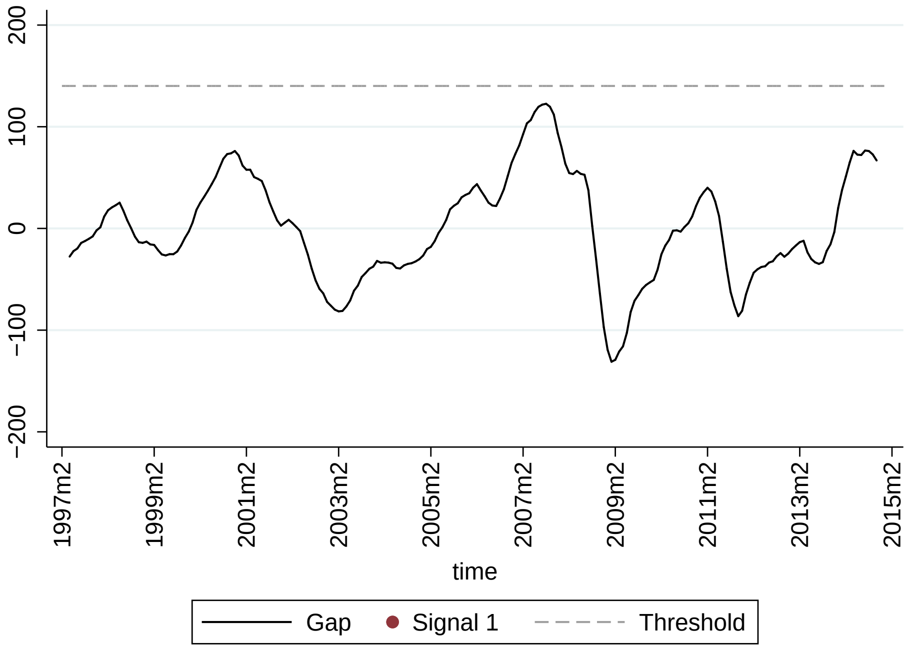


FIGURE A.5: Adapted from Datastream: Denmark: OMXC20 - monthly data.

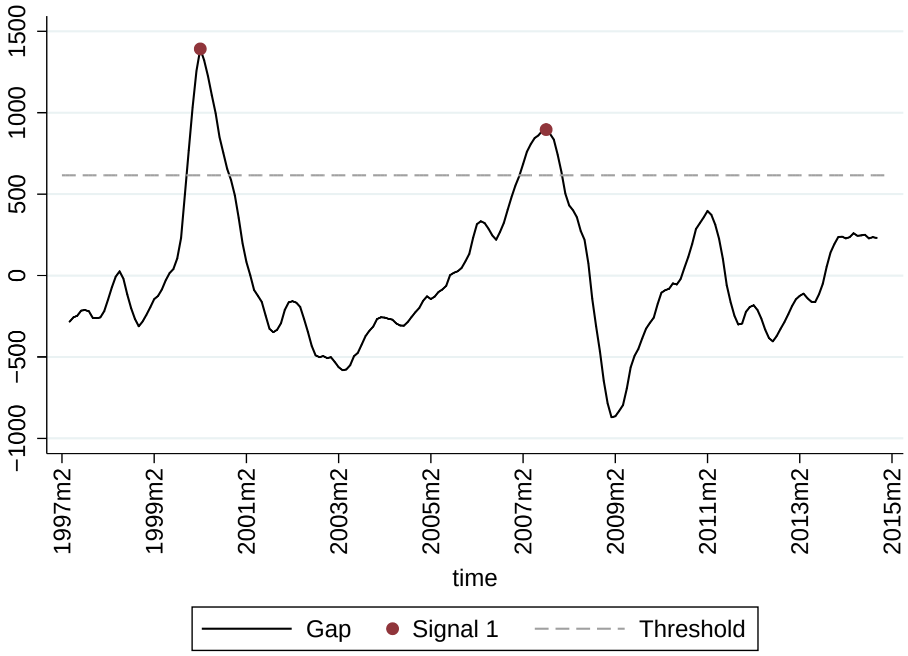


FIGURE A.6: Adapted from Datastream: Finland: OMXH25 - monthly data.

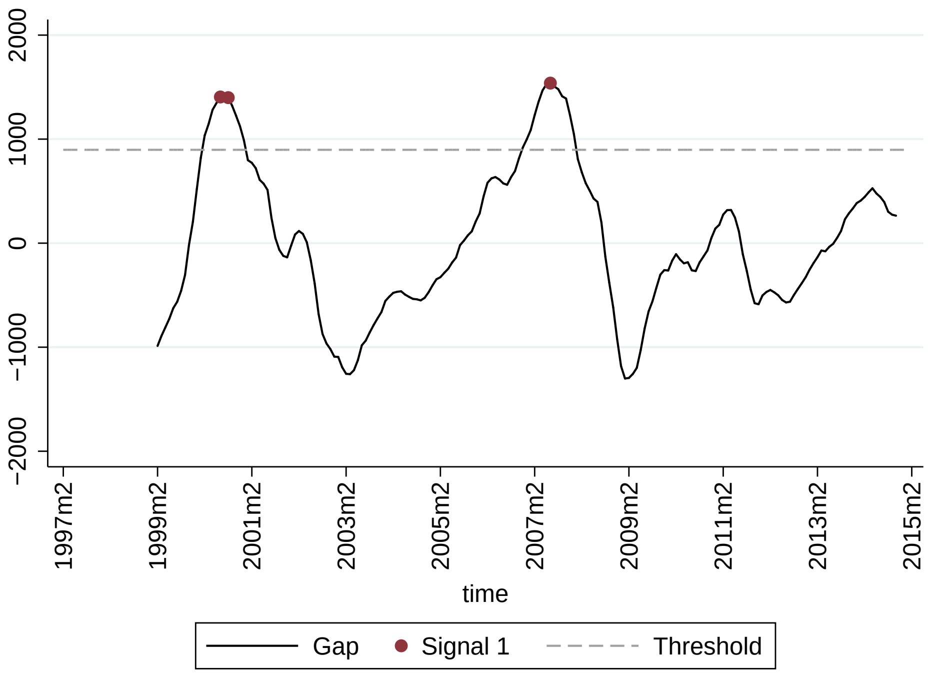


FIGURE A.7: Adapted from Datastream: France: CAC40 - monthly data.

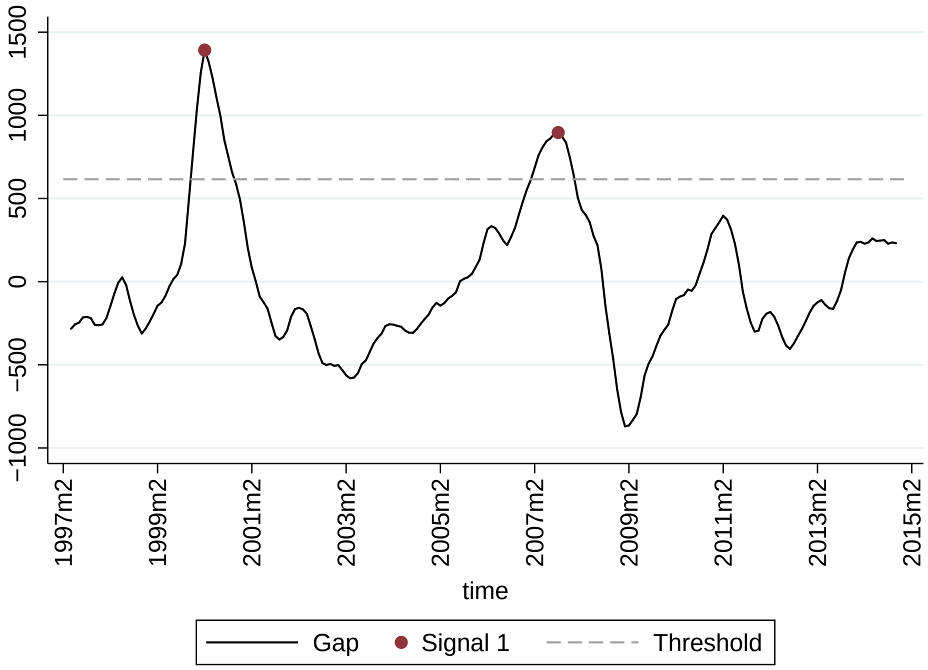


FIGURE A.8: Adapted from Datastream: Germany: DAX - monthly data.

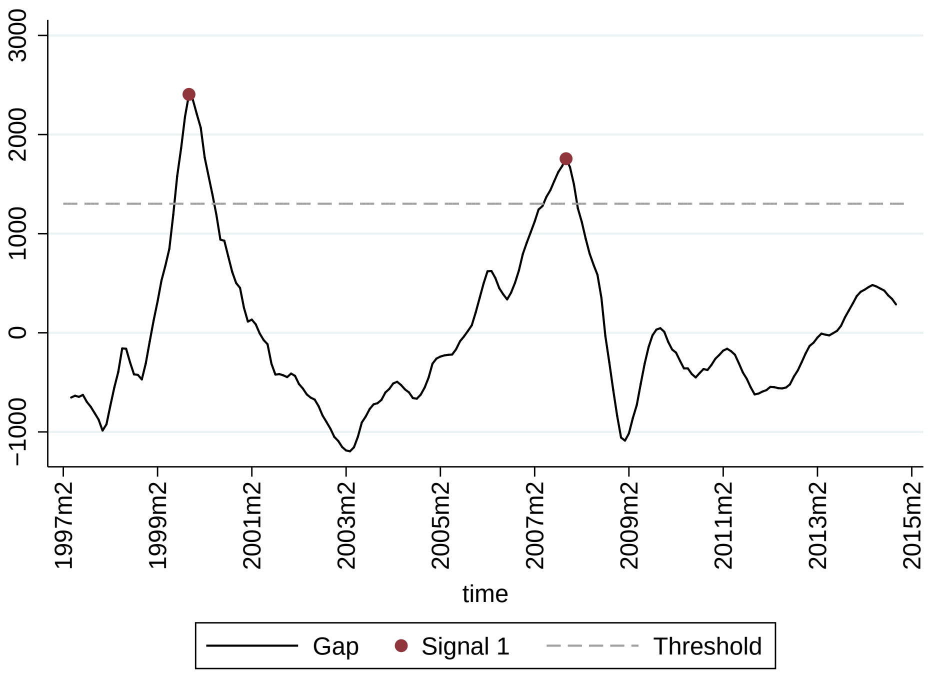


FIGURE A.9: Adapted from Datastream: Greece: ATHEX - monthly data.

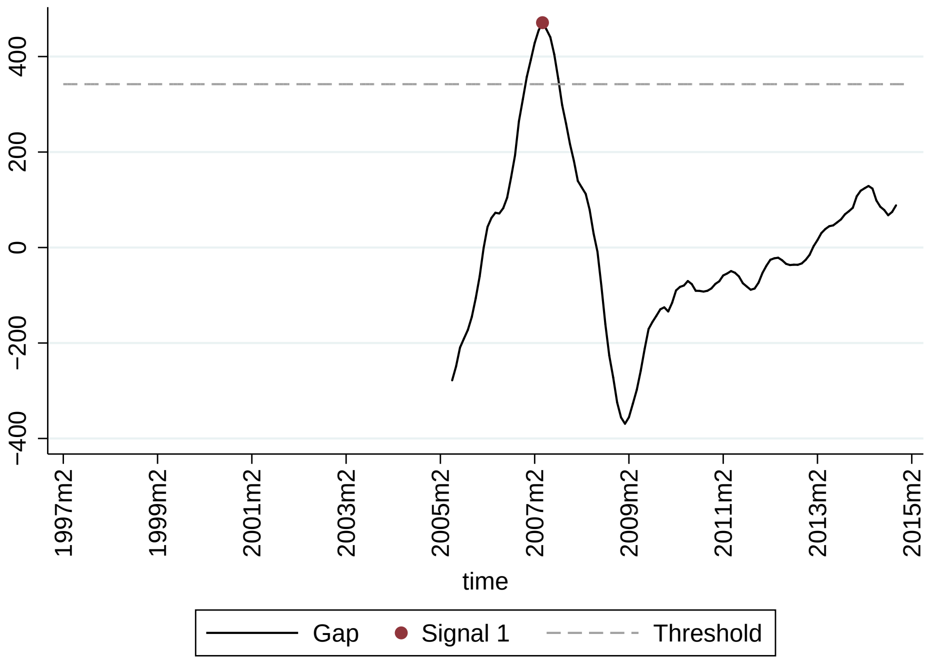


Figure A.10: Adapted from Datastream: Ireland: ISEQ20 - monthly data.

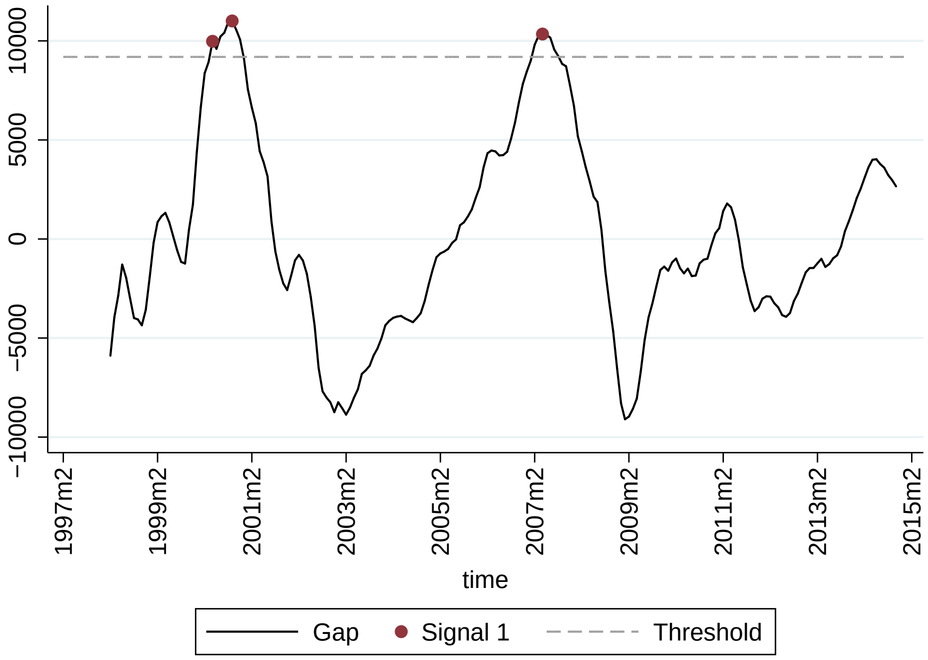


Figure A.11: Adapted from Datastream: Italy: FTSE MIB - monthly data.

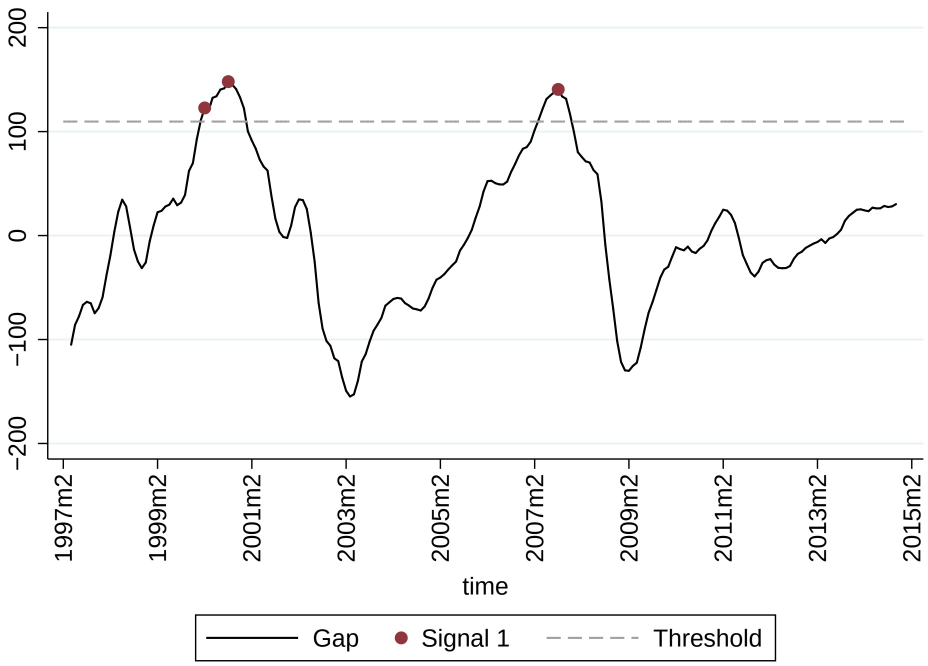


FIGURE A.12: Adapted from Datastream: Netherlands: AEX - monthly data.

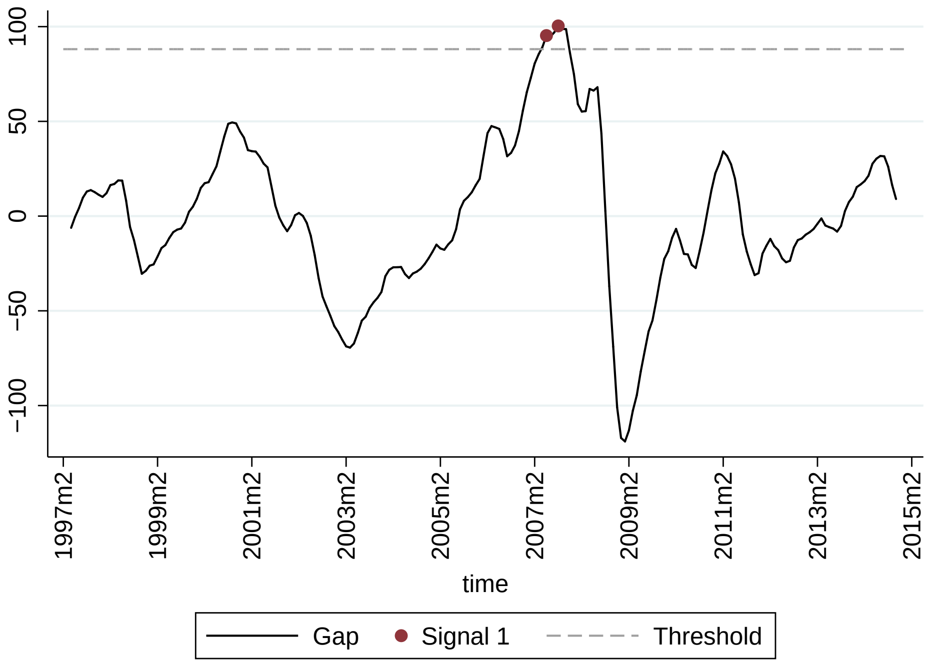


FIGURE A.13: Adapted from Datastream: Norway: OBX - monthly data.

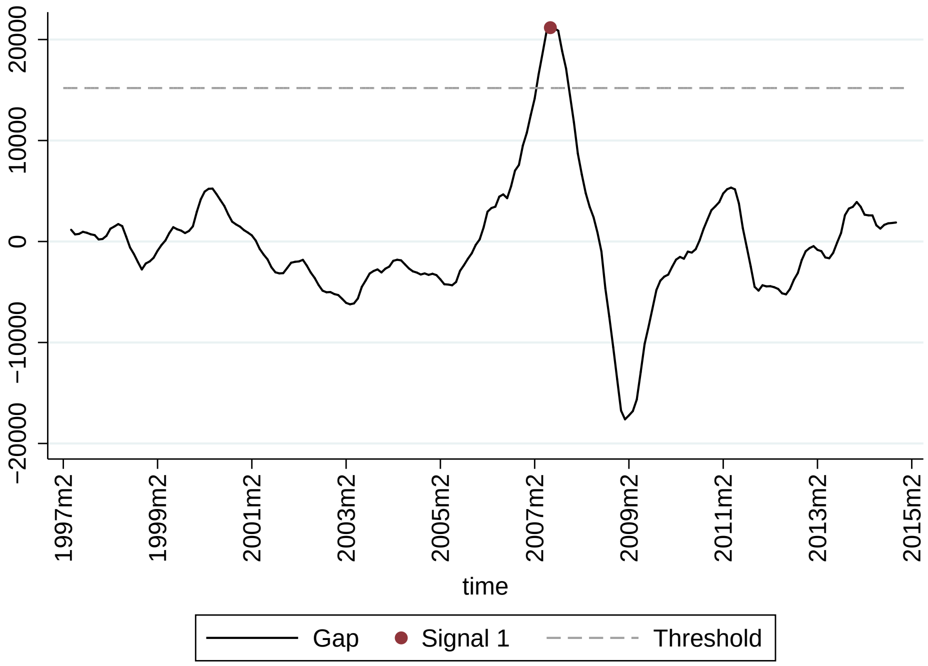


FIGURE A.14: Adapted from Datastream: Poland: WIG - monthly data.

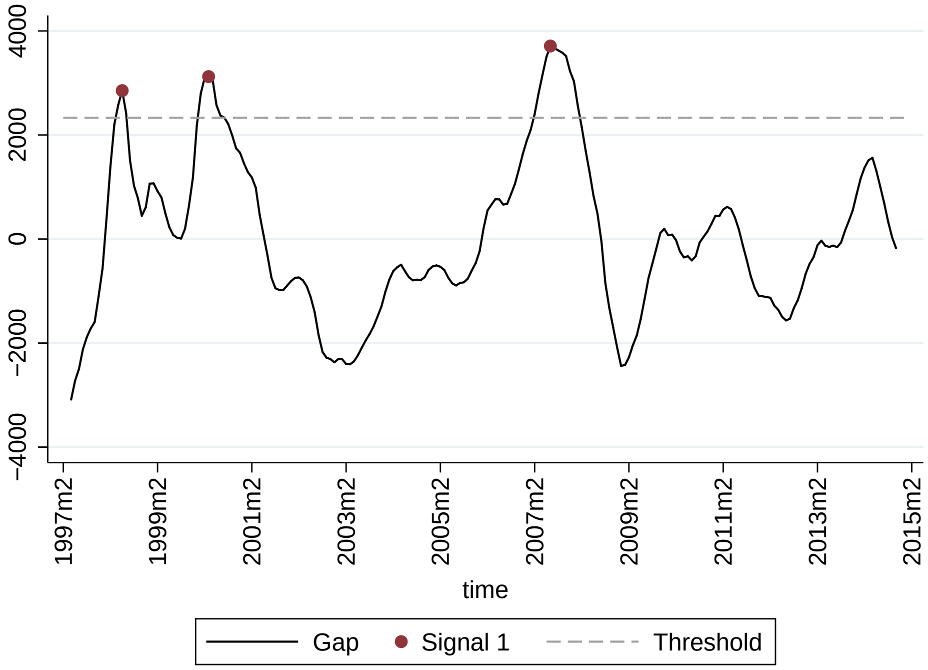


FIGURE A.15: Adapted from Datastream: Portugal: PSI20 - monthly data.

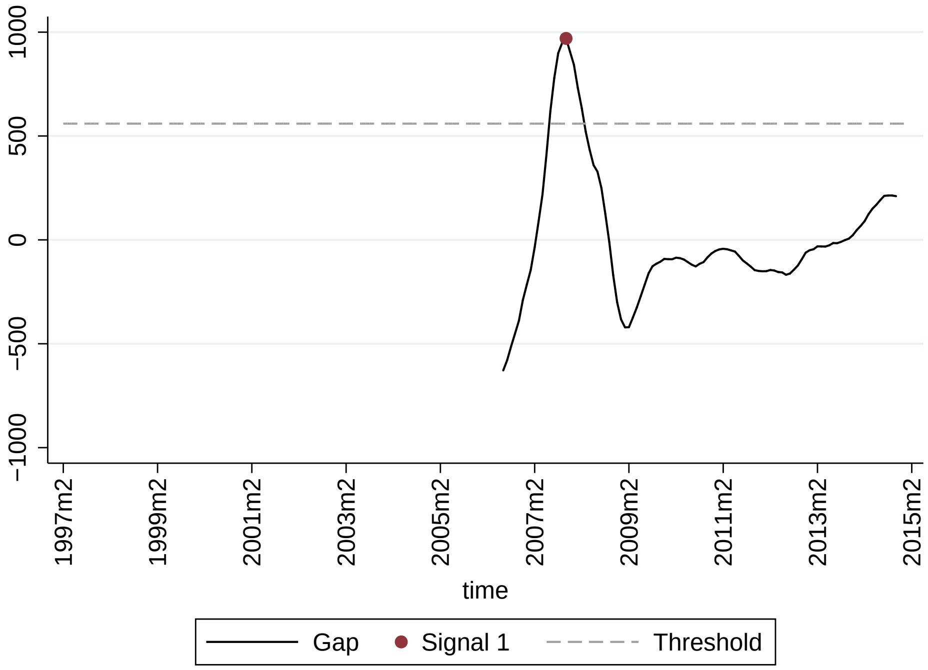


Figure A.16: Adapted from Datastream: Slovenia: SBI TOP - monthly data.

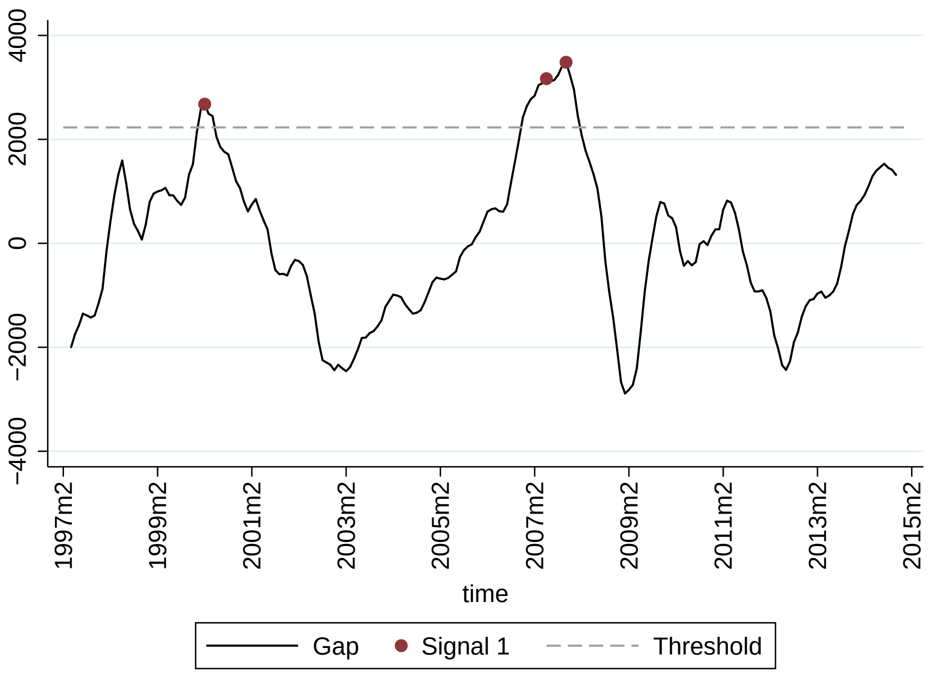


Figure A.17: Adapted from Datastream: Spain: IBEX35 - monthly data.

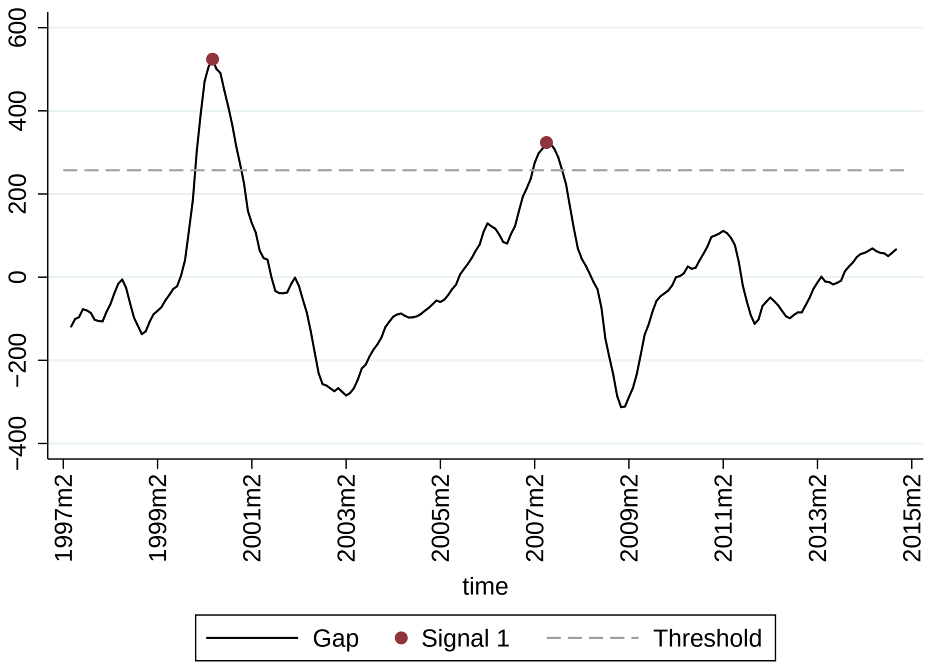


FIGURE A.18: Adapted from Datastream: Sweden: OMXS30 - monthly data.

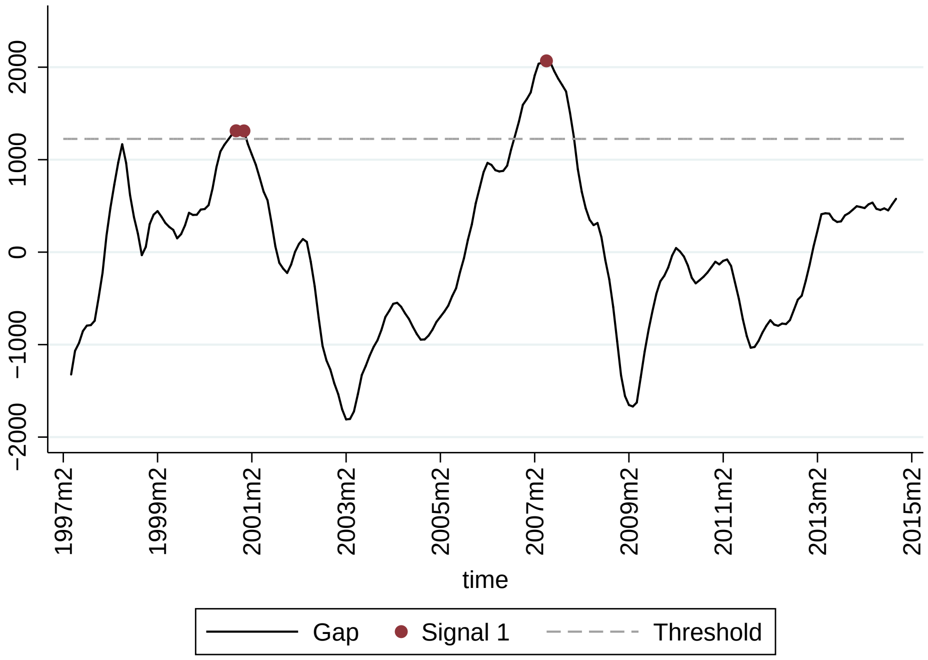


FIGURE A.19: Adapted from Datastream: Switzerland: SMI - monthly data.

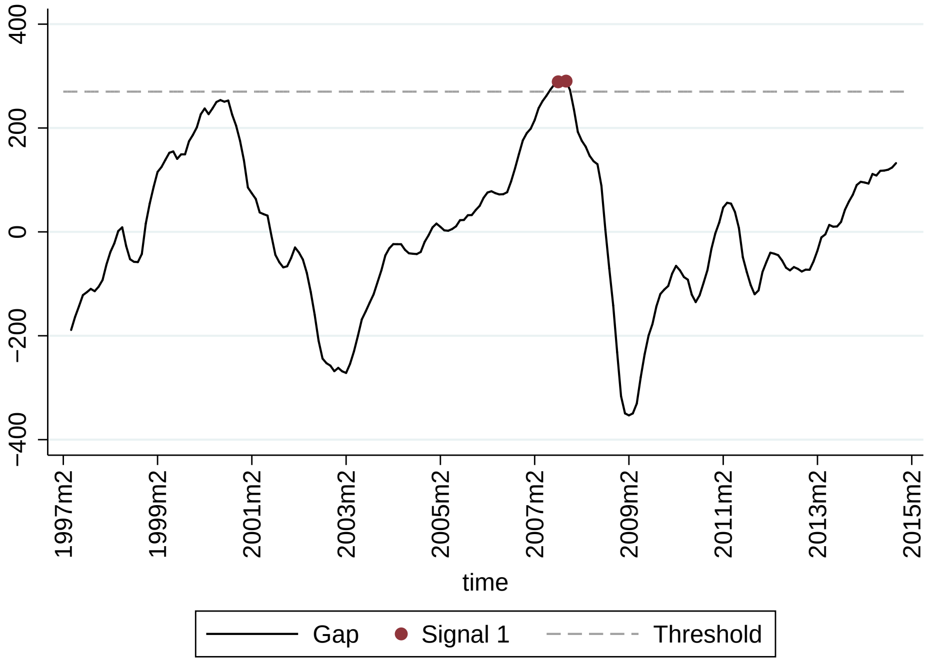


FIGURE A.20: Adapted from Datastream: United States of America: S&P 500 - monthly data.

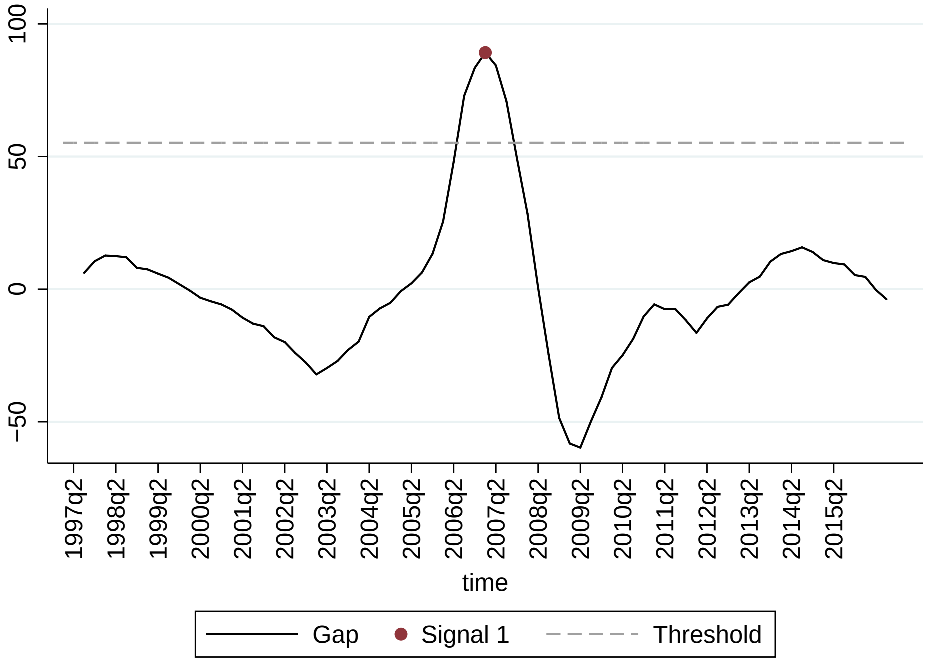


FIGURE A.21: Adapted from Datastream: Europe: MSCI EU - quarterly data.

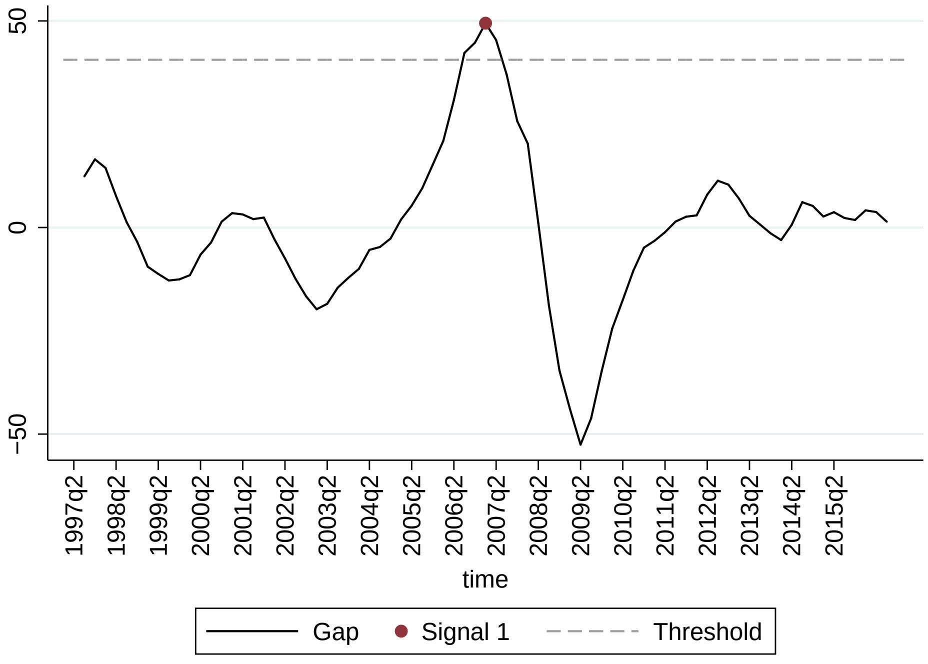


FIGURE A.22: Adapted from Datastream: North America: MSCI US - quarterly data.

A.2 Results

Table A.1: Case (1): US (ratings and dividend payments).

Variable ↓		fcLTR		fcSTR		fcDIV	
	Group →	*u*	*c*	*u*	*c*	*u*	*c*
	Signal 1 →	NO	NO	NO	NO	NO	NO
	Signal 2 →	NO	NO	NO	NO	NO	NO
casHOL	Mean	0.092	0.216	0.081	0.189	0.111	0.220
	Diff.	-0.124***		-0.108***		-0.109***	
	t-value	-74.90		-58.38		-56.280	
	Median	0.057	0.142	0.052	0.112	0.066	0.141
	N	10,988	26,437	3,254	34,171	11,512	22,040
netWOC	Mean	0.054	0.090	0.034	0.084	0.065	0.075
	Diff.	-0.036***		-0.050***		-0.010***	
	t-value	-21.65		-23.26		-5.523	
	Median	0.040	0.080	0.022	0.071	0.049	0.063
	N	10,368	26,012	3,064	33,316	10,993	21,646
capETA	Mean	0.060	0.052	0.056	0.054	0.059	0.053
	Diff.	0.008***		0.002**		0.006***	
	t-value	10.64		2.50		8.380	
	Median	0.040	0.031	0.044	0.033	0.040	0.030
	N	10,926	26,437	3,238	33,963	11,407	21,941
totLEV	Mean	0.611	0.414	0.599	0.459	0.541	0.442
	Diff.	0.197***		0.140***		0.099***	
	t-value	98.00		48.52		42.397	
	Median	0.606	0.394	0.597	0.455	0.554	0.430
	N	10,988	26,437	3,256	33,171	11,512	22,040

Remark: Groups are assigned by the criteria mentioned on page 52. For every criterion separately, Diff. $= \text{Mean}_u - \text{Mean}_c \neq 0$ is tested using a two-sample t-test with unequal variances (Welch, 1947).
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table A.2: Case (2): Europe (size and stock market).

Variable ↓	Group → / *Signal 1* → / *Signal 2* →	*u*: NO / NO	*u*: YES / NO	*c*: NO / NO	*c*: YES / NO
casHOL	Mean	0.077	0.075	0.126	0.133
	Diff.	0.002		-0.007*	
	t-value	0.80		-1.68	
	Median	0.053	0.047	0.063	0.069
	N	11,019	1,702	11,314	1,519
netWOC	Mean	0.036	0.045	0.099	0.121
	Diff.	-0.009**		-0.022***	
	t-value	-2.31		-3.74	
	Median	0.027	0.038	0.093	0.111
	N	10,966	1,695	11,200	1,504
capETA	Mean	0.054	0.063	0.045	0.053
	Diff.	-0.009***		-0.008***	
	t-value	-6.22		-4.45	
	Median	0.042	0.049	0.024	0.033
	N	10,097	1,556	8,787	1,183
totLEV	Mean	0.614	0.616	0.475	0.467
	Diff.	-0.002		0.007	
	t-value	-0.53		1.24	
	Median	0.626	0.631	0.471	0.463
	N	11,019	1,702	11,314	1,519

Remark: Groups are assigned by using the top/bottom three deciles of `totAST`. `s1STM` is used as *Signal 1*. Note, Diff. = $\text{Mean}_{\text{Not obs.}} - \text{Mean}_{\text{Obs.}} \neq 0$ within group u and c is tested using a two-sample t-test with unequal variances (Welch, 1947).
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table A.3: Case (2): US (size and stock market).

Variable ↓	Group → / *Signal 1* → / *Signal 2* →	*u*: NO / NO	*u*: YES / NO	*c*: NO / NO	*c*: YES / NO
casHOL	Mean	0.104	0.105	0.259	0.274
	Diff.	-0.001		-0.015	
	t-value	-0.18		-1.64	
	Median	0.065	0.065	0.183	0.201
	N	10,527	701	10,505	723
netWOC	Mean	0.040	0.036	0.096	0.087
	Diff.	0.004		0.009	
	t-value	0.89		1.09	
	Median	0.030	0.024	0.085	0.071
	N	9,932	666	10,435	720
capETA	Mean	0.058	0.063	0.044	0.047
	Diff.	-0.005*		-0.003	
	t-value	-1.86		-1.24	
	Median	0.039	0.040	0.023	0.022
	N	10,457	698	10,443	722
totLEV	Mean	0.581	0.567	0.385	0.372
	Diff.	-0.014**		0.013	
	t-value	2.04		1.52	
	Median	0.586	0.572	0.348	0.333
	N	10,527	701	10,505	723

Remark: Groups are assigned by using the top/bottom three deciles of `totAST`. `s1STM` is used as *Signal 1*. Note, Diff. = $\text{Mean}_{\text{Not obs.}} - \text{Mean}_{\text{Obs.}} \neq 0$ within group u and c is tested using a two-sample t-test with unequal variances (Welch, 1947). Note, for the US, `s1STM` and `s1REM` mark the same years.
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

TABLE A.4: Case (2): Europe (size and real estate market).

Variable	Group →	u		c	
	Signal 1 →	NO	YES	NO	YES
↓	*Signal 2* →	NO	NO	NO	NO
casHOL	Mean	0.076	0.081	0.125	0.136
	Diff.	-0.005*		-0.011**	
	t-value	-1.89		-2.14	
	Median	0.051	0.053	0.062	0.071
	N	12,108	1,009	12,114	1,003
netWOC	Mean	0.038	0.035	0.103	0.096
	Diff.	0.003		0.007	
	t-value	0.54		1.01	
	Median	0.029	0.027	0.097	0.090
	N	12,051	1,004	11,991	995
capETA	Mean	0.055	0.062	0.046	0.049
	Diff.	-0.007***		-0.003	
	t-value	-3.84		-1.18	
	Median	0.043	0.047	0.025	0.029
	N	11,013	969	9,254	870
totLEV	Mean	0.615	0.604	0.474	0.466
	Diff.	0.011**		0.008	
	t-value	2.10		1.08	
	Median	0.628	0.622	0.470	0.461
	N	12,108	1,009	12,114	1,002

Remark: Groups are assigned by using the top/bottom three deciles of `totAST`. `s1REM` is used as *Signal 1*. Note, Diff. = $\text{Mean}_{\text{Not obs.}} - \text{Mean}_{\text{Obs.}} \neq 0$ within group u and c is tested using a two-sample t-test with unequal variances (Welch, 1947).
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

TABLE A.5: Case (2): US (dividend payments and stock market).

Variable	Group →	u		c	
	Signal 1 →	NO	YES	NO	YES
↓	*Signal 2* →	NO	NO	NO	NO
casHOL	Mean	0.112	0.107	0.218	0.238
	Diff.	0.005		-0.020***	
	t-value	0.93		-3.11	
	Median	0.066	0.060	0.140	0.163
	N	10,804	708	20,662	1,378
netWOC	Mean	0.065	0.061	0.076	0.064
	Diff.	0.004		0.012**	
	t-value	0.84		2.43	
	Median	0.049	0.041	0.064	0.057
	N	10,318	675	20,290	1,356
capETA	Mean	0.058	0.064	0.053	0.055
	Diff.	-0.006**		-0.002	
	t-value	-2.48		-1.13	
	Median	0.040	0.042	0.030	0.030
	N	10,705	702	20,563	1,378
totLEV	Mean	0.541	0.535	0.443	0.429
	Diff.	0.006		0.014**	
	t-value	0.89		2.26	
	Median	0.555	0.547	0.431	0.416
	N	10,804	708	20,662	1,378

Remark: Groups are assigned by using the top/bottom three deciles of `divPCA`. `s1STM` is used as *Signal 1*. Note, Diff. = $\text{Mean}_{\text{Not obs.}} - \text{Mean}_{\text{Obs.}} \neq 0$ within group u and c is tested using a two-sample t-test with unequal variances (Welch, 1947). Note, for the US, `s1STM` and `s1REM` mark the same years.
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

TABLE A.6: Case (2): US (bond rating and stock market).

Variable	Group →	u		c	
↓	*Signal 1* →	NO	YES	NO	YES
	Signal 2 →	NO	NO	NO	NO
`casHOL`	Mean	0.092	0.089	0.215	0.230
	Diff.	0.003		-0.015***	
	t-value	0.71		-2.64	
	Median	0.057	0.056	0.141	0.155
	N	10,346	642	24,755	1,682
`netWOC`	Mean	0.055	0.045	0.091	0.081
	Diff.	0.010*		0.010**	
	t-value	1.83		2.09	
	Median	0.041	0.032	0.080	0.072
	N	9,762	606	24,354	1,658
`capETA`	Mean	0.060	0.063	0.052	0.056
	Diff.	-0.003		-0.003**	
	t-value	-1.22		-2.17	
	Median	0.040	0.040	0.031	0.031
	N	10,286	640	24,597	1,678
`totLEV`	Mean	0.612	0.599	0.414	0.407
	Diff.	0.013*		0.006	
	t-value	1.93		1.19	
	Median	0.607	0.590	0.395	0.391
	N	10,346	642	24,755	1,682

Remark: Groups are assigned by existence or absence of a long-term rating. `s1STM` is used as *Signal 1*. Note, Diff. = $\text{Mean}_{\text{Not obs.}} - \text{Mean}_{\text{Obs.}} \neq 0$ within group u and c is tested using a two-sample t-test with unequal variances (Welch, 1947).
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

TABLE A.7: Case (2): US (commercial paper rating and stock market).

Variable	Group →	u		c	
↓	*Signal 1* →	NO	YES	NO	YES
	Signal 2 →	NO	NO	NO	NO
`casHOL`	Mean	0.081	0.078	0.188	0.201
	Diff.	0.003		-0.013***	
	t-value	0.55		-2.62	
	Median	0.052	0.053	0.111	0.119
	N	3,072	181	32,028	2,143
`netWOC`	Mean	0.036	0.015	0.085	0.076
	Diff.	0.021**		0.009**	
	t-value	2.40		2.39	
	Median	0.023	0.007	0.071	0.066
	N	2,893	171	31,223	2,093
`capETA`	Mean	0.056	0.058	0.054	0.058
	Diff.	-0.001		-0.004**	
	t-value	-0.30		-2.39	
	Median	0.044	0.045	0.033	0.033
	N	3,073	181	31,826	2,137
`totLEV`	Mean	0.600	0.590	0.460	0.449
	Diff.	0.010		0.011**	
	t-value	0.87		2.14	
	Median	0.598	0.579	0.456	0.440
	N	3,073	181	32,028	2,143

Remark: Groups are assigned by existence or absence of a short-term rating. `s1STM` is used as *Signal 1*. Note, Diff. = $\text{Mean}_{\text{Not obs.}} - \text{Mean}_{\text{Obs.}} \neq 0$ within group u and c is tested using a two-sample t-test with unequal variances (Welch, 1947). Note, for the US, `s1STM` and `s1REM` mark the same years.
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

TABLE A.8: Case (3): Europe (size and RR).

Variable	Group →	*u*		*c*	
↓	*Signal 1* →	NO	NO	NO	NO
	Signal 2 →	NO	YES	NO	YES
`casHOL`	Mean	0.075	0.088	0.128	0.136
	Diff.	-0.013***		-0.007*	
	t-value	-6.48		-1.78	
	Median	0.050	0.062	0.066	0.075
	N	10,945	2,085	10,770	1,581
`netWOC`	Mean	0.043	0.013	0.109	0.085
	Diff.	0.030***		0.024***	
	t-value	8.02		4.10	
	Median	0.034	0.009	0.103	0.077
	N	10,890	2,078	10,662	1,557
`capETA`	Mean	0.056	0.050	0.048	0.037
	Diff.	0.006***		0.010***	
	t-value	-5.72		6.79	
	Median	0.044	0.037	0.026	0.020
	N	9,850	2,046	8,134	1,279
`totLEV`	Mean	0.615	0.618	0.474	0.491
	Diff.	-0.003		-0.017***	
	t-value	-0.89		-2.92	
	Median	0.627	0.628	0.471	0.488
	N	10,944	2,085	10,768	1,581

Remark: Groups are assigned by using the top/bottom three deciles of `totAST`. `bcRR` is used as *Signal 2*. Note, Diff. = $\text{Mean}_{\text{Not obs.}} - \text{Mean}_{\text{Obs.}} \neq 0$ within group u and c is tested using a two-sample t-test with unequal variances (Welch, 1947).
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

TABLE A.9: Case (3): US (size and RR).

Variable	Group →	*u*		*c*	
↓	*Signal 1* →	NO	NO	NO	NO
	Signal 2 →	NO	YES	NO	YES
`casHOL`	Mean	0.103	0.112	0.255	0.276
	Diff.	-0.009***		-0.021***	
	t-value	-3.47		-3.98	
	Median	0.062	0.074	0.173	0.211
	N	8,073	2,853	8,122	2,882
`netWOC`	Mean	0.040	0.037	0.098	0.081
	Diff.	0.004		0.017***	
	t-value	1.39		3.61	
	Median	0.029	0.027	0.087	0.072
	N	7,594	2,731	8,061	2,872
`capETA`	Mean	0.059	0.057	0.044	0.040
	Diff.	0.002		0.004***	
	t-value	1.48		3.45	
	Median	0.040	0.036	0.024	0.019
	N	8,014	2,843	8,067	2,877
`totLEV`	Mean	0.582	0.573	0.385	0.382
	Diff.	0.009**		0.003	
	t-value	2.26		0.54	
	Median	0.586	0.577	0.348	0.342
	N	8,073	2,853	8,122	2,882

Remark: Groups are assigned by using the top/bottom three deciles of `totAST`. `bcRR` is used as *Signal 2*. Note, Diff. = $\text{Mean}_{\text{Not obs.}} - \text{Mean}_{\text{Obs.}} \neq 0$ within group u and c is tested using a two-sample t-test with unequal variances (Welch, 1947).
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

TABLE A.10: Case (3): US (dividend payments and stock market).

Variable ↓	Group → / *Signal 1* → / *Signal 2* →	*u* NO / NO	*u* NO / YES	*c* NO / NO	*c* NO / YES
casHOL	Mean	0.110	0.119	0.217	0.230
	Diff.	-0.009***		-0.013***	
	t-value	-3.28		-3.53	
	Median	0.064	0.077	0.136	0.161
	N	8,324	2,821	15,866	5,744
netWOC	Mean	0.066	0.060	0.077	0.064
	Diff.	0.006**		0.013***	
	t-value	1.98		4.95	
	Median	0.049	0.044	0.065	0.055
	N	7,930	2,723	15,569	5,658
capETA	Mean	0.058	0.058	0.054	0.049
	Diff.	0.000		0.005***	
	t-value	0.25		4.96	
	Median	0.040	0.038	0.031	0.026
	N	8,244	2,804	15,775	5,741
totLEV	Mean	0.542	0.534	0.443	0.439
	Diff.	0.008*		0.004	
	t-value	1.95		1.29	
	Median	0.557	0.547	0.432	0.425
	N	8,324	2,821	15,866	5,744

Remark: Groups are assigned by using the top/bottom three deciles of divPCA. bcRR is used as *Signal 2*. Note, Diff. = $\text{Mean}_{\text{Not obs.}} - \text{Mean}_{\text{Obs.}} \neq 0$ within group u and c is tested using a two-sample t-test with unequal variances (Welch, 1947).
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

TABLE A.11: Case (3): US (bond paper rating and stock market).

Variable ↓	Group → / *Signal 1* → / *Signal 2* →	*u* NO / NO	*u* NO / YES	*c* NO / NO	*c* NO / YES
casHOL	Mean	0.091	0.098	0.214	0.225
	Diff.	-0.007***		-0.011***	
	t-value	-3.08		-3.66	
	Median	0.055	0.067	0.138	0.160
	N	8,066	2,584	18,980	6,869
netWOC	Mean	0.054	0.051	0.093	0.077
	Diff.	0.004		0.016***	
	t-value	1.46		6.06	
	Median	0.040	0.038	0.082	0.069
	N	7,597	2,463	18,657	6,787
capETA	Mean	0.060	0.056	0.053	0.049
	Diff.	0.004***		0.003***	
	t-value	3.04		3.88	
	Median	0.041	0.036	0.032	0.027
	N	8,015	2,579	18,841	6,854
totLEV	Mean	0.612	0.607	0.413	0.413
	Diff.	0.005		-0.000	
	t-value	1.31		-0.21	
	Median	0.607	0.599	0.394	0.392
	N	8,066	2,584	18,980	6,869

Remark: Groups are assigned by existence or absence of a long-term rating. bcRR is used as *Signal 2*. Note, Diff. = $\text{Mean}_{\text{Not obs.}} - \text{Mean}_{\text{Obs.}} \neq 0$ within group u and c is tested using a two-sample t-test with unequal variances (Welch, 1947).
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

TABLE A.12: Case (3): US (commercial paper rating and stock market).

Variable ↓	Group → / *Signal 1* → / *Signal 2* →	u: NO / NO	u: NO / YES	c: NO / NO	c: NO / YES
casHOL	Mean	0.080	0.090	0.187	0.198
	Diff.	-0.010***		-0.011***	
	t-value	-2.81		-4.39	
	Median	0.051	0.067	0.108	0.127
	N	2,436	673	24,610	8,780
netWOC	Mean	0.036	0.027	0.086	0.073
	Diff.	0.009**		0.013***	
	t-value	2.00		5.98	
	Median	0.022	0.020	0.073	0.063
	N	2,292	639	23,962	8,611
capETA	Mean	0.056	0.053	0.055	0.051
	Diff.	0.003**		0.004***	
	t-value	1.99		4.79	
	Median	0.043	0.040	0.033	0.029
	N	2,422	673	24,434	8,760
totLEV	Mean	0.602	0.590	0.459	0.457
	Diff.	0.012*		0.002	
	t-value	1.74		0.90	
	Median	0.600	0.585	0.456	0.447
	N	2,436	673	24,610	8,780

Remark: Groups are assigned by existence or absence of a short-term rating. bcRR is used as *Signal 2*. Note, Diff. = $\text{Mean}_{\text{Not obs.}} - \text{Mean}_{\text{Obs.}} \neq 0$ within group u and c is tested using a two-sample t-test with unequal variances (Welch, 1947).
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

TABLE A.13: Case (4): US (size, stock estate market and RR).

Variable ↓	Group → / *Signal 1* → / *Signal 2* →	u: NO / NO	u: YES / YES	c: NO / NO	c: YES / YES
casHOL	Mean	0.104	0.108	0.259	0.262
	Diff.	-0.005		-0.003	
	t-value	-1.50		-0.45	
	Median	0.064	0.073	0.181	0.201
	N	9,878	1,350	9,981	1,247
netWOC	Mean	0.040	0.041	0.095	0.095
	Diff.	-0.001		-0.000	
	t-value	-0.31		-0.05	
	Median	0.029	0.030	0.082	0.091
	N	9,308	1,290	9,914	1,241
capETA	Mean	0.059	0.058	0.044	0.039
	Diff.	0.000		0.005***	
	t-value	0.25		3.16	
	Median	0.039	0.038	0.023	0.020
	N	9,807	1,348	9,921	1,244
totLEV	Mean	0.580	0.580	0.384	0.383
	Diff.	0.000		0.001	
	t-value	0.02		0.15	
	Median	0.585	0.582	0.347	0.343
	N	9,878	1,350	9,981	1,247

Remark: Groups are assigned by using the top/bottom three deciles of totAST. s1REM is used as *Signal 1*. Note, Diff. = $\text{Mean}_{\text{Not obs.}} - \text{Mean}_{\text{Obs.}} \neq 0$ within group u and c is tested using a two-sample t-test with unequal variances (Welch, 1947).
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

TABLE A.14: Case (4): US (dividend payments, stock estate market and RR).

Variable ↓	Group → / *Signal 1* → / *Signal 2* →	u: NO / NO	u: YES / YES	c: NO / NO	c: YES / YES
casHOL	Mean	0.111	0.115	0.219	0.219
	Diff.	-0.005		0.000	
	t-value	-1.27		0.09	
	Median	0.065	0.074	0.139	0.153
	N	10,173	1,339	19,459	2,581
netWOC	Mean	0.065	0.064	0.076	0.071
	Diff.	0.001		0.004	
	t-value	0.38		1.15	
	Median	0.048	0.052	0.064	0.062
	N	9,701	1,292	19,108	2,538
capETA	Mean	0.059	0.057	0.053	0.048
	Diff.	0.002		0.005***	
	t-value	0.44		3.69	
	Median	0.040	0.040	0.031	0.026
	N	10,074	1,333	19,361	2,580
totLEV	Mean	0.541	0.543	0.442	0.442
	Diff.	-0.002		-0.000	
	t-value	-0.41		-0.09	
	Median	0.554	0.558	0.430	0.427
	N	10,173	1,339	19,459	2,581

Remark: Groups are assigned by using the top/bottom three deciles of divPCA. s1STM is used as *Signal 1*. bcRR is used as *Signal 2*. Note, Diff. = $\text{Mean}_{\text{Not obs.}} - \text{Mean}_{\text{Obs.}} \neq 0$ within group u and c is tested using a two-sample t-test with unequal variances (Welch, 1947). Note, for the US, s1STM and s1REM mark the same years.
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

TABLE A.15: Case (4): US (bond rating, stock estate market and RR).

Variable ↓	Group → / *Signal 1* → / *Signal 2* →	u: NO / NO	u: YES / YES	c: NO / NO	c: YES / YES
casHOL	Mean	0.091	0.096	0.216	0.216
	Diff.	-0.005*		0.000	
	t-value	-1.75		0.07	
	Median	0.056	0.065	0.141	0.154
	N	9,740	1,248	23,363	3,074
netWOC	Mean	0.055	0.053	0.091	0.087
	Diff.	0.001		0.004	
	t-value	0.35		1.09	
	Median	0.040	0.042	0.080	0.079
	N	9,179	1,189	22,978	3,034
capETA	Mean	0.060	0.057	0.053	0.048
	Diff.	0.003		0.005***	
	t-value	1.50		3.83	
	Median	0.040	0.037	0.031	0.027
	N	9,679	1,247	23,207	3,068
totLEV	Mean	0.610	0.614	0.413	0.415
	Diff.	-0.004		-0.002	
	t-value	-0.83		-0.55	
	Median	0.606	0.607	0.394	0.394
	N	9,740	1,248	23,363	3,074

Remark: Groups are assigned by existence or absence of a long-term rating. s1REM is used as *Signal 1*. bcRR is used as *Signal 2*. Note, Diff. = $\text{Mean}_{\text{Not obs.}} - \text{Mean}_{\text{Obs.}} \neq 0$ within group u and c is tested using a two-sample t-test with unequal variances (Welch, 1947).
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

TABLE A.16: Case (4): US (commercial paper rating, stock estate market and RR).

Variable ↓	Group →	*u*		*c*	
	Signal 1 →	NO	YES	NO	YES
	Signal 2 →	NO	YES	NO	YES
`casHOL`	Mean	0.080	0.086	0.189	0.189
	Diff.	-0.006		-0.000	
	t-value	-1.32		-0.09	
	Median	0.051	0.063	0.111	0.121
	N	2,923	331	30,180	3,991
`netWOC`	Mean	0.035	0.030	0.085	0.081
	Diff.	0.005		0.004	
	t-value	0.79		1.19	
	Median	0.024	0.022	0.071	0.070
	N	2,750	314	29,407	3,909
`capETA`	Mean	0.057	0.054	0.054	0.051
	Diff.	0.003		0.004	
	t-value	1.09		3.91	
	Median	0.044	0.042	0.033	0.029
	N	2,907	331	29,979	3,984
`totLEV`	Mean	0.599	0.599	0.459	0.462
	Diff.	0.000		-0.003	
	t-value	0.02		-0.98	
	Median	0.597	0.597	0.455	0.454
	N	2,923	331	30,180	3,991

Remark: Groups are assigned by existence or absence of a short-term rating. `s1STM` is used as *Signal 1*. `bcRR` is used as *Signal 2*. Note, Diff. $=$ Mean$_{\text{Not obs.}}-$Mean$_{\text{Obs.}} \neq 0$ within group u and c is tested using a two-sample t-test with unequal variances (Welch, 1947). Note, for the US, `s1STM` and `s1REM` mark the same years.
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

TABLE A.17: Case (4): Europe (size, stock estate market and RR).

Variable ↓	Group →	*u*		*c*	
	Signal 1 →	NO	YES	NO	YES
	Signal 2 →	NO	YES	NO	YES
`casHOL`	Mean	0.074	0.086	0.126	0.119
	Diff.	-0.010**		0.007	
	t-value	-2.54		0.86	
	Median	0.051	0.059	0.063	0.057
	N	12,576	541	12,759	358
`netWOC`	Mean	0.039	0.013	0.103	0.088
	Diff.	0.026***		0.015	
	t-value	3.84		1.33	
	Median	0.030	0.012	0.097	0.072
	N	12,514	541	12,635	351
`capETA`	Mean	0.056	0.051	0.047	0.036
	Diff.	0.004*		0.011***	
	t-value	1.95		3.68	
	Median	0.043	0.039	0.026	0.018
	N	11,450	532	9,834	290
`totLEV`	Mean	0.614	0.622	0.472	0.506
	Diff.	-0.007		-0.034***	
	t-value	-1.16		-2.87	
	Median	0.627	0.627	0.468	0.516
	N	12,576	541	12,759	358

Remark: Groups are assigned by using the top/bottom three deciles of `totAST`. `s1STM` is used as *Signal 1*. `bcRR` is used as *Signal 2*. Note, Diff. $=$ Mean$_{\text{Not obs.}}-$Mean$_{\text{Obs.}} \neq 0$ within group u and c is tested using a two-sample t-test with unequal variances (Welch, 1947).
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

TABLE A.18: Case (4): Europe (size, real estate market and RR).

Variable ↓	Group →	*u*		*c*	
	Signal 1 →	NO	YES	NO	YES
	Signal 2 →	NO	YES	NO	YES
`casHOL`	Mean	0.077	0.083	0.126	0.121
	Diff.	-0.006		0.005	
	t-value	-1.35		0.49	
	Median	0.051	0.054	0.063	0.060
	N	12,775	342	12,872	245
`netWOC`	Mean	0.038	0.011	0.103	0.099
	Diff.	0.027***		0.004	
	t-value	3.13		0.25	
	Median	0.029	0.008	0.097	0.079
	N	12,713	342	12,744	242
`capETA`	Mean	0.055	0.048	0.047	0.037
	Diff.	0.008***		0.010**	
	t-value	3.36		2.38	
	Median	0.043	0.035	0.026	0.020
	N	11,647	335	9,926	198
`totLEV`	Mean	0.614	0.625	0.473	0.503
	Diff.	-0.010		-0.030**	
	t-value	-1.26		-2.17	
	Median	0.627	0.628	0.468	0.510
	N	12,775	342	12,872	245

Remark: Groups are assigned by using the top/bottom three deciles of `totAST`. `s1REM` is used as *Signal 1*. `bcRR` is used as *Signal 2*. Note, Diff. = $\text{Mean}_{\text{Not obs.}} - \text{Mean}_{\text{Obs.}} \neq 0$ within group u and c is tested using a two-sample t-test with unequal variances (Welch, 1947).
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

TABLE A.19: Regression: US (ratings/ dividend payments, stock market and RR).

	fcLTR				fcSTR				fcDIV			
	(3)		(4)		(5)		(6)		(7)		(8)	
casHOL	*u*	*c*	*u*	*c*	*u*	*c*	*u*	*c*	*u*	*c*	*u*	*c*
size	-0.013***	-0.017***	-0.011***	-0.010***	0.011**	-0.016***	-0.001	-0.011***	-0.007	-0.020***	-0.016***	-0.009***
	(-4.25)	(-5.20)	(-13.04)	(-15.91)	(2.03)	(-6.24)	(-0.64)	(-21.38)	(-1.60)	(-6.32)	(-18.22)	(-13.24)
netWOC	-0.238***	-0.411***	-0.281***	-0.491***	-0.210***	-0.376***	-0.177***	-0.461***	-0.373***	-0.372***	-0.359***	-0.485***
	(-11.37)	(-22.54)	(-26.03)	(-67.62)	(-5.42)	(-23.27)	(-8.60)	(-70.22)	(-12.75)	(-20.01)	(-28.71)	(-60.09)
capETA	-0.274***	-0.306***	-0.275***	-0.503***	-0.448***	-0.294***	-0.375***	-0.457***	-0.290***	-0.304***	-0.359***	-0.493***
	(-8.44)	(13.07)	(-14.58)	(-29.27)	(-5.78)	(-14.52)	(-9.26)	(-31.50)	(-8.87)	(-11.87)	(-17.66)	(-26.00)
totLEV	-0.121***	-0.358***	-0.161***	-0.438***	-0.113***	-0.305***	-0.129***	-0.390***	-0.177***	-0.320***	-0.255***	-0.419***
	(-8.10)	(-27.44)	(-22.02)	(-75.02)	(-4.62)	(-27.47)	(-10.30)	(-78.67)	(-10.96)	(-24.02)	(-32.29)	(-66.72)
retAST	0.142***	0.103***	0.226***	0.050***	0.283***	0.110***	0.354***	0.055***	0.146***	0.097***	0.269***	0.027***
	(5.45)	(9.97)	(11.28)	(5.61)	(4.70)	(11.25)	(8.97)	(6.44)	(5.72)	(8.90)	(9.24)	(2.85)
retSAL	-0.026*	-0.017***	-0.074***	-0.024***	-0.059**	-0.019***	-0.057**	-0.028***	-0.010	-0.016***	-0.065***	-0.023***
	(-1.84)	(-5.18)	(-7.22)	(-11.29)	(-2.07)	(-5.99)	(-2.43)	(-13.17)	(-0.93)	(-4.87)	(-4.52)	(-10.71)
bcRR	0.011***	0.003	0.009***	0.001	0.005*	0.004**	0.008**	0.002	0.009**	0.003	0.011***	-0.002
	(5.81)	(1.40)	(4.07)	(0.47)	(1.77)	(2.23)	(2.29)	(0.81)	(2.55)	(1.31)	(4.22)	(-0.69)
s1STM	-0.011***	-0.003	-0.014***	0.005	-0.015***	0.000	-0.018***	0.001	-0.009***	0.004	-0.015***	0.005
	(-4.53)	(1.12)	(-3.59)	(1.12)	(-4.23)	(0.12)	(-3.39)	(0.44)	(-3.56)	(1.39)	(-3.42)	(1.07)
s1STM × bcRR	0.002	-0.000	-0.001	0.000	0.001	-0.000	-0.000	0.000	-0.001	0.001	-0.006	0.005
	(0.65)	(-0.11)	(-0.23)	(0.00)	(0.11)	(-0.09)	(-0.12)	(0.06)	(-0.30)	(0.20)	(-1.01)	(0.77)
cons	0.294***	0.496***	0.390***	0.435***	0.062	0.463***	0.151***	0.449***	0.292***	0.508***	0.198***	0.560***
	(10.52)	(29.67)	(10.81)	(32.73)	(1.16)	(30.37)	(7.91)	(11.40)	(8.37)	(29.06)	(2.66)	(20.24)
Company FE	YES	YES	NO	NO	YES	YES	NO	NO	YES	YES	NO	NO
Industry FE	NO	NO	YES	YES	NO	NO	YES	YES	NO	NO	YES	YES
N	10,013	25,293	10,013	25,293	2,917	32,389	2,917	32,389	10,567	21,131	10,567	21,131
AIC	-30,936	-49,400	-21,202	-22,444	-10,177	-66,463	-7,355	-32,878	-31,875	-40,731	-18,836	-17,933
BIC	-30,872	-49,327	-20,979	-22,184	-10,123	-66,387	-7,176	-32,610	-31,809	-40,660	18,603	17,678
R^2	0.172	0.380	0.368	0.494	0.176	0.397	0.391	0.146	0.262	0.374	0.446	0.494

Remark: Groups are assigned by the criteria mentioned on page 52. Note, for the US, s1STM and s1REM mark the same years. The Hausman-test strongly suggests the use of fixed effects ($p < 0.0000$) (Hausman, 1978). Industries are clustered using the first four digits of GICS.
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table A.20: Regression: Europe (size, real estate market and RR).

	(13)		(14)		(15)		(16)	
casHOL	u	c	u	c	u	c	u	c
size	-0.007*	-0.016***	-0.005***	-0.004**	-0.006***	-0.012***	-0.006***	-0.011***
	(-1.96)	(-2.77)	(-9.75)	(-2.28)	(-11.99)	(-6.36)	(-10.38)	(-5.63)
netWOC	-0.167***	-0.344***	-0.147***	-0.269***	-0.148***	-0.264***	-0.148***	-0.257***
	(-9.69)	(-16.87)	(-21.89)	(-30.98)	(-22.79)	(-30.89)	(-21.76)	(-29.76)
capETA	-0.169***	-0.097***	-0.275***	-0.293***	-0.251***	-0.283***	-0.254***	-0.260***
	(-7.38)	(-3.50)	(-15.76)	(-13.52)	(-14.64)	(-13.44)	(-14.70)	(-12.41)
totLEV	-0.113***	-0.370***	-0.122***	-0.343***	-0.116***	-0.356***	-0.116***	-0.341***
	(-7.04)	(-17.03)	(-17.18)	(-37.72)	(-16.29)	(-38.99)	(-15.88)	(-37.01)
retAST	0.207***	0.056***	0.292***	0.062***	0.285***	0.074***	0.289***	0.081***
	(5.94)	(3.81)	(11.95)	(4.68)	(11.61)	(5.76)	(12.07)	(6.33)
retSAL	-0.047**	-0.001	-0.068***	-0.018***	-0.069***	-0.016***	-0.067***	-0.014***
	(-2.30)	(-0.19)	(-5.55)	(-4.02)	(-5.46)	(-3.61)	(-5.41)	(-3.22)
bcRR	0.004**	-0.004	0.007***	0.003	0.006***	-0.001	0.006***	-0.001
	(2.11)	(-0.85)	(3.59)	(0.72)	(2.91)	(-0.17)	(2.75)	(-0.09)
s1REM	0.002	0.006*	0.001	-0.002	0.001	0.011**	0.001	0.010**
	(0.83)	(1.71)	(0.22)	(-0.31)	(0.36)	(2.33)	(0.31)	(2.14)
s1REM $\times$ bcRR	-0.000	0.011	-0.002*	-0.015	-0.004	-0.001	-0.004**	0.001
	(-0.06)	(0.82)	(0.35)	(-1.62)	(-0.85)	(-0.06)	(-0.79)	(0.08)
cons	0.209***	0.394***	0.209***	0.314***	0.161***	0.347***	0.171***	0.313***
	(6.97)	(19.97)	(27.82)	(22.89)	(14.48)	(22.37)	(14.50)	(16.54)
Company FE	YES	YES	NO	NO	NO	NO	NO	NO
Industry FE	NO	NO	YES	YES	NO	NO	YES	YES
Country FE	NO	NO	NO	NO	YES	YES	YES	YES
N	11,867	9,402	11,867	9,402	11,867	9,402	11,866	9,402
AIC	-39,534	-22,227	-27,895	-11,122	28,228	11,799	-28,678	-11,972
BIC	-39,468	-22,162	-27,726	-10,958	28,029	11,606	-28,383	-11,686
R^2	0.122	0.230	0.170	0.290	0.194	0.340	0.225	0.354

Remark: Groups are assigned by using the top/bottom three deciles of totAST. The Hausman-test strongly suggests the use of fixed effects ($p < 0.0000$) (Hausman, 1978). Industries are clustered at supersector-level.
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table A.21: Regression: Europe (size, stock market, RR and financial stress).

	(17)		(18)		(19)		(20)	
casHOL	*u*	*c*	*u*	*c*	*u*	*c*	*u*	*c*
size	-0.005	-0.017***	-0.005***	-0.005***	-0.006***	-0.013***	-0.005***	-0.012***
	(-1.38)	(-3.04)	(-9.37)	(-2.68)	(-11.59)	(-6.58)	(-9.91)	(-5.88)
netWOC	-0.165***	-0.347***	-0.143***	-0.274***	-0.144***	-0.268***	-0.142***	-0.260***
	(-9.16)	(-16.85)	(-20.76)	(-31.13)	(-21.55)	(-30.90)	(-20.45)	(-29.79)
capETA	-0.174***	-0.117***	-0.286***	-0.312***	-0.261***	-0.292***	-0.264***	-0.270***
	(-7.48)	(-4.29)	(-16.20)	(-13.89)	(-15.11)	(-13.63)	(-15.09)	(-12.72)
totLEV	-0.120***	-0.369***	-0.124***	-0.345***	-0.115***	-0.355***	-0.115***	-0.340***
	(-6.98)	(-16.74)	(-16.83)	(-37.63)	(-15.63)	(-38.65)	(-15.33)	(-36.68)
retAST	0.204***	0.052***	0.285***	0.062***	0.283***	0.076***	0.288***	0.082***
	(5.72)	(3.56)	(11.50)	(4.65)	(11.34)	(5.82)	(11.80)	(6.33)
retSAL	-0.047**	0.000	-0.066***	-0.018***	-0.068***	-0.016***	-0.066***	-0.015***
	(-2.24)	(0.06)	(-5.37)	(-4.13)	(-5.38)	(-3.78)	(-5.33)	(-3.37)
finSTR	0.005	-0.023***	0.002	-0.015***	0.004	-0.008**	0.003	-0.021*
	(-1.13)	(-2.75)	(0.30)	(-4.33)	(0.67)	(-1.85)	(0.54)	(-1.95)
bcRR	0.004***	0.002	0.008***	0.006	0.005**	0.003	0.005**	0.005
	(3.09)	(0.61)	(3.43)	(2.08)	(2.20)	(0.89)	(2.19)	(1.03)
s1STM	0.000	0.013***	0.001	0.009**	-0.001	0.015***	-0.001	0.016***
	(0.10)	(4.05)	(0.47)	(2.85)	(-0.28)	(4.00)	(-0.37)	(3.79)
s1STM × bcRR	-0.005*	0.001	-0.001	-0.007	-0.002	-0.002	-0.002	-0.003
	(-1.74)	(0.10)	(-0.30)	(-0.82)	(-0.54)	(-0.45)	(-0.57)	(-0.32)
cons	0.201***	0.401***	0.213***	0.321***	0.161***	0.314***	0.172***	0.281***
	(6.47)	(20.19)	(25.00)	(23.31)	(14.39)	(24.25)	(14.50)	(15.69)
Company FE	YES	YES	NO	NO	NO	NO	NO	NO
Industry FE	NO	NO	YES	YES	NO	NO	YES	YES
Country FE	NO	NO	NO	NO	YES	YES	YES	YES
N	11,211	9,150	11,211	9,150	11,211	9,150	11,211	9,150
AIC	-37,497	-21,756	-26,483	-10,866	26,725	11,506	-27,170	-11,658
BIC	-37,424	-21,685	-26,307	-10,694	26,520	11,307	-26,869	-11,366
R^2	0.122	0.234	0.173	0.294	0.192	0.342	0.225	0.355

Remark: Groups are assigned by using the top/bottom three deciles of totAST. The Hausman-test strongly suggests the use of fixed effects ($p < 0.0000$) (Hausman, 1978). Industries are clustered at supersector-level.
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

TABLE A.22: Regression: Europe (size, real estate market, RR and financial stress).

	(21)		(22)		(23)		(24)	
casHOL	*u*	*c*	*u*	*c*	*u*	*c*	*u*	*c*
size	-0.006	-0.015***	-0.005***	-0.005***	-0.006***	-0.013***	-0.005***	-0.011***
	(-1.60)	(-2.71)	(-9.23)	(-2.84)	(-11.57)	(-6.400)	(-9.91)	(-5.70)
netWOC	-0.167***	-0.345***	-0.145***	-0.271***	-0.147***	-0.264***	-0.145***	-0.256***
	(-9.33)	(-16.82)	(-21.07)	(-30.90)	(-21.95)	(-30.60)	(-20.89)	(-29.52)
capETA	-0.173***	-0.108***	-0.283***	-0.302***	-0.254***	-0.286***	-0.259***	-0.264***
	(-7.57)	(-3.99)	(-15.60)	(-13.84)	(-14.34)	(-13.50)	(-14.47)	(-12.52)
totLEV	-0.120***	-0.369***	-0.123***	-0.343***	-0.116***	-0.355***	-0.116***	-0.339***
	(-7.13)	(-16.84)	(-16.88)	(-37.49)	(-15.88)	(-38.63)	(-15.47)	(-36.68)
retAST	0.203***	0.054***	0.290***	0.061***	0.286***	0.074***	0.289***	0.081***
	(5.72)	(3.70)	(11.69)	(4.65)	(11.39)	(5.72)	(11.84)	(6.27)
retSAL	-0.047**	-0.000	-0.068***	-0.018***	-0.069***	-0.016***	-0.067***	-0.014***
	(-2.27)	(-0.02)	(-5.51)	(-4.11)	(-5.44)	(-3.70)	(-5.40)	(-3.30)
finSTR	-0.005	-0.022**	-0.003	-0.044***	0.003	-0.021*	0.002	-0.021*
	(-1.28)	(-2.58)	(-0.52)	(-3.89)	(0.48)	(-1.84)	(0.34)	(-1.93)
bcRR	0.004**	0.000	0.008***	0.010**	0.006**	0.003	0.006**	0.004
	(2.52)	(0.01)	(3.39)	(2.06)	(2.38)	(0.65)	(2.34)	(0.79)
s1REM	0.002	0.007**	0.001	0.002	0.002	0.013***	0.001	0.012**
	(1.00)	(2.81)	(0.35)	(0.33)	(0.28)	(2.64)	(0.29)	(2.50)
s1REM $\times$ bcRR	-0.000	0.005	-0.002	-0.016	-0.006	-0.013	-0.004	0.000
	(-0.01)	(0.77)	(-0.36)	(-1.70)	(-0.84)	(-0.11)	(-0.78)	(0.04)
cons	0.206***	0.396***	0.210***	0.324***	0.161***	0.316***	0.171***	0.281***
	(6.75)	(20.03)	(27.05)	(23.16)	(14.37)	(24.50)	(14.42)	(15.72)
Company FE	YES	YES	NO	NO	NO	NO	NO	NO
Industry FE	NO	NO	YES	YES	NO	NO	YES	YES
Country FE	NO	NO	NO	NO	YES	YES	YES	YES
N	11,366	9,238	11,366	9,239	11,367	9,239	11,366	9,238
AIC	-37,963	-21,908	-26,604	-10,925	26,905	11,586	-27,337	-11,747
BIC	-37,889	-21,837	-26,428	-10,754	26,699	11,386	-27,036	-11,454
R^2	0.121	0.230	0.170	0.290	0.192	0.340	0.225	0.353

Remark: Groups are assigned by using the top/bottom three deciles of totAST. The Hausman-test strongly suggests the use of fixed effects ($p < 0.0000$) (Hausman, 1978). Industries are clustered at supersector-level.
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table A.23: Regression: US (size, stock market, RR and financial stress).

	(25)		(26)	
casHOL	*u*	*c*	*u*	*c*
size	-0.026***	-0.011*	-0.012***	0.002
	(-6.49)	(-1.78)	(-12.06)	(0.85)
netWOC	-0.273***	-0.417***	-0.313***	-0.484***
	(-9.63)	(-17.07)	(-27.94)	(-44.61)
capETA	-0.209***	-0.279***	-0.262***	-0.521***
	(-6.79)	(-7.82)	(-14.59)	(-16.53)
totLEV	-0.091***	-0.450***	-0.167***	-0.521***
	(-5.58)	(5.30)	(-23.79)	(-53.95)
retAST	0.130***	0.070***	0.295***	-0.002
	(5.07)	(5.37)	(11.14)	(-0.15)
retSAL	0.003	-0.014***	-0.034***	-0.018***
	(0.27)	(-3.87)	(-2.67)	(-7.42)
finSTR	-0.010***	-0.004**	-0.008***	-0.007***
	(-13.83)	(-3.15)	(-10.12)	(-4.54)
bcRR	0.013***	0.013**	0.011***	0.014**
	(5.42)	(2.44)	(3.20)	(2.03)
s1STM	0.003	0.001	-0.004	0.002
	(0.85)	(0.13)	(-0.76)	(0.21)
s1STM $\times$ bcRR	0.015***	-0.001	0.014***	0.006
	(6.10)	(-0.20)	(3.11)	(0.73)
cons	0.390***	0.516***	0.311***	0.406***
	(10.45)	(23.69)	(13.25)	(6.34)
Company FE	YES	YES	NO	NO
Industry FE	NO	NO	YES	YES
N	10,267	10,871	10,267	10,871
AIC	-31,421	-19,616	-20,679	-6,917
BIC	-31,349	-19,543	-20,440	-6,676
R^2	0.188	0.205	0.449	0.478

Remark: Groups are assigned by using the top/bottom three deciles of totAST. Note, for the US, s1STM and s1REM mark the same years. The Hausman-test strongly suggests the use of fixed effects ($p < 0.0000$) (Hausman, 1978). Industries are clustered using the first four digits of GICS.
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

TABLE A.24: Regression: US (ratings/ dividend payments, stock market, RR and financial stress).

	fcLTR				fcSTR				fcDIV			
	(27)		(28)		(29)		(30)		(31)		(32)	
casHOL	*u*	*c*	*u*	*c*	*u*	*c*	*u*	*c*	*u*	*c*	*u*	*c*
size	-0.020***	-0.017***	-0.012***	-0.010***	-0.002	-0.018***	-0.003*	-0.011***	-0.014***	-0.021***	-0.161***	-0.009***
	(-6.61)	(-5.45)	(-13.37)	(-16.10)	(-0.38)	(-6.78)	(-1.79)	(-21.62)	(-3.07)	(-6.54)	(-18.21)	(-13.22)
netWOC	-0.233***	-0.409***	-0.277***	-0.491***	-0.211***	-0.374***	-0.175***	-0.459***	-0.366***	-0.370***	-0.358***	-0.484***
	(-11.71)	(-22.28)	(-25.68)	(-67.03)	(-5.92)	(-23.07)	(-8.75)	(-69.60)	(-12.50)	(-19.92)	(-28.65)	(-60.07)
capETA	-0.217***	-0.296***	-0.260***	-0.503***	-0.326***	-0.279***	-0.307***	-0.448***	-0.254***	-0.295***	-0.358***	-0.492***
	(-6.90)	(-12.53)	(-13.77)	(-28.52)	(-4.42)	(-13.69)	(-8.03)	(-30.73)	(-7.95)	(-11.36)	(-17.62)	(-25.95)
totLEV	-0.117***	-0.358***	-0.161***	-0.438***	-0.108***	-0.304***	-0.124***	-0.389***	-0.171***	-0.320***	-0.255***	-0.419***
	(-8.00)	(-27.38)	(-21.83)	(-74.76)	(-4.38)	(-27.36)	(-10.08)	(-78.34)	(-10.48)	(-24.02)	(-32.24)	(-66.71)
retAST	0.135***	0.103***	0.225***	-0.050***	0.285***	0.110***	0.368***	0.055***	0.151***	0.096***	0.268***	0.027***
	(5.16)	(9.85)	(11.25)	(5.59)	(4.98)	(11.17)	(9.65)	(6.42)	(5.99)	(8.80)	(9.21)	(2.81)
retSAL	-0.026*	-0.017***	-0.074***	-0.024***	-0.067**	-0.019***	-0.076**	-0.028***	-0.010	-0.016***	-0.065***	-0.023***
	(-1.81)	(-5.22)	(-7.21)	(-11.32)	(-2.56)	(-6.07)	(-3.43)	(-13.21)	(-0.88)	(-4.91)	(-4.52)	(-10.69)
finSTR	-0.010***	-0.002***	-0.008***	-0.024***	-0.012***	-0.003***	-0.014***	-0.004***	-0.008***	-0.002**	-0.065***	-0.023***
	(-14.21)	(-3.14)	(-10.60)	(-4.18)	(-10.92)	(-5.47)	(-12.56)	(-5.36)	(-10.55)	(-2.30)	(-4.52)	(-10.69)
bcRR	0.015***	0.008***	0.011***	0.003	0.013***	0.007***	0.015**	0.003	0.009***	0.007**	0.014***	0.001
	(6.93)	(2.90)	(3.32)	(0.93)	(4.37)	(3.26)	(2.34)	(1.09)	(3.71)	(2.17)	(3.60)	(0.32)
s1STM	0.002	0.002	-0.003	0.003	-0.004	0.003	-0.004	0.007	-0.002	0.004	-0.019***	0.003
	(0.54)	(0.48)	(-0.67)	(1.60)	(-0.88)	(0.90)	(-0.49)	(1.40)	(0.54)	(1.03)	(-3.57)	(0.48)
s1STM × bcRR	0.017***	-0.002	0.013***	-0.003	0.015***	0.003	0.018**	0.007	-0.016***	-0.001	-0.007	-0.005
	(6.84)	(-0.72)	(3.09)	(1.04)	(4.09)	(1.20)	(-2.34)	(1.61)	(5.58)	(-0.15)	(-1.40)	(-0.91)
cons	0.343***	0.498***	0.391***	0.435***	0.172***	0.469***	0.164***	0.447***	0.331***	0.510***	0.197***	0.560***
	(12.31)	(29.91)	(10.73)	(32.57)	(3.27)	(30.79)	(8.55)	(11.44)	(9.52)	(29.29)	(2.64)	(20.24)
Company FE	YES	YES	NO	NO	YES	YES	NO	NO	YES	YES	NO	NO
Industry FE	NO	NO	YES	YES	NO	NO	YES	YES	NO	NO	YES	YES
N	10,013	25,293	10,013	25,293	2,917	32,389	2,917	32,389	10,567	21,131	10,567	21,131
AIC	-31,306	-49,423	-21,307	-22,460	-10,397	-66,518	-7,500	-32,907	-32,122	-40,741	-18,837	-17,933
BIC	-31,234	-49,341	-21,077	-22,192	-10,337	-66,434	-7,314	-32,630	-32,049	-40,661	18,605	17,678
R^2	0.148	0.380	0.375	0.495	0.212	0.395	0.421	0.502	0.287	0.375	0.446	0.494

Remark: Groups are assigned by the criteria mentioned on page 52. Note, for the US, s1STM and s1REM mark the same years. The Hausman-test strongly suggests the use of fixed effects ($p < 0.0000$) (Hausman, 1978). Industries are clustered using the first four digits of GICS.
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table A.25: Regression: Europe (Model specification).

	(13)		(33)	
casHOL	u	c	u	c
size	-0.007*	-0.016***	-0.007*	-0.012**
	(-1.96)	(-2.77)	(-1.96)	(-2.14)
netWOC	-0.167***	-0.344***	-0.167***	-0.289***
	(-9.69)	(-16.87)	(-9.69)	(-13.40)
$-$netWOC^2				0.216***
				(5.87)
capETA	-0.169***	-0.097***	-0.169***	-0.112***
	(-7.38)	(-3.50)	(-7.38)	(-4.06)
totLEV	-0.113***	-0.370***	-0.113***	-0.374***
	(-7.04)	(-17.03)	(-7.04)	(-17.49)
retAST	0.207***	0.056***	0.207***	
	(5.94)	(3.81)	(5.94)	
retAST^2				0.067**
				(2.44)
retSAL	-0.047**	-0.001	-0.047**	
	(-2.30)	(-0.19)	(-2.30)	
retSAL^2				-0.003
				(-1.40)
bcRR	0.004**	-0.004	0.004**	-0.004
	(2.11)	(-0.85)	(2.11)	(-0.96)
s1REM	0.002	0.006*	0.002	0.006*
	(0.83)	(1.71)	(0.83)	(1.79)
s1REM $\times$ bcRR	-0.000	0.011	-0.000	0.012
	(-0.06)	(0.82)	(-0.06)	(0.50)
cons	0.209***	0.394***	0.209***	0.390***
	(6.97)	(19.97)	(6.97)	(20.44)
Company FE	YES	YES	YES	YES
Industry FE	NO	NO	NO	NO
Country FE	NO	NO	NO	NO
N	11,867	9,402	11,867	9,402
AIC	-39,534	-22,227	-39,534	-22,313
BIC	-39,468	-22,162	-39,468	-22,242
R^2	0.122	0.230	0.122	0.236

Remark: Groups are assigned by using the top/bottom three deciles of totAST. The Hausman-test strongly suggests the use of fixed effects ($p < 0.0000$) (Hausman, 1978). Industries are clustered at supersector-level.
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table A.26: Regression: US (Model specification).

	(25)		(34)	
casHOL	*u*	*c*	*u*	*c*
size	-0.026***	-0.011*	-0.026***	-0.010
	(-6.49)	(-1.78)	(-6.49)	(1.56)
netWOC	-0.273***	-0.417***	-0.273***	-0.383***
	(-9.63)	(-17.07)	(-9.63)	(-14.56)
$-$netWOC^2				0.155***
				(3.52)
capETA	-0.209***	-0.279***	-0.209***	-0.277***
	(-6.79)	(-7.82)	(6.79)	(-7.73)
totLEV	-0.091***	-0.450***	-0.091***	-0.454***
	(-5.58)	(5.30)	(-5.58)	(-23.27)
retAST	0.130***	0.070***	0.130***	
	(5.07)	(5.37)	(5.07)	
retAST^2				-0.024**
				(-1.27)
retSAL	0.003	-0.014***	0.003	
	(0.27)	(-3.87)	(0.27)	
retSAL^2				0.001**
				(2.31)
finSTR	-0.010***	-0.004**	-0.010***	-0.004***
	(-13.83)	(-3.15)	(-13.83)	(-3.86)
bcRR	0.013***	0.013**	0.013***	0.012***
	(5.42)	(2.44)	(5.42)	(2.61)
s1STM	0.003	0.001	0.003	0.001
	(0.85)	(0.13)	(0.85)	(0.11)
s1STM $\times$ bcRR	0.015***	-0.001	0.015***	0.001
	(6.10)	(-0.20)	(6.10)	(0.13)
cons	0.390***	0.516***	0.390***	0.518***
	(10.45)	(23.69)	(10.45)	(23.29)
Company FE	YES	YES	YES	YES
Industry FE	NO	NO	NO	NO
N	10,267	10,871	10,267	10,871
AIC	-31,421	-19,616	-31,421	-19,570
BIC	-31,349	-19,543	-31,349	-19,490
R^2	0.188	0.205	0.188	0.376

Remark: Groups are assigned by using the top/bottom three deciles of totAST. Note, for the US, s1STM and s1REM mark the same years. The Hausman-test strongly suggests the use of fixed effects ($p < 0.0000$) (Hausman, 1978). Industries are clustered using the first four digits of GICS.
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Appendix B

Regulated Industries, Banking Crises and Capital Structure Decisions

B.1 Identification Strategy

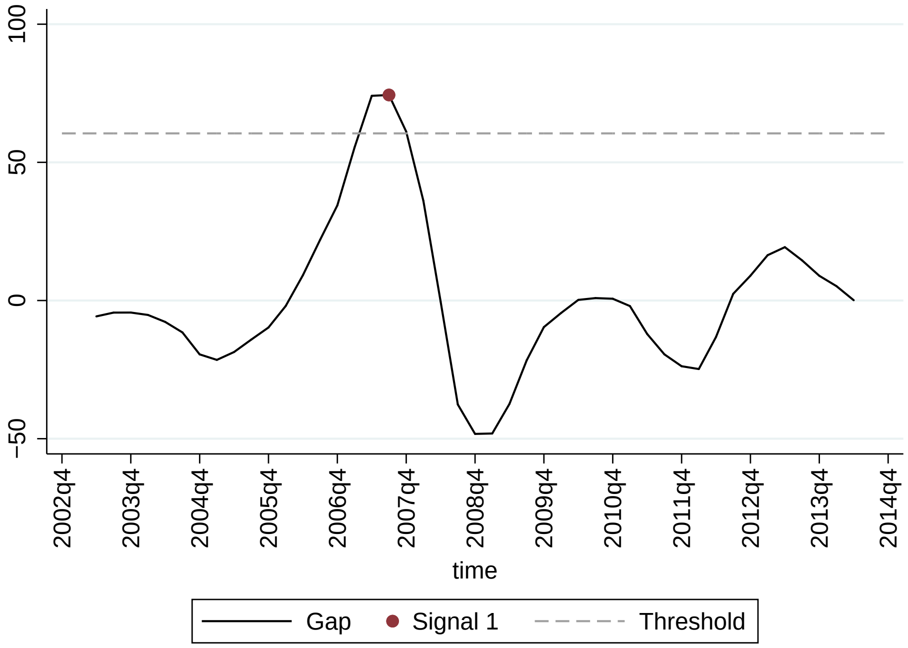


FIGURE B.1: Adapted from Datastream: Asia Pacific: Thomson Reuters Asia Pacific Real Estate Index - quarterly data.

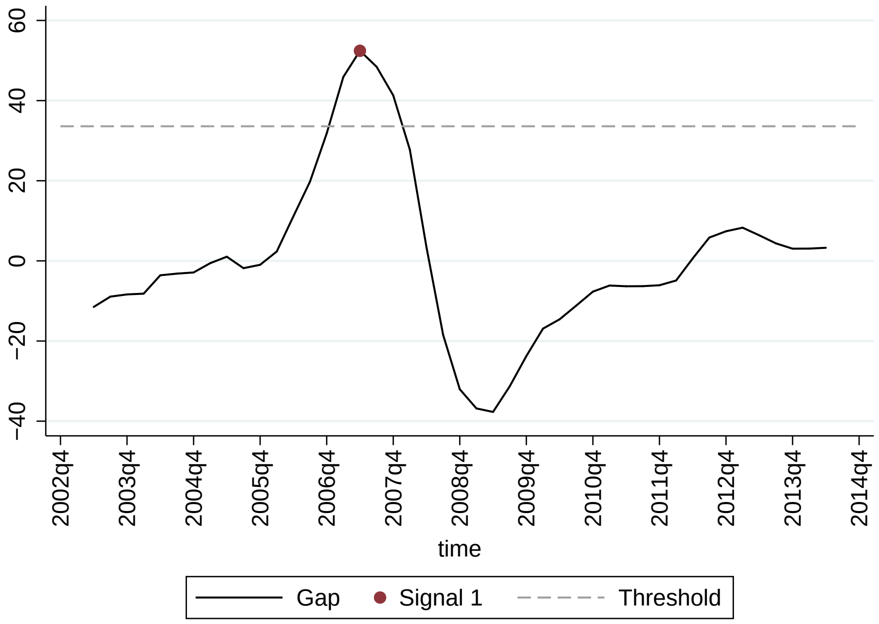


Figure B.2: Adapted from Datastream: Australia: MSCI International Australia Industry Group - Real Estate Price - quarterly data.

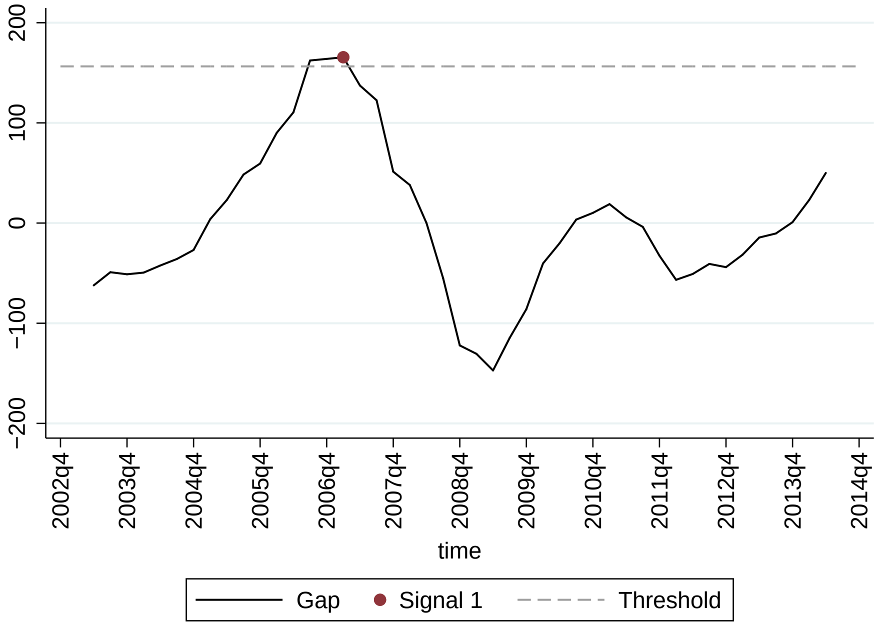


Figure B.3: Adapted from Datastream: Belgium: FTSE EPRA/NAREIT Belgium/Luxembourg Index - quarterly data.

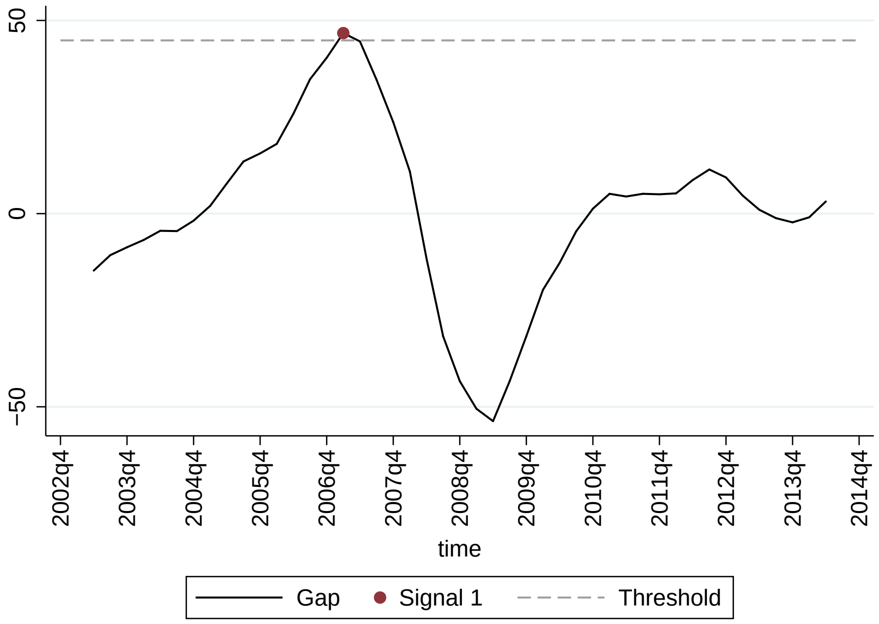


FIGURE B.4: Adapted from Datastream: Canada: S&P/TSX Canadian Real Estate Index - quarterly data.

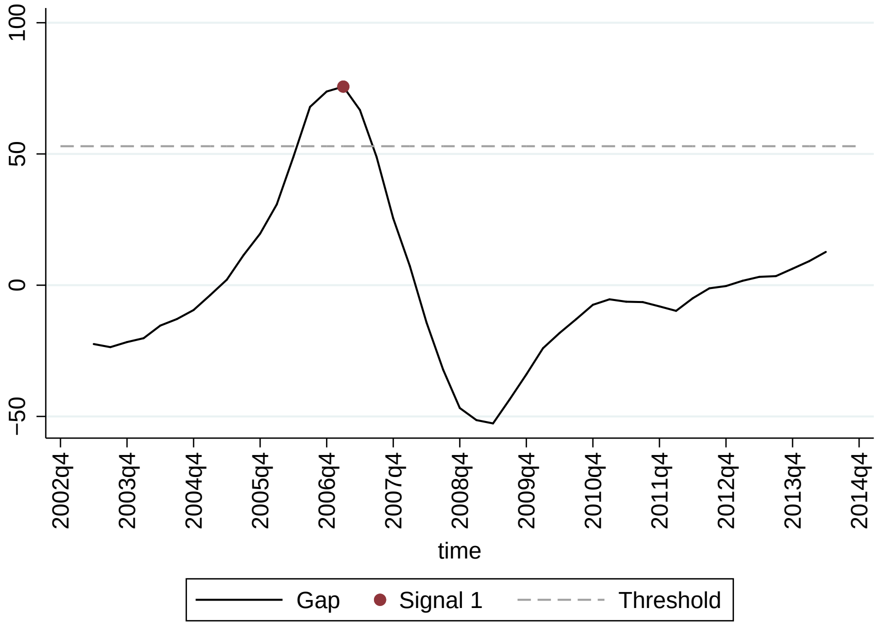


FIGURE B.5: Adapted from Datastream: Europe: MSCI International Europe Real Estate Price - quarterly data.

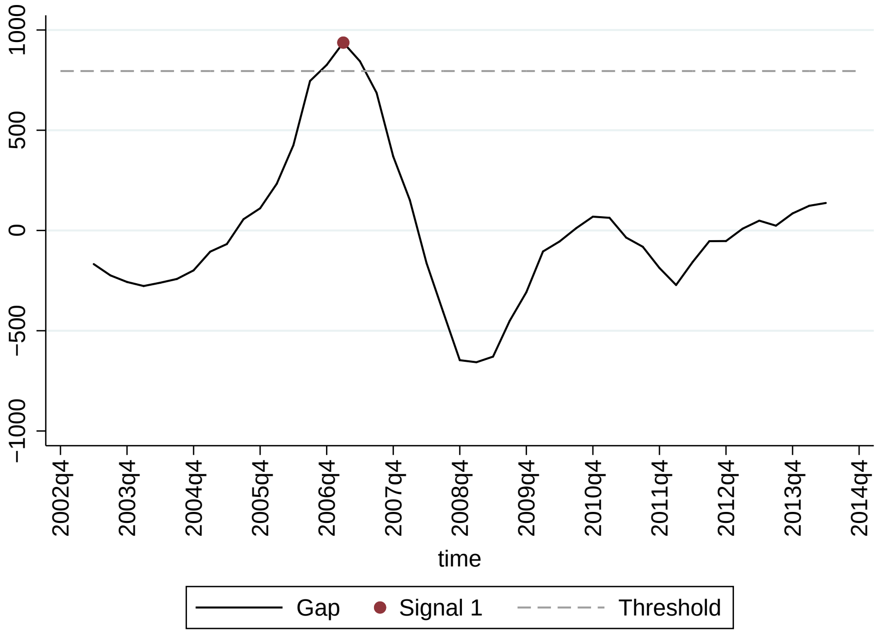


FIGURE B.6: Adapted from Datastream: France: FTSE EPRA/NAREIT France Index - quarterly data.

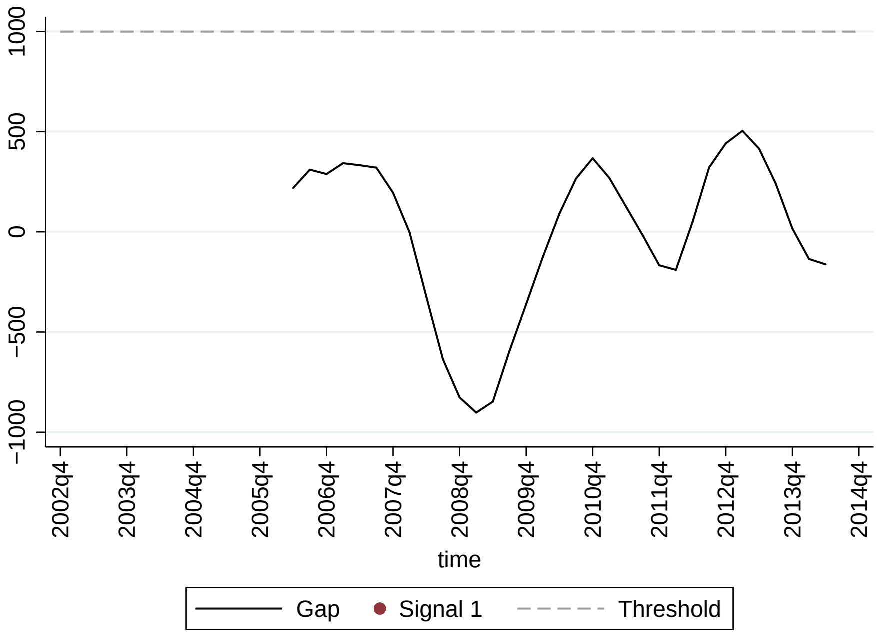


FIGURE B.7: Adapted from Datastream: Hong Kong: Hang Seng REIT Index - quarterly data.

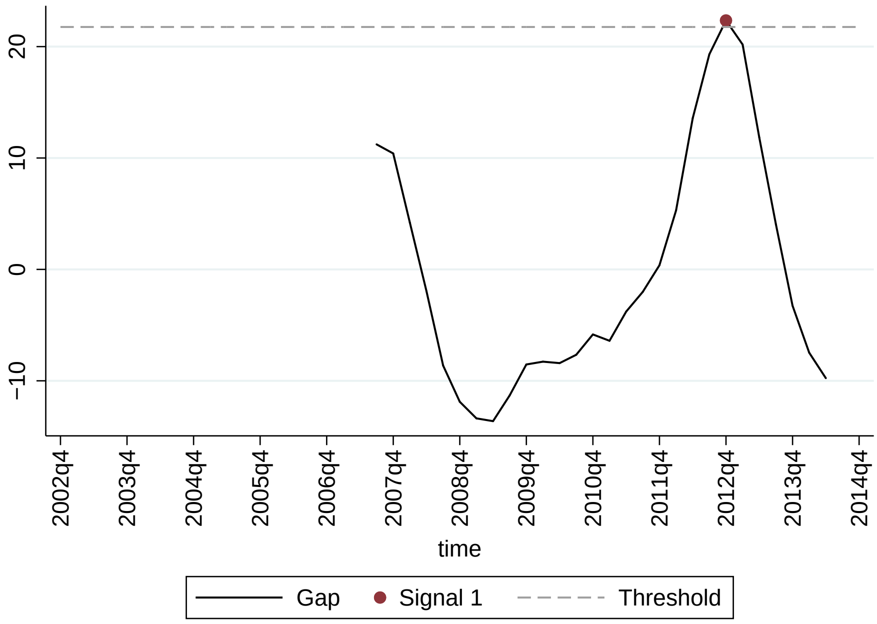


FIGURE B.8: Adapted from Datastream: Malaysia: S&P Malaysia REIT Index - quarterly data.

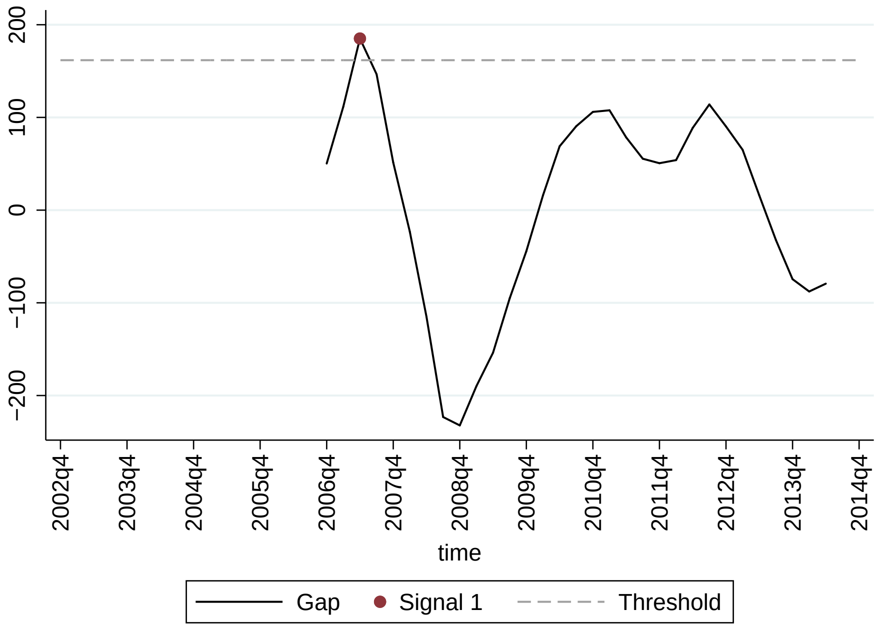


FIGURE B.9: Adapted from Datastream: Middle East & Africa: Dow Jones Middle East & Africa Select REIT Index - quarterly data.

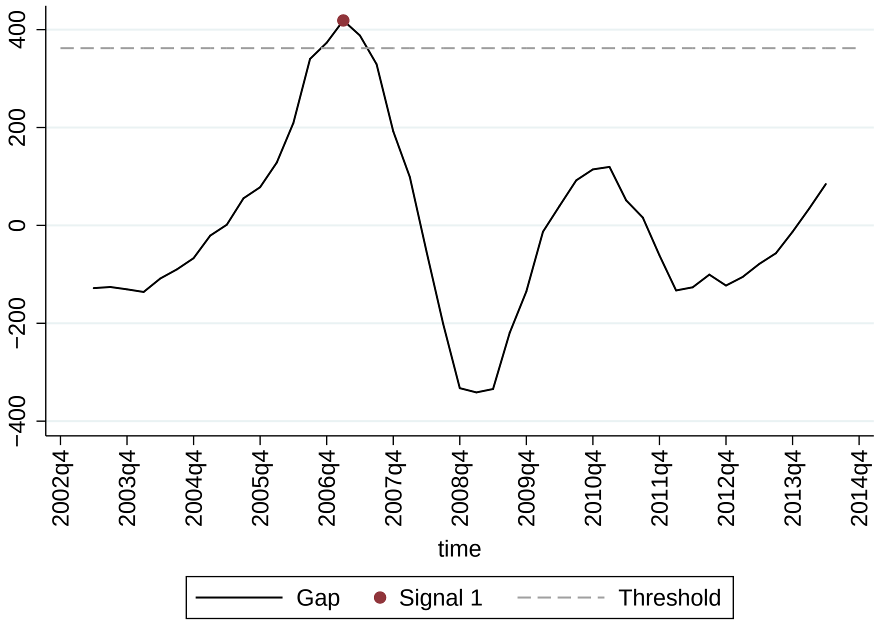


Figure B.10: Adapted from Datastream: Netherlands: FTSE EPRA/NAREIT Netherlands Index - quarterly data.

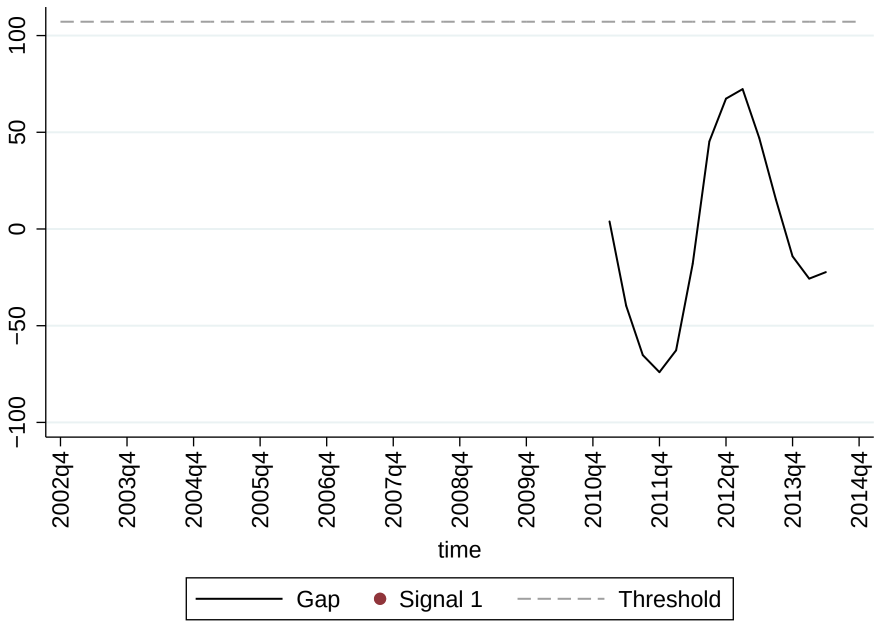


Figure B.11: Adapted from Datastream: Singapore: SGX Real Estate 20 Index - quarterly data.

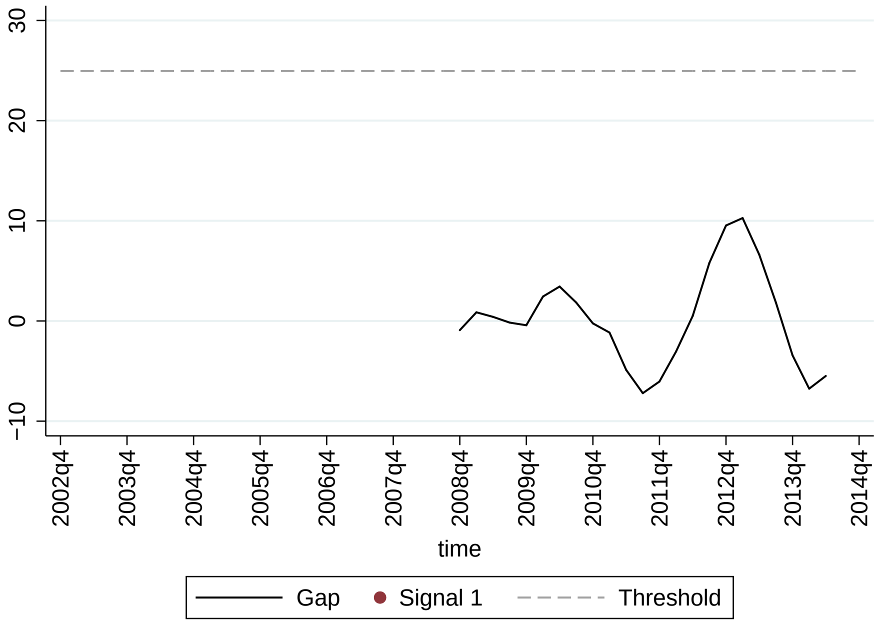


FIGURE B.12: Adapted from Datastream: South Africa: Thomson Reuters South Africa Real Estate Index - quarterly data.

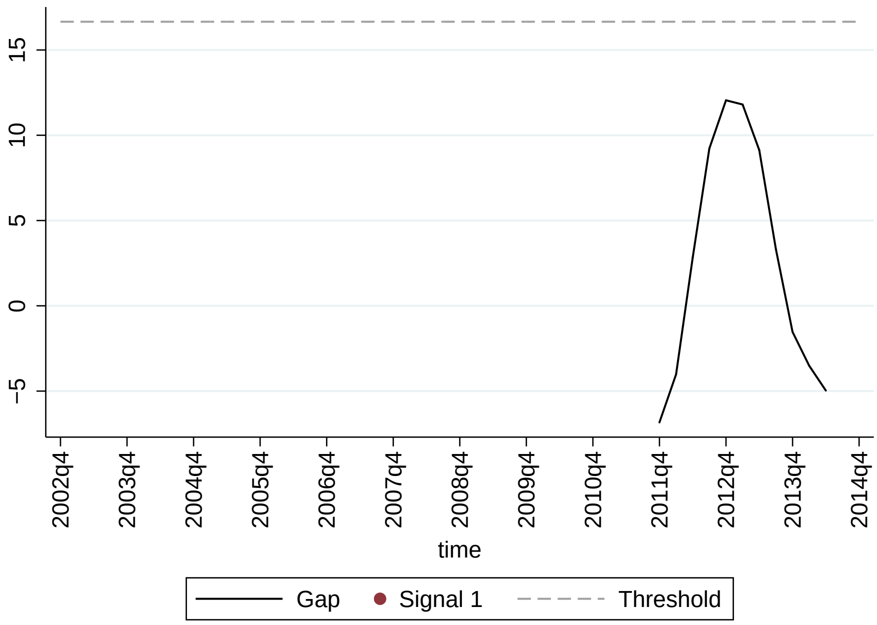


FIGURE B.13: Adapted from Datastream: Thailand: Thomson Reuters Thailand Commercial REITs Index - quarterly data.

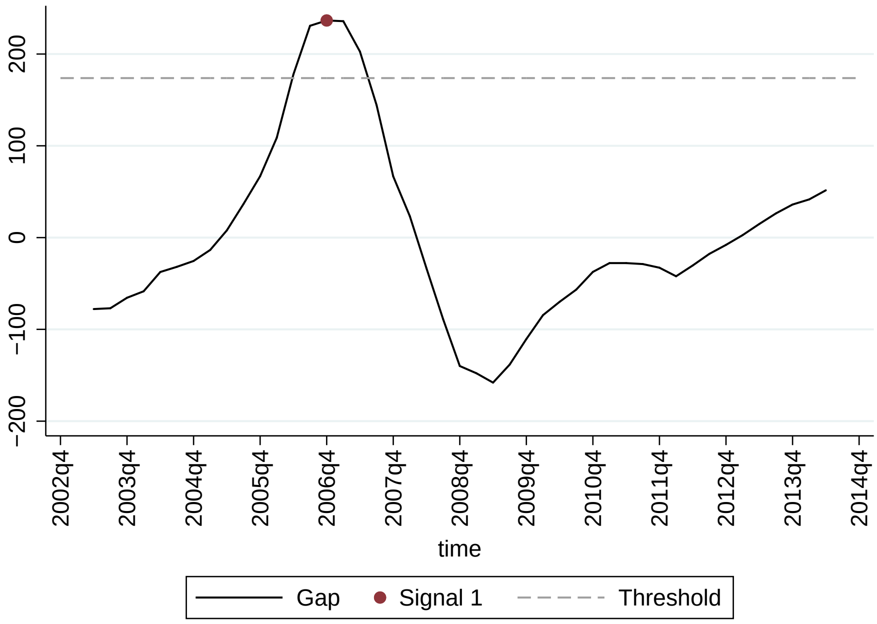


FIGURE B.14: Adapted from Datastream: United Kingdom: FTSE 350 Real Estate Index - quarterly data.

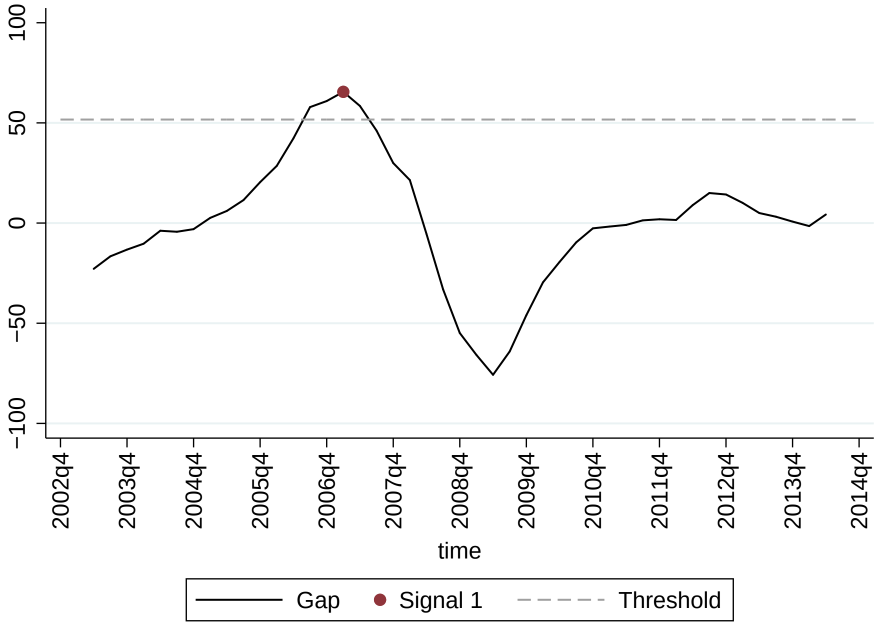


FIGURE B.15: Adapted from Datastream: US: Dow Jones US Real Estate Index - quarterly data.

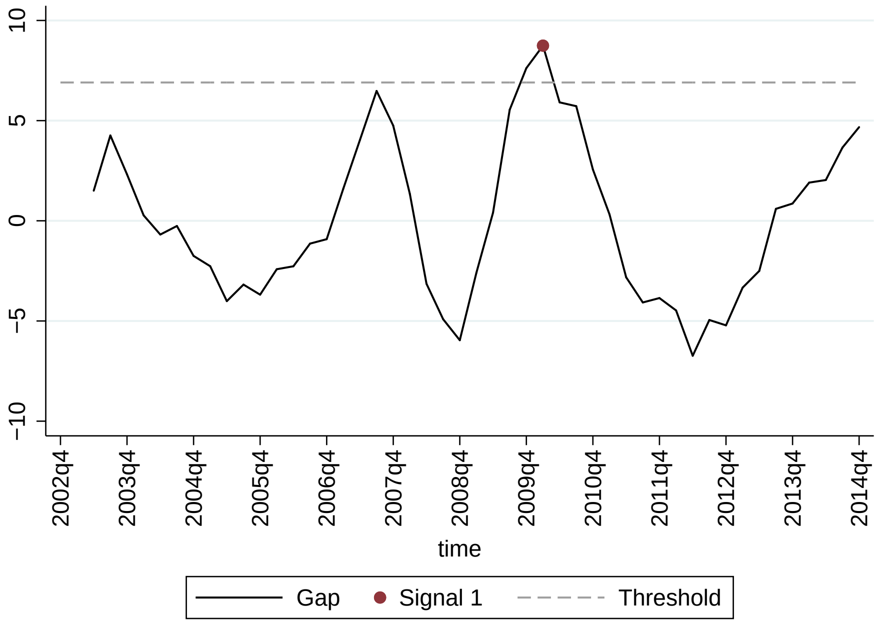


Figure B.16: Adapted from FRED Data: Australia: Residential Property Prices - quarterly data.

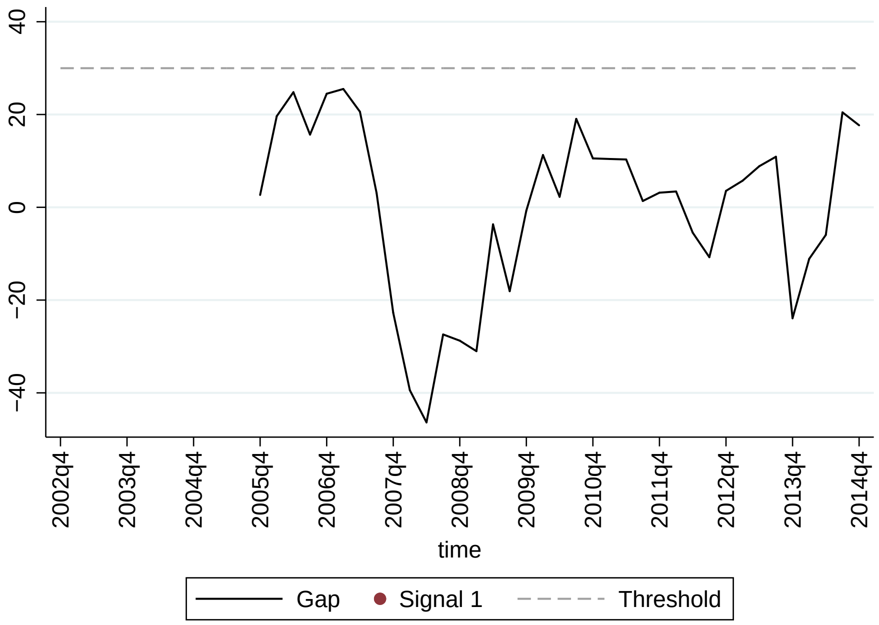


Figure B.17: Adapted from FRED Data: Belgium: Residential Property Prices - quarterly data.

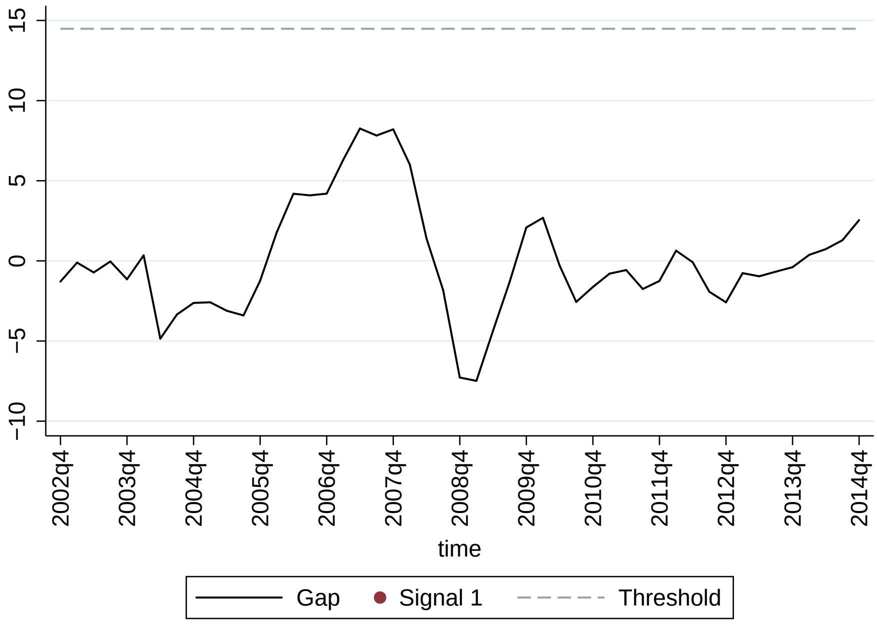


FIGURE B.18: Adapted from FRED Data: Canada: Residential Property Prices - quarterly data.

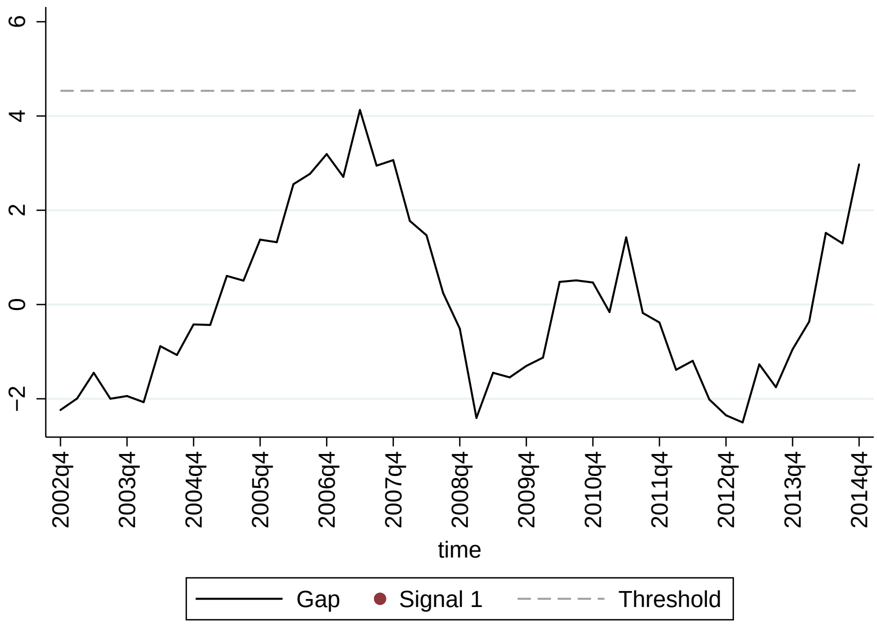


FIGURE B.19: Adapted from FRED Data: Euro Area: Residential Property Prices - quarterly data.

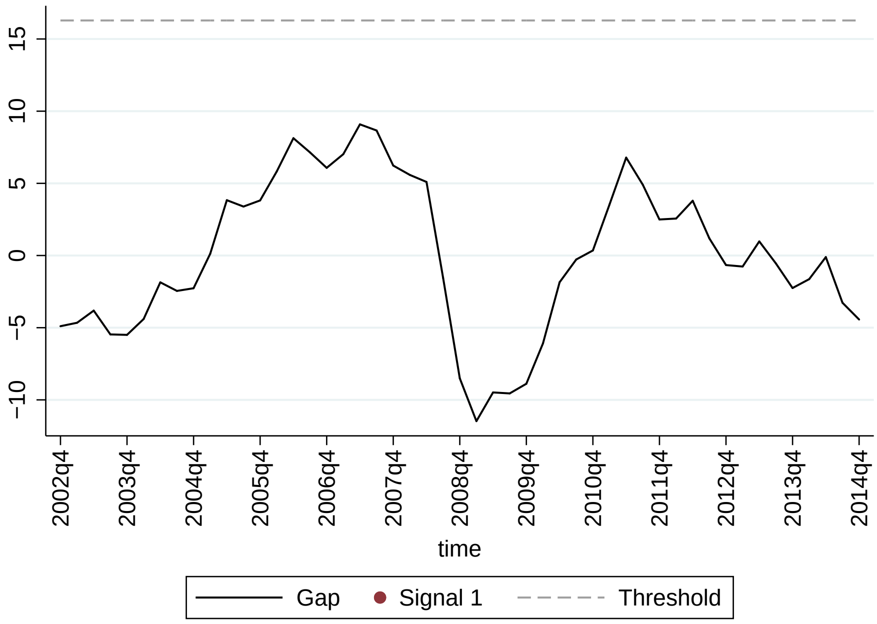


Figure B.20: Adapted from FRED Data: France: Residential Property Prices - quarterly data.

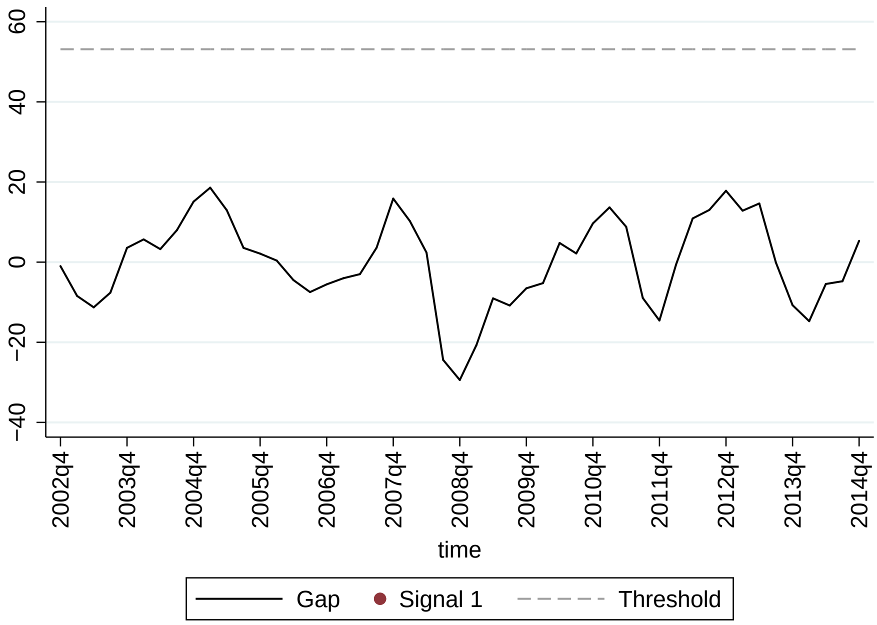


Figure B.21: Adapted from FRED Data: Hong Kong: Residential Property Prices - quarterly data.

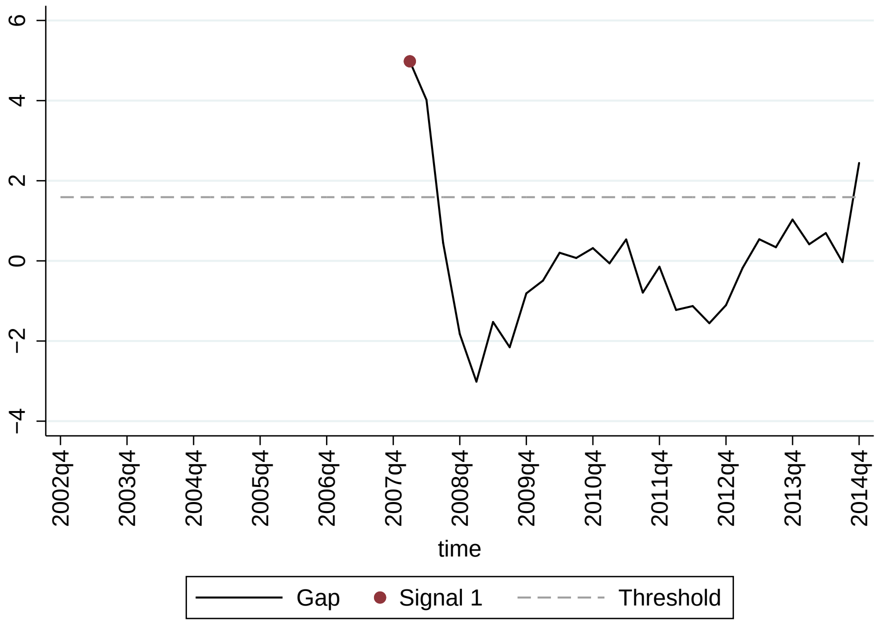


Figure B.22: Adapted from FRED Data: Japan: Residential Property Prices - quarterly data.

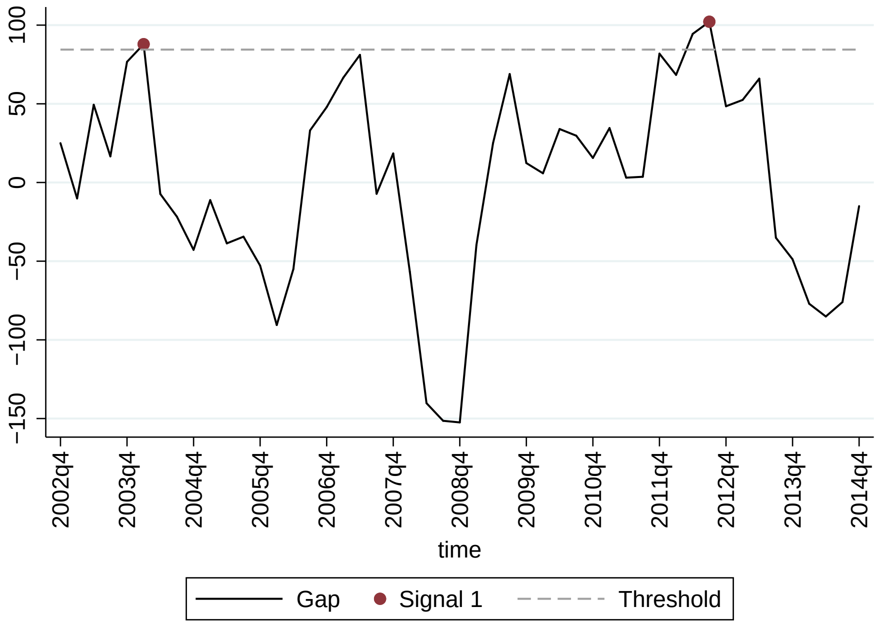


Figure B.23: Adapted from FRED Data: Malaysia: Residential Property Prices - quarterly data.

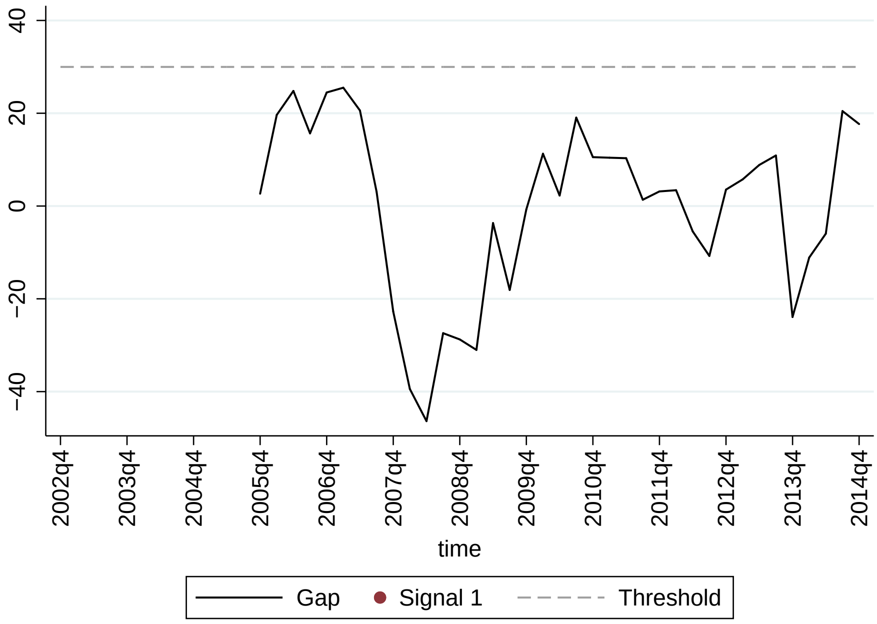


FIGURE B.24: Adapted from FRED Data: Netherlands: Residential Property Prices - quarterly data.

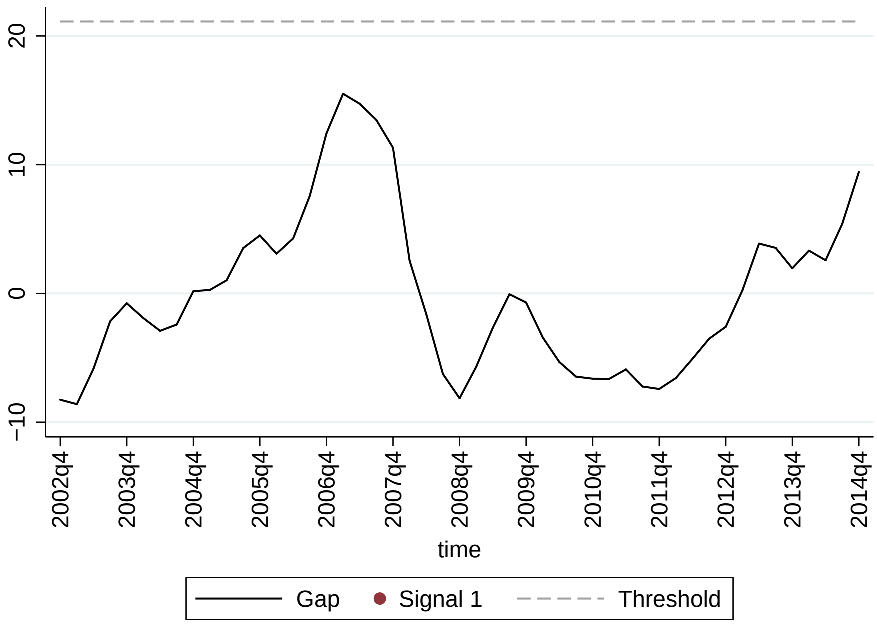


FIGURE B.25: Adapted from FRED Data: New Zealand: Residential Property Prices - quarterly data.

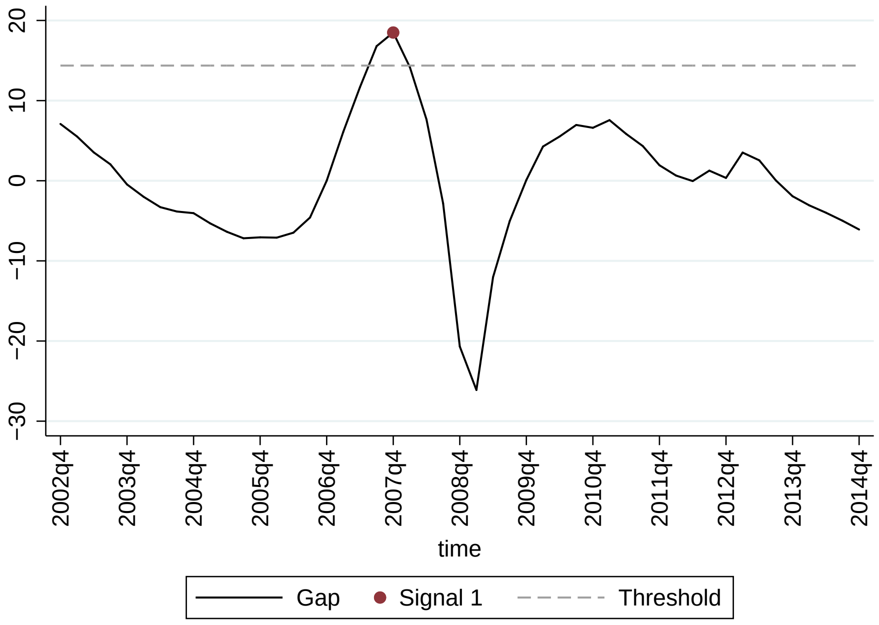


FIGURE B.26: Adapted from FRED Data: Singapore: Residential Property Prices - quarterly data.

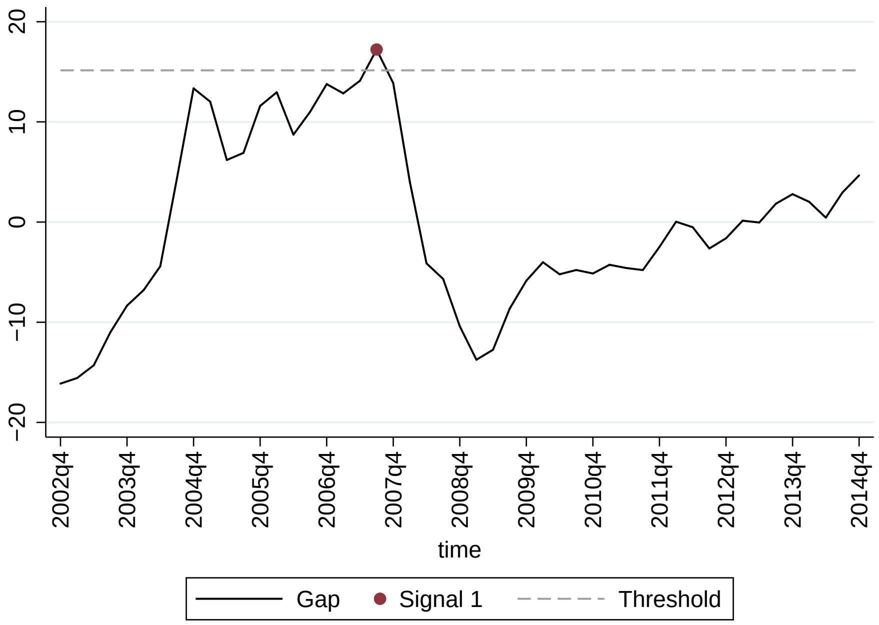


FIGURE B.27: Adapted from FRED Data: South Africa: Residential Property Prices - quarterly data.

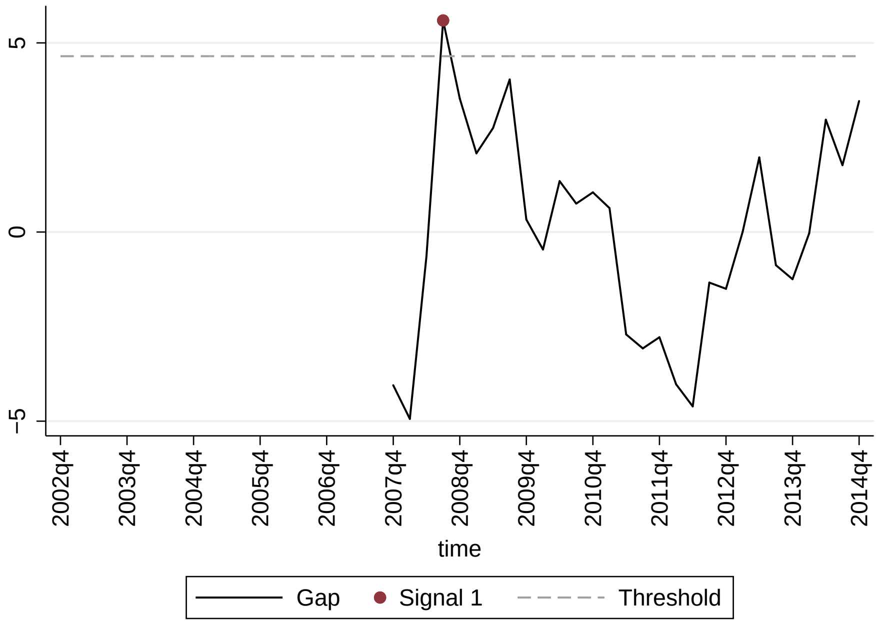


Figure B.28: Adapted from FRED Data: Thailand: Residential Property Prices - quarterly data.

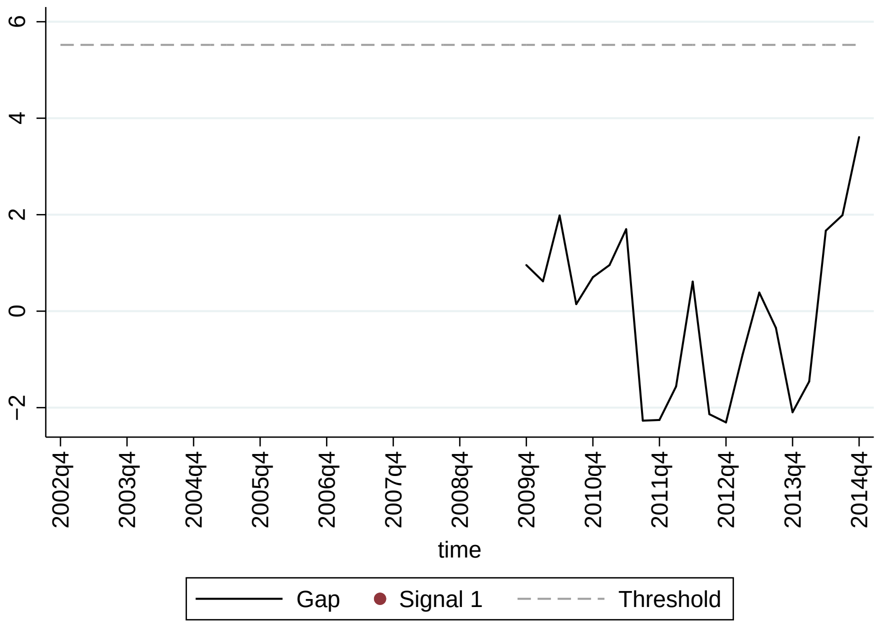


Figure B.29: Adapted from FRED Data: Turkey: Residential Property Prices - quarterly data.

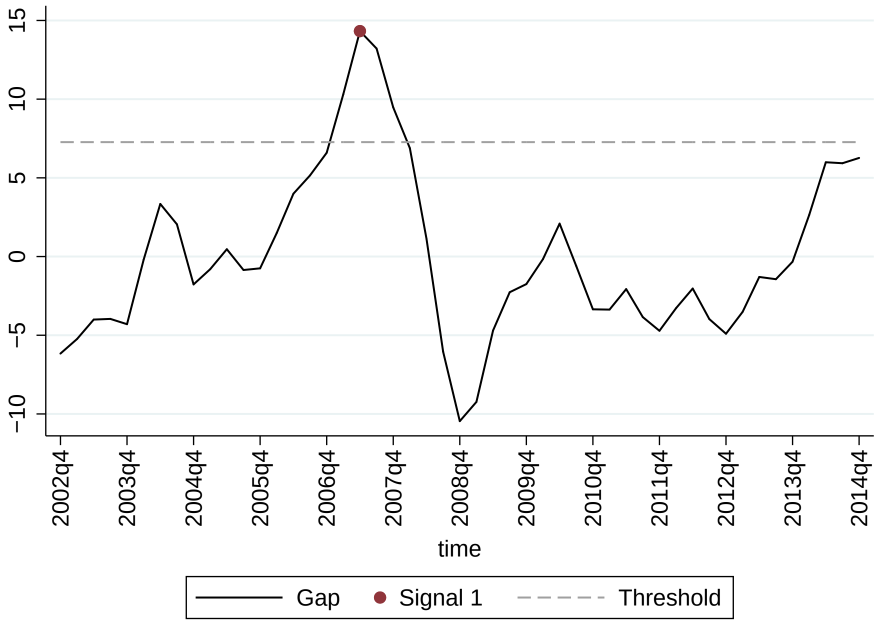


Figure B.30: Adapted from FRED Data: United Kingdom: Residential Property Prices - quarterly data.

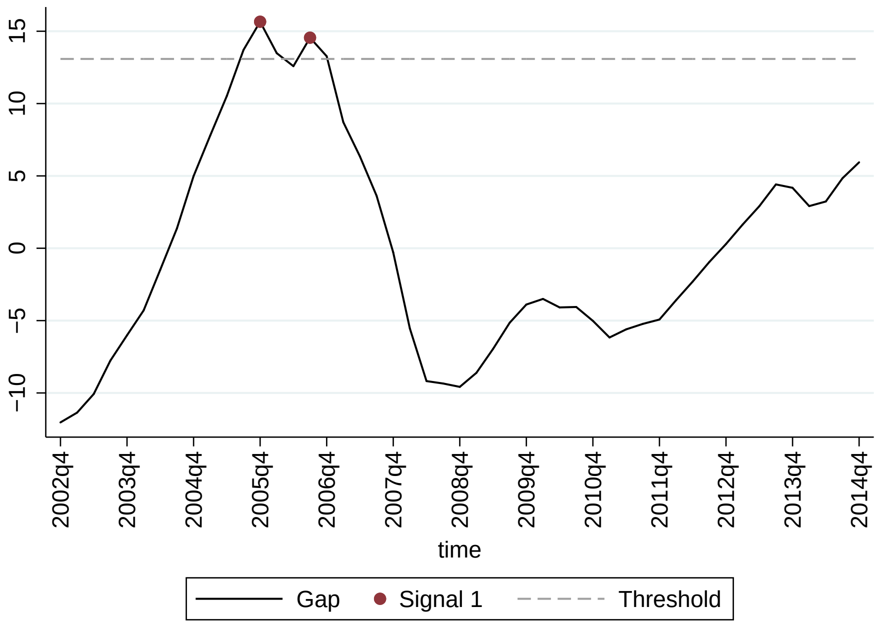


Figure B.31: Adapted from FRED Data: US: Residential Property Prices - quarterly data.

B.2 Results

Table B.1: Degree of regulation per country (Approach 2).

Country	minSCA	shaREQ	lisMAN	totLER	disOIN	incTAX	sanc
Australia	*l* (12/12)	*l* (12/12)	*l* (12/12)	*l* (12/12)	*h* (12/12)	*l* (12/12)	*l* (10/12)
Belgium	*m* (12/12)	*l* (12/12)	*h* (12/12)	*m* (12/12)	*l* (10/12)	*l* (12/12)	*m* (12/12)
Canada	*l* (12/12)	*h* (12/12)	*l* (12/12)	*l* (12/12)	*h* (12/12)	*m* (12/12)	*h* (8/12)
France	*h* (12/12)	*h* (9/12)	*h* (12/12)	*l* (12/12)	*l* (11/12)	*l* (10/12)	*m* (12/12)
Hong Kong	*l* (12/12)	*l* (12/12)	*h* (12/12)	*m* (8/12)	*m* (12/12)	*m* (12/12)	*h* (8/12)
Japan	*l* (8/12)	*l* (9/12)	*l* (12/12)	*l* (12/12)	*m* (12/12)	*m* (12/12)	*m* (12/12)
Malaysia	*h* (12/12)	*l* (12/12)	*l* (12/12)	*m/h* (6/12)	*m* (12/12)	*l* (12/12)	*m* (12/12)
Netherlands	*l* (12/12)	*h* (12/12)	*l* (12/12)	*m* (12/12)	*h* (12/12)	*l* (12/12)	*h* (12/12)
New Zealand	*l* (12/12)	*h* (12/12)	*l* (12/12)	*l* (12/12)	*l* (12/12)	*h* (12/12)	*h* (12/12)
Singapore	*m* (9/12)	*h* (12/12)	*l* (8/12)	*h* (12/12)	*m* (12/12)	*l* (12/12)	*h* (12/12)
South Africa	*h* (12/12)	*l* (12/12)	*h* (12/12)	*m* (12/12)	*l* (12/12)	*m* (12/12)	*h* (12/12)
Thailand	*m* (7/12)	*h* (12/12)	*h* (12/12)	*h* (12/12)	*m* (12/12)	*m* (12/12)	*l* (10/12)
Turkey	*m* (12/12)	*h* (12/12)	*h* (12/12)	*l* (12/12)	*l* (12/12)	*l* (12/12)	*h* (12/12)
United Kingdom	*h* (12/12)	*h* (12/12)	*h* (12/12)	*l* (12/12)	*h* (12/12)	*l* (12/2)	*m* (12/12)
United States	*l* (12/12)	*h* (12/12)	*l* (12/12)	*l* (12/12)	*m* (12/12)	*l* (12/12)	*m* (12/12)
Total	**180**	**180**	**180**	**180**	**180**	**180**	**180**

Remark: The values in this table are based on the second approach to control for missing values. Further, the table displays the mode over the full observation period per country. The figures in brackets display the number of observations with the highest occurrence (mode) and the total number of country years. Note, the enactment years for Malaysia, New Zealand South Africa, Thailand and the United Kingdom are 2005, 2007, 2013, 2007 and 2007 in that order. For the remaining countries, this year is 2003 or prior.

Table B.2: Degree of regulation per country (Approach 3).

Country	minSCA	shaREQ	lisMAN	totLER	disOIN	incTAX	sanc
Australia	*l* (12/12)	*l* (12/12)	*l* (12/12)	*l* (12/12)	*h* (12/12)	*l* (12/12)	*l* (10/12)
Belgium	*m* (12/12)	*l* (12/12)	*h* (12/12)	*m* (12/12)	*l* (10/12)	*l* (12/12)	*m* (12/12)
Canada	*l* (12/12)	*h* (12/12)	*l* (12/12)	*l* (12/12)	*h* (12/12)	*m* (12/12)	*h* (8/12)
France	*h* (12/12)	*h* (9/12)	*h* (12/12)	*l* (12/12)	*l* (11/12)	*l* (10/12)	*m* (12/12)
Hong Kong	*l* (12/12)	*l* (12/12)	*h* (12/12)	*m* (8/12)	*m* (12/12)	*m* (12/12)	*h* (8/12)
Japan	*l* (8/12)	*l* (9/12)	*l* (12/12)	*l* (12/12)	*m* (12/12)	*m* (12/12)	*m* (12/12)
Netherlands	*l* (12/12)	*h* (12/12)	*l* (12/12)	*m* (12/12)	*h* (12/12)	*l* (12/12)	*h* (12/12)
Singapore	*m* (9/12)	*h* (12/12)	*l* (8/12)	*h* (12/12)	*m* (12/12)	*l* (12/12)	*h* (12/12)
Turkey	*m* (12/12)	*h* (12/12)	*h* (12/12)	*l* (12/12)	*l* (12/12)	*l* (12/12)	*h* (12/12)
United States	*l* (12/12)	*h* (12/12)	*l* (12/12)	*l* (12/12)	*m* (12/12)	*l* (12/12)	*m* (12/12)
Total	**120**	**120**	**120**	**120**	**120**	**120**	**120**

Remark: The values in this table are based on the third approach to control for missing values. Further, the table displays the mode over the full observation period per country. The figures in brackets display the number of observations with the highest occurrence (mode) and the total number of country years.

Table B.3: Case (2): Cash holdings (real estate market, equity and debt: Approach 1).

Criterion ↓	Group →	l		m		h	
	Signal 1 →	NO	YES	NO	YES	NO	YES
	Signal 2 →	NO	NO	NO	NO	NO	NO
minSCA	Mean	0.029	0.024	0.045	0.071	0.039	0.034
	Diff.	0.005		-0.026		0.004	
	t-value	1.19		-1.23		0.37	
	Median	0.013	0.009	0.013	0.013	0.018	0.014
	N	1,541	128	311	22	634	28
shaREQ	Mean	0.030	0.023			0.035	0.034
	Diff.	0.006				0.001	
	t-value	0.83				0.15	
	Median	0.011	0.007			0.015	0.011
	N	702	45			1,784	133
lisMAN	Mean	0.028	0.023			0.043	0.056
	Diff.	0.004				-0.012	
	t-value	1.04				-0.95	
	Median	0.013	0.009			0.017	0.016
	N	1,567	135			919	43
totLER	Mean	0.035	0.034	0.022	0.007	0.017	0.017
	Diff.	0.001		0.015***		0.001	
	t-value	0.29		4.00		0.05	
	Median	0.015	0.011	0.008	0.004	0.001	0.001
	N	2,094	157	373	14	19	7

Remark: Controls are assigned following the definition(s) on page 109. `s1REM` is used as *Signal 1*. Note, Diff. $=$ Mean$_{\text{Not obs.}}-$Mean$_{\text{Obs.}} \neq 0$ within group l, m and h is tested using a two-sample t-test with unequal variances (Welch, 1947).
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table B.4: Case (2): Cash holdings (real estate market, income distribution, taxes and sanctions: Approach 1).

Criterion ↓	Group →	l		m		h	
	Signal 1 →	NO	YES	NO	YES	NO	YES
	Signal 2 →	NO	NO	NO	NO	NO	NO
disOIN	Mean	0.040	0.056	0.028	0.023	0.036	0.025
	Diff.	-0.016		0.006		0.010	
	t-value	-1.19		1.29		1.33	
	Median	0.016	0.009	0.013	0.009	0.013	0.009
	N	577	43	1,141	91	768	44
incTAX	Mean	0.034	0.032	0.025	0.017	0.040	n/a
	Diff.	0.002		0.008		n/a	
	t-value	0.38		1.41		n/a	
	Median	0.015	0.009	0.008	0.008	0.009	n/a
	N	1,541	128	283	14	32	n/a
sanc	Mean	0.035	0.032	0.031	0.024	0.043	0.062
	Diff.	0.004		0.006		-0.018	
	t-value	0.29		1.50		-1.09	
	Median	0.017	0.009	0.014	0.008	0.014	0.020
	N	226	27	1,824	123	436	28

Remark: Controls are assigned following the definition(s) on page 109. `s1REM` is used as *Signal 1*. Note, Diff. $=$ Mean$_{\text{Not obs.}}-$Mean$_{\text{Obs.}} \neq 0$ within group l, m and h is tested using a two-sample t-test with unequal variances (Welch, 1947).
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

TABLE B.5: Case (2): Cash holdings (residential property prices, equity and debt: Approach 1).

Criterion ↓	Group →	*l*		*m*		*h*	
	Signal 1 →	NO	YES	NO	YES	NO	YES
	Signal 2 →	NO	NO	NO	NO	NO	NO
`minSCA`	Mean	0.027	0.034	0.041	0.024	0.039	0.030
	Diff.	-0.006		0.017***		0.009	
	t-value	-1.46		3.61		0.89	
	Median	0.011	0.018	0.017	0.021	0.019	0.012
	N	1,612	116	485	28	714	33
`shaREQ`	Mean	0.030	0.030			0.033	0.032
	Diff.	-0.000				0.001	
	t-value	-0.06				0.34	
	Median	0.010	0.018			0.015	0.018
	N	682	47			2,129	130
`lisMAN`	Mean	0.027	0.032			0.042	0.029
	Diff.	-0.005				0.012	
	t-value	-1.27				1.10	
	Median	0.013	0.019			0.016	0.013
	N	1,787	149			1,024	28
`totLER`	Mean	0.035	0.034	0.021	0.021	0.028	0.023
	Diff.	0.001		0.000		0.004	
	t-value	0.16		0.06		1.03	
	Median	0.015	0.017	0.007	0.016	0.018	0.021
	N	2,180	135	344	14	287	28

Remark: Controls are assigned following the definition(s) on page 109. `s1RPP` is used as *Signal 1*. Note, Diff. $=$ Mean$_{\text{Not obs.}}$ $-$Mean$_{\text{Obs.}}$ $\neq 0$ within group l, m and h is tested using a two-sample t-test with unequal variances (Welch, 1947).
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

TABLE B.6: Case (2): Cash holdings (residential property prices, income distribution, taxes and sanctions: Approach 1).

Criterion ↓	Group →	*l*		*m*		*h*	
	Signal 1 →	NO	YES	NO	YES	NO	YES
	Signal 2 →	NO	NO	NO	NO	NO	NO
`disOIN`	Mean	0.039	n/a	0.028	0.030	0.035	0.034
	Diff.	n/a		-0.002		0.001	
	t-value	n/a		-0.52		0.10	
	Median	0.016	n/a	0.014	0.018	0.013	0.017
	N	577	n/a	1,396	125	752	52
`incTAX`	Mean	0.034	0.032	0.022	0.015	0.019	n/a
	Diff.	0.002		0.007**		n/a	
	t-value	0.66		2.07		n/a	
	Median	0.016	0.018	0.008	0.014	0.003	n/a
	N	2,330	168	385	9	96	n/a
`sanc`	Mean	0.032	0.030	0.030	0.032	0.039	0.028
	Diff.	0.002		-0.002		0.011	
	t-value	0.27		-0.51		1.94	
	Median	0.013	0.017	0.014	0.017	0.017	0.023
	N	274	42	1,844	116	693	19

Remark: Controls are assigned following the definition(s) on page 109. `s1RPP` is used as *Signal 1*. Note, Diff. $=$ Mean$_{\text{Not obs.}}$ $-$Mean$_{\text{Obs.}}$ $\neq 0$ within group l, m and h is tested using a two-sample t-test with unequal variances (Welch, 1947).
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

TABLE B.7: Case (3): Cash holdings (equity and debt: Approach 1).

Criterion	Group →	l		m		h	
↓	*Signal 1* →	NO	NO	NO	NO	NO	NO
	Signal 2 →	NO	YES	NO	YES	NO	YES
`minSCA`	Mean	0.028	0.021	0.038	0.031	0.037	0.050
	Diff.	0.007**		0.007*		-0.013	
	t-value	2.33		1.74		-1.29	
	Median	0.013	0.009	0.018	0.020	0.019	0.016
	N	1,723	153	567	85	679	68
`shaREQ`	Mean	0.030	0.024			0.033	0.033
	Diff.	0.005				0.000	
	t-value	1.61				0.11	
	Median	0.016	0.014			0.015	0.013
	N	894	93			2,075	213
`lisMAN`	Mean	0.028	0.022			0.040	0.047
	Diff.	0.006***				-0.007	
	t-value	2.65				-0.93	
	Median	0.015	0.011			0.016	0.017
	N	1,997	205			972	101
`totLER`	Mean	0.034	0.033	0.022	0.019	0.029	0.023
	Diff.	0.001		0.003		0.006	
	t-value	0.43		0.42		1.47	
	Median	0.016	0.013	0.007	0.007	0.018	0.021
	N	2,331	241	362	25	276	39

Remark: Controls are assigned following the definition(s) on page 109. `s2LB` is used as *Signal 2*. Note, Diff. $=\text{Mean}_{\text{Not obs.}} - \text{Mean}_{\text{Obs.}} \neq 0$ within group l, m and h is tested using a two-sample t-test with unequal variances (Welch, 1947).
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

TABLE B.8: Case (3): Cash holdings (income distribution, taxes and sanctions: Approach 1).

Criterion	Group →	l		m		h	
↓	*Signal 1* →	NO	NO	NO	NO	NO	NO
	Signal 2 →	NO	YES	NO	YES	NO	YES
`disOIN`	Mean	0.038	0.035	0.028	0.024	0.035	0.039
	Diff.	-0.016		0.006		-0.005	
	t-value	-1.19		1.29		-0.52	
	Median	0.014	0.013	0.016	0.014	0.013	0.011
	N	619	65	1,617	162	733	79
`incTAX`	Mean	0.034	0.033	0.025	0.025	0.020	0.003
	Diff.	0.001		-0.000		-0.017***	
	t-value	0.50		-0.02		2.75	
	Median	0.016	0.013	0.016	0.016	0.003	0.001
	N	2,293	234	588	64	88	8
`sanc`	Mean	0.032	0.022	0.030	0.032	0.040	0.031
	Diff.	0.010**		-0.002		0.008	
	t-value	2.23		-0.44		1.64	
	Median	0.015	0.013	0.015	0.013	0.017	0.013
	N	276	40	2,043	196	650	70

Remark: Controls are assigned following the definition(s) on page 109. `s2LB` is used as *Signal 2*. Note, Diff. $=\text{Mean}_{\text{Not obs.}} - \text{Mean}_{\text{Obs.}} \neq 0$ within group l, m and h is tested using a two-sample t-test with unequal variances (Welch, 1947).
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

TABLE B.9: Case (1): Cash holdings (equity and debt: Approach 2).

Criterion ↓	Group → / *Signal 1* → / *Signal 2* →	l NO NO	m NO NO	h NO NO
minSCA	Mean	0.028	0.037	0.035
	Diff. $l-h$	-0.008*** (-3.76)		
	Diff. $l-m$	-0.010*** (-4.15)		
	Diff. $m-h$	-0.002 (-0.68)		
	Median	0.013	0.018	0.016
	N	1,901	652	927
shaREQ	Mean	0.029		0.033
	Diff. $l-h$	-0.004** (-2.11)		
	Median	0.014		0.015
	N	1,104		2,376
lisMAN	Mean	0.028		0.038
	Diff. $l-h$	-0.011*** (-5.67)		
	Median	0.015		0.014
	N	2,231		1,249
totLER	Mean	0.033	0.023	0.028
	Diff. $l-h$	0.006*** (2.84)		
	Diff. $l-m$	0.011*** (4.54)		
	Diff. $m-h$	-0.005* (-1.78)		
	Median	0.016	0.007	0.018
	N	2,659	500	321

Remark: Controls are assigned following the definition(s) on page 109. Diff. = $\text{Mean}_l - \text{Mean}_h \neq 0$ (analogously for $l-m$ and $m-h$) are tested using a two-sample t-test with unequal variances (Welch, 1947). The values in brackets are t-values associated with the respective tests.
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

TABLE B.10: Case (1): Cash holdings (income distribution, taxes and sanctions: Approach 2).

Criterion ↓	Group → / *Signal 1* → / *Signal 2* →	l NO NO	m NO NO	h NO NO
disOIN	Mean	0.035	0.028	0.034
	Diff. $l-h$	0.001 (0.47)		
	Diff. $l-m$	0.007*** (3.07)		
	Diff. $m-h$	-0.006*** (-2.74)		
	Median	0.012	0.016	0.013
	N	822	1,785	873
incTAX	Mean	0.034	0.025	0.016
	Diff. $l-h$	0.018*** (4.23)		
	Diff. $l-m$	0.008*** (4.79)		
	Diff. $m-h$	0.009** (2.22)		
	Median	0.015	0.015	0.003
	N	2,592	767	121
sanc	Mean	0.031	0.030	0.036
	Diff. $l-h$	-0.005 (-1.38)		
	Diff. $l-m$	0.002 (0.61)		
	Diff. $m-h$	-0.007*** (-3.10)		
	Median	0.014	0.015	0.141
	N	858	2,304	858

Remark: Controls are assigned following the definition(s) on page 109. Diff. = $\text{Mean}_l - \text{Mean}_h \neq 0$ (analogously for $l-m$ and $m-h$) are tested using a two-sample t-test with unequal variances (Welch, 1947). The values in brackets are t-values associated with the respective tests.
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

TABLE B.11: Case (2): Cash holdings (real estate market, equity and debt: Approach 2).

Criterion ↓	Group →	l		m		h	
	Signal 1 →	NO	YES	NO	YES	NO	YES
	Signal 2 →	NO	NO	NO	NO	NO	NO
`minSCA`	Mean	0.029	0.024	0.045	0.071	0.036	0.031
	Diff.	0.005		-0.026		0.005	
	t-value	1.19		-1.23		0.53	
	Median	0.013	0.009	0.013	0.013	0.016	0.009
	N	1,541	128	311	22	767	52
`shaREQ`	Mean	0.029	0.028			0.034	0.032
	Diff.	0.001				0.003	
	t-value	0.14				0.52	
	Median	0.010	0.007			0.015	0.010
	N	790	53			1,829	149
`lisMAN`	Mean	0.027	0.023			0.041	0.045
	Diff.	0.004				-0.005	
	t-value	1.02				-0.49	
	Median	0.013	0.009			0.015	0.011
	N	1,571	135			1,048	67
`totLER`	Mean	0.035	0.032	0.022	0.023	0.014	0.017
	Diff.	0.003		-0.001		-0.002	
	t-value	0.64		-0.09		-0.20	
	Median	0.015	0.011	0.008	0.005	0.001	0.001
	N	2,139	173	373	22	23	7

Remark: Controls are assigned following the definition(s) on page 109. `s1REM` is used as *Signal 1*. Note, Diff. $=$ Mean$_{\text{Not obs.}}-$Mean$_{\text{Obs.}} \neq 0$ within group l, m and h is tested using a two-sample t-test with unequal variances (Welch, 1947).
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

TABLE B.12: Case (2): Cash holdings (real estate market, income distribution, taxes and sanctions: Approach 2).

Criterion ↓	Group →	l		m		h	
	Signal 1 →	NO	YES	NO	YES	NO	YES
	Signal 2 →	NO	NO	NO	NO	NO	NO
`disOIN`	Mean	0.038	0.055	0.028	0.023	0.035	0.022
	Diff.	-0.016		0.006		0.013**	
	t-value	-1.38		1.26		2.08	
	Median	0.015	0.014	0.013	0.009	0.013	0.009
	N	661	164	1,145	91	813	60
`incTAX`	Mean	0.034	0.031	0.025	0.030	0.040	n/a
	Diff.	0.003		-0.005		n/a	
	t-value	0.70		-0.35		n/a	
	Median	0.015	0.009	0.008	0.010	0.009	n/a
	N	2,220	180	367	22	32	n/a
`sanc`	Mean	0.035	0.032	0.031	0.023	0.040	0.060
	Diff.	0.004		0.007		-0.020	
	t-value	0.29		1.87		-1.26	
	Median	0.017	0.009	0.013	0.008	0.013	0.015
	N	226	27	1,873	139	520	36

Remark: Controls are assigned following the definition(s) on page 109. `s1REM` is used as *Signal 1*. Note, Diff. $=$ Mean$_{\text{Not obs.}}-$Mean$_{\text{Obs.}} \neq 0$ within group l, m and h is tested using a two-sample t-test with unequal variances (Welch, 1947).
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

TABLE B.13: Case (2): Cash holdings (residential property prices, equity and debt: Approach 2).

Criterion ↓	Group →	l		m		h	
	Signal 1 →	NO	YES	NO	YES	NO	YES
	Signal 2 →	NO	NO	NO	NO	NO	NO
minSCA	Mean	0.027	0.034	0.041	0.024	0.035	0.032
	Diff.	-0.007		0.017***		0.003	
	t-value	-1.54		3.61		0.28	
	Median	0.011	0.018	0.017	0.021	0.016	0.012
	N	1,637	116	485	28	882	43
shaREQ	Mean	0.029	0.032			0.033	0.032
	Diff.	-0.000				0.001	
	t-value	-0.06				0.34	
	Median	0.010	0.015			0.014	0.018
	N	789	57			2,215	130
lisMAN	Mean	0.027	0.032			0.039	0.034
	Diff.	-0.005				0.012	
	t-value	-1.27				1.10	
	Median	0.013	0.019			0.015	0.013
	N	1,814	151			1,190	36
totLER	Mean	0.034	0.034	0.023	0.033	0.028	0.022
	Diff.	-0.000		-0.010		0.006	
	t-value	-0.01		-0.70		1.38	
	Median	0.014	0.017	0.007	0.011	0.018	0.020
	N	2,266	135	449	22	289	30

Remark: Controls are assigned following the definition(s) on page 109. `s1RPP` is used as *Signal 1*. Note, Diff. = $\text{Mean}_{\text{Not obs.}} - \text{Mean}_{\text{Obs.}} \neq 0$ within group l, m and h is tested using a two-sample t-test with unequal variances (Welch, 1947).
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

TABLE B.14: Case (2): Cash holdings (residential property prices, income distribution, taxes and sanctions: Approach 2).

Criterion ↓	Group →	l		m		h	
	Signal 1 →	NO	YES	NO	YES	NO	YES
	Signal 2 →	NO	NO	NO	NO	NO	NO
disOIN	Mean	0.036	0.052	0.028	0.030	0.034	0.034
	Diff.	-0.017		-0.002		-0.000	
	t-value	-0.43		-0.42		-0.06	
	Median	0.012	0.011	0.014	0.018	0.013	0.017
	N	793	8	1,398	127	813	52
incTAX	Mean	0.034	0.032	0.022	0.033	0.016	n/a
	Diff.	0.002		-0.010		n/a	
	t-value	0.66		-0.54		n/a	
	Median	0.015	0.018	0.008	0.013	0.003	n/a
	N	2,393	170	490	17	121	n/a
sanc	Mean	0.032	0.030	0.030	0.032	0.036	0.035
	Diff.	0.002		-0.002		0.011	
	t-value	0.27		-0.48		0.10	
	Median	0.013	0.017	0.014	0.017	0.014	0.022
	N	274	42	1,907	118	823	27

Remark: Controls are assigned following the definition(s) on page 109. `s1RPP` is used as *Signal 1*. Note, Diff. = $\text{Mean}_{\text{Not obs.}} - \text{Mean}_{\text{Obs.}} \neq 0$ within group l, m and h is tested using a two-sample t-test with unequal variances (Welch, 1947).
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

TABLE B.15: Case (3): Cash holdings (equity and debt: Approach 2).

Criterion ↓	Group →	l		m		h	
	Signal 1 →	NO	NO	NO	NO	NO	NO
	Signal 2 →	NO	YES	NO	YES	NO	YES
minSCA	Mean	0.028	0.021	0.038	0.031	0.034	0.045
	Diff.	0.007**		0.007*		-0.011	
	t-value	2.22		1.74		-1.23	
	Median	0.013	0.009	0.018	0.020	0.016	0.015
	N	1,748	153	567	85	847	80
shaREQ	Mean	0.030	0.024			0.033	0.033
	Diff.	0.006*				-0.000	
	t-value	1.85				-0.07	
	Median	0.014	0.014			0.015	0.013
	N	999	105			2,163	213
lisMAN	Mean	0.028	0.022			0.038	0.044
	Diff.	0.006***				-0.007	
	t-value	2.65				-0.93	
	Median	0.015	0.011			0.016	0.017
	N	2,026	205			1,136	113
totLER	Mean	0.034	0.033	0.023	0.019	0.028	0.023
	Diff.	0.001		0.003		0.006	
	t-value	0.43		0.42		1.47	
	Median	0.016	0.013	0.007	0.007	0.018	0.021
	N	2,417	242	463	37	282	39

Remark: Controls are assigned following the definition(s) on page 109. s2LB is used as *Signal 2*. Note, Diff. = $\text{Mean}_{\text{Not obs.}} - \text{Mean}_{\text{Obs.}} \neq 0$ within group l, m and h is tested using a two-sample t-test with unequal variances (Welch, 1947).
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

TABLE B.16: Case (3): Cash holdings (income distribution, taxes and sanctions: Approach 2).

Criterion ↓	Group →	l		m		h	
	Signal 1 →	NO	NO	NO	NO	NO	NO
	Signal 2 →	NO	YES	NO	YES	NO	YES
disOIN	Mean	0.036	0.032	0.028	0.024	0.033	0.039
	Diff.	-0.016		0.006		-0.005	
	t-value	-1.19		1.29		-0.52	
	Median	0.012	0.012	0.016	0.014	0.013	0.011
	N	745	77	1,623	162	794	79
incTAX	Mean	0.034	0.033	0.026	0.025	0.017	0.003
	Diff.	0.001		0.001		0.013***	
	t-value	0.38		0.41		2.64	
	Median	0.016	0.013	0.015	0.014	0.003	0.001
	N	2,358	234	691	76	113S	8
sanc	Mean	0.032	0.022	0.029	0.032	0.037	0.029
	Diff.	0.010**		-0.003		0.008*	
	t-value	2.25		-0.53		1.67	
	Median	0.015	0.013	0.015	0.013	0.014	0.012
	N	278	40	2,108	196	776	82

Remark: Controls are assigned following the definition(s) on page 109. s2LB is used as *Signal 2*. Note, Diff. = $\text{Mean}_{\text{Not obs.}} - \text{Mean}_{\text{Obs.}} \neq 0$ within group l, m and h is tested using a two-sample t-test with unequal variances (Welch, 1947).
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

TABLE B.17: Case (1): Cash holdings (equity and debt: Approach 3).

Criterion ↓	Group →	l	m	h
	Signal 1 →	NO	NO	NO
	Signal 2 →	NO	NO	NO
`minSCA`	Mean	0.029	0.040	0.036
	Diff. $l-h$	-0.008*** (-2.63)		
	Diff. $l-m$	-0.012*** (-4.63)		
	Diff. $m-h$	0.004 (1.23)		
	Median	0.013	0.021	0.020
	N	1,812	562	380
`shaREQ`	Mean	0.030		0.033
	Diff. $l-h$	-0.002 (-1.15)		
	Median	0.016		0.016
	N	843		1,911
`lisMAN`	Mean	0.029		0.042
	Diff. $l-h$	-0.013*** (-5.06)		
	Median	0.016		0.016
	N	2,034		720
`totLER`	Mean	0.033	0.021	0.034
	Diff. $l-h$	-0.002 (-0.65)		
	Diff. $l-m$	0.012*** (3.72)		
	Diff. $m-h$	-0.014*** (-3.46)		
	Median	0.016	0.006	0.024
	N	2,290	265	199

Remark: Controls are assigned following the definition(s) on page 109. Diff. = $\text{Mean}_l - \text{Mean}_h \neq 0$ (analogously for $l-m$ and $m-h$) are tested using a two-sample t-test with unequal variances (Welch, 1947). The values in brackets are t-values associated with the respective tests.
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

TABLE B.18: Case (1): Cash holdings (real estate market, income distribution, taxes and sanctions: Approach 3).

Criterion ↓	Group →	l	m	h
	Signal 1 →	NO	NO	NO
	Signal 2 →	NO	NO	NO
`disOIN`	Mean	0.043	0.029	0.029
	Diff. $l-h$	0.014*** (4.18)		
	Diff. $l-m$	0.013*** (4.60)		
	Diff. $m-h$	0.001 (0.36)		
	Median	0.017	0.017	0.011
	N	580	1,581	593
`incTAX`	Mean	0.033	0.028	0.040
	Diff. $l-h$	-0.007 (-0.46)		
	Diff. $l-m$	0.005** (2.69)		
	Diff. $m-h$	0.006 (-0.82)		
	Median	0.015	0.018	0.009
	N	2,204	518	32
`sanc`	Mean	0.035	0.028	0.043
	Diff. $l-h$	-0.008** (-2.07)		
	Diff. $l-m$	-0.009 (0.48)		
	Diff. $m-h$	-0.009*** (-3.82)		
	Median	0.014	0.015	0.017
	N	253	1,885	616

Remark: Controls are assigned following the definition(s) on page 109. Diff. = $\text{Mean}_l - \text{Mean}_h \neq 0$ (analogously for $l-m$ and $m-h$) are tested using a two-sample t-test with unequal variances (Welch, 1947). The values in brackets are t-values associated with the respective tests.
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

TABLE B.19: Case (2): Cash holdings (real estate market, equity and debt: Approach 3).

Criterion ↓	Group →	*l*		*m*		*h*	
	Signal 1 →	NO	YES	NO	YES	NO	YES
	Signal 2 →	NO	NO	NO	NO	NO	NO
`minSCA`	Mean	0.029	0.024	0.045	0.071	0.036	0.040
	Diff.	0.005		-0.026		-0.004	
	t-value	1.19		-1.23		-0.27	
	Median	0.013	0.009	0.013	0.013	0.018	0.018
	N	1,541	128	311	22	278	21
`shaREQ`	Mean	0.032	0.025			0.032	0.034
	Diff.	0.007				-0.002	
	t-value	0.79				-0.32	
	Median	0.010	0.007			0.014	0.011
	N	565	38			1,565	133
`lisMAN`	Mean	0.028	0.024			0.042	0.056
	Diff.	0.004				-0.014	
	t-value	0.96				-1.06	
	Median	0.013	0.009			0.016	0.016
	N	1,470	128			660	43
`totLER`	Mean	0.033	0.034	0.022	0.007	0.002	n/a
	Diff.	0.003		-0.001		n/a	
	t-value	0.64		-0.09		n/a	
	Median	0.015	0.011	0.008	0.005	0.001	n/a
	N	1,875	157	251	14	4	n/a

Remark: Controls are assigned following the definition(s) on page 109. `s1REM` is used as *Signal 1*. Note, Diff. = $\text{Mean}_{\text{Not obs.}} - \text{Mean}_{\text{Obs.}} \neq 0$ within group l, m and h is tested using a two-sample t-test with unequal variances (Welch, 1947).
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

TABLE B.20: Case (2): Cash holdings (real estate market, income distribution, taxes and sanctions: Approach 3).

Criterion ↓	Group →	*l*		*m*		*h*	
	Signal 1 →	NO	YES	NO	YES	NO	YES
	Signal 2 →	NO	NO	NO	NO	NO	NO
`disOIN`	Mean	0.041	0.055	0.029	0.023	0.029	0.025
	Diff.	-0.014		0.006		0.004	
	t-value	-1.06		1.19		0.47	
	Median	0.017	0.016	0.013	0.009	0.011	0.025
	N	537	43	1,044	84	549	44
`incTAX`	Mean	0.033	0.033	0.026	0.017	0.040	n/a
	Diff.	-0.000		0.009		n/a	
	t-value	-0.10		1.56		n/a	
	Median	0.015	0.010	0.008	0.008	0.009	n/a
	N	1,855	157	243	14	32	n/a
`sanc`	Mean	0.035	0.032	0.028	0.025	0.046	0.062
	Diff.	0.004		0.007		-0.020	
	t-value	0.29		1.87		-1.26	
	Median	0.017	0.010	0.013	0.009	0.017	0.020
	N	226	27	1,508	116	396	28

Remark: Controls are assigned following the definition(s) on page 109. `s1REM` is used as *Signal 1*. Note, Diff. = $\text{Mean}_{\text{Not obs.}} - \text{Mean}_{\text{Obs.}} \neq 0$ within group l, m and h is tested using a two-sample t-test with unequal variances (Welch, 1947).
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

TABLE B.21: Case (2): Cash holdings (residential property prices, equity and debt: Approach 3).

Criterion ↓	Group → / *Signal 1* → / *Signal 2* →	*l* NO / NO	*l* YES / NO	*m* NO / NO	*m* YES / NO	*h* NO / NO	*h* YES / NO
`minSCA`	Mean	0.030	0.034	0.046	0.028	0.035	n/a
	Diff.	-0.006		0.018***		n/a	
	t-value	-1.28		2.89		n/a	
	Median	0.011	0.018	0.020	0.023	0.016	n/a
	N	1,548	116	404	19	882	n/a
`shaREQ`	Mean	0.032	0.034			0.033	0.032
	Diff.	-0.002				0.000	
	t-value	-0.30				0.03	
	Median	0.010	0.018			0.015	0.019
	N	552	33			1,780	102
`lisMAN`	Mean	0.028	0.033			0.043	n/a
	Diff.	-0.005				n/a	
	t-value	-1.20				n/a	
	Median	0.013	0.019			0.017	n/a
	N	1,633	135			699	n/a
`totLER`	Mean	0.033	0.034	0.022	n/a	0.036	0.025
	Diff.	-0.001		n/a		0.008	
	t-value	-0.04		n/a		1.25	
	Median	0.014	0.018	0.006	n/a	0.025	0.023
	N	1,916	116	236	n/a	180	19

Remark: Controls are assigned following the definition(s) on page 109. `s1RPP` is used as *Signal 1*. Note, Diff. $= \text{Mean}_{\text{Not obs.}} - \text{Mean}_{\text{Obs.}} \neq 0$ within group l, m and h is tested using a two-sample t-test with unequal variances (Welch, 1947).
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

TABLE B.22: Case (2): Cash holdings (residential property prices, income distribution, taxes and sanctions: Approach 3).

Criterion ↓	Group → / *Signal 1* → / *Signal 2* →	*l* NO / NO	*l* YES / NO	*m* NO / NO	*m* YES / NO	*h* NO / NO	*h* YES / NO
`disOIN`	Mean	0.044	n/a	0.029	0.032	0.028	0.034
	Diff.	n/a		-0.003		-0.005	
	t-value	n/a		-0.71		-0.78	
	Median	0.018	n/a	0.014	0.019	0.010	0.018
	N	559	n/a	1,221	102	552	33
`incTAX`	Mean	0.033	0.033	0.025	n/a	0.040	n/a
	Diff.	0.000		n/a		n/a	
	t-value	0.10		n/a		n/a	
	Median	0.015	0.018	0.008	n/a	0.009	n/a
	N	2,040	135	260	n/a	32	n/a
`sanc`	Mean	0.035	0.034	0.027	0.035	0.044	0.028
	Diff.	0.001		-0.006		0.016**	
	t-value	0.18		-1.10		2.72	
	Median	0.015	0.018	0.013	0.017	0.021	0.023
	N	220	33	1,523	83	589	19

Remark: Controls are assigned following the definition(s) on page 109. `s1RPP` is used as *Signal 1*. Note, Diff. $= \text{Mean}_{\text{Not obs.}} - \text{Mean}_{\text{Obs.}} \neq 0$ within group l, m and h is tested using a two-sample t-test with unequal variances (Welch, 1947).
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

TABLE B.23: Case (3): Cash holdings (equity and debt: Approach 3).

Criterion ↓	Group →	*l*		*m*		*h*	
	Signal 1 →	NO	NO	NO	NO	NO	NO
	Signal 2 →	NO	YES	NO	YES	NO	YES
minSCA	Mean	0.029	0.022	0.038	0.031	0.036	0.038
	Diff.	0.007**		0.009*		-0.002	
	t-value	2.12		1.95		-0.21	
	Median	0.014	0.009	0.018	0.020	0.020	0.016
	N	1,667	145	486	76	350	30
shaREQ	Mean	0.031	0.025			0.033	0.029
	Diff.	0.006*				0.005	
	t-value	1.69				1.28	
	Median	0.016	0.015			0.016	0.012
	N	761	82			1,742	169
lisMAN	Mean	0.029	0.023			0.042	0.040
	Diff.	0.006**				0.002	
	t-value	2.65				0.28	
	Median	0.016	0.012			0.016	0.017
	N	1,848	186			655	65
totLER	Mean	0.033	0.028	0.022	0.019	0.036	0.028
	Diff.	0.001		0.003		0.006	
	t-value	0.43		0.42		1.47	
	Median	0.016	0.013	0.006	0.007	0.025	0.023
	N	2,083	207	240	25	180	19

Remark: Controls are assigned following the definition(s) on page 109. `s2LB` is used as *Signal 2*. Note, Diff. = $\text{Mean}_{\text{Not obs.}} - \text{Mean}_{\text{Obs.}} \neq 0$ within group l, m and h is tested using a two-sample t-test with unequal variances (Welch, 1947).
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

TABLE B.24: Case (3): Cash holdings (income distribution, taxes and sanctions: Approach 3).

Criterion ↓	Group →	*l*		*m*		*h*	
	Signal 1 →	NO	NO	NO	NO	NO	NO
	Signal 2 →	NO	YES	NO	YES	NO	YES
disOIN	Mean	0.043	0.039	0.030	0.025	0.029	0.020
	Diff.	0.004		0.005		0.009**	
	t-value	0.44		1.48		2.38	
	Median	0.018	0.017	0.017	0.014	0.011	0.009
	N	523	57	1,439	142	541	52
incTAX	Mean	0.034	0.027	0.028	0.027	0.040	n/a
	Diff.	0.006*		0.001		n/a	
	t-value	1.86		0.17		n/a	
	Median	0.015	0.012	0.018	0.018	0.009	n/a
	N	2,008	196	463	55	32	n/a
sanc	Mean	0.037	0.024	0.029	0.025	0.044	0.035
	Diff.	0.012**		0.003		0.009*	
	t-value	2.12		0.88		1.69	
	Median	0.016	0.011	0.015	0.012	0.021	0.022
	N	222	31	1,727	158	554	62

Remark: Controls are assigned following the definition(s) on page 109. `s2LB` is used as *Signal 2*. Note, Diff. = $\text{Mean}_{\text{Not obs.}} - \text{Mean}_{\text{Obs.}} \neq 0$ within group l, m and h is tested using a two-sample t-test with unequal variances (Welch, 1947).
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table B.25: Regression: Real estate market and Lehman Brothers (Approach 1) (panel 2).

casHOL	(8)	(9)	(10)	(11)	(12)
size	-0.008***	-0.008***	-0.008***	-0.008***	-0.007***
	(-6.85)	(-7.65)	(-8.80)	(-8.43)	(-7.73)
totLEV	-0.035***	-0.034***	-0.039***	-0.033***	-0.031***
	(-4.27)	(-4.30)	(-4.72)	(-4.11)	(-3.86)
retAST	-0.023	-0.033	-0.023	-0.035	-0.033
	(-1.03)	(-1.43)	(-0.99)	(-1.56)	(-1.46)
retSAL	-0.006***	-0.007***	-0.006***	-0.007***	-0.007***
	(-3.21)	(-3.51)	(-3.20)	(-3.44)	(-3.47)
s2LB	-0.002	-0.002	-0.001	0.002	-0.002
	(-0.45)	(-0.52)	(-0.35)	(-0.48)	(-0.52)
s1REM	-0.001	-0.001	-0.001	-0.001	-0.001
	(-0.31)	(-0.18)	(-0.35)	(-0.30)	(-0.31)
s1REM × s2LB	-0.003	-0.003	-0.003***	-0.004	-0.004
	(-0.22)	(-0.25)	(-0.23)	(-0.33)	(-0.33)
cons	0.112***	0.110***	0.086***	0.126***	0.089***
	(7.47)	(11.79)	(10.22)	(13.42)	(7.67)
Controls:					
Company FE	NO	NO	NO	NO	NO
Country FE	NO	NO	NO	NO	NO
Equity	YES	YES	NO	NO	NO
Debt	YES	NO	YES	NO	NO
Distribution	YES	NO	NO	YES	NO
Taxes	YES	NO	NO	NO	YES
Sanctions	YES	YES	YES	YES	YES
N	2,654	2,654	2,654	2,654	2,654
AIC	-8,475	-8,409	-8,454	8,408	8,410
BIC	-8,369	-8,338	-8,383	8,337	8,339
R^2	0.136	0.110	0.125	0.110	0.110

Remark: Controls are assigned following the definition(s) on page 109. s1REM is used as *Signal 1* and s2LB as *Signal 2*. The Hausman-test strongly suggests the use of fixed effects ($p < 0.0000$) (Hausman, 1978).
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

TABLE B.26: Regression: Real estate market and Lehman Brothers (Approach 2) (panel 1).

casHOL	(13)	(14)	(15)	(16)	(17)	(18)
size	-0.008***	-0.008***	-0.008***	-0.008***	-0.008***	-0.008***
	(-7.68)	(-8.70)	(-8.57)	(-8.49)	(-9.14)	(-7.07)
totLEV	-0.035***	-0.041***	-0.035***	-0.034***	-0.032***	-0.035***
	(-4.66)	(-5.18)	(-4.61)	(-4.48)	(-4.06)	(-4.44)
retAST	-0.028	-0.014	-0.031	-0.029	-0.038*	-0.026
	(-1.29)	(-0.65)	(-1.42)	(-1.36)	(-1.73)	(-1.17)
retSAL	-0.007***	-0.007***	-0.007***	-0.007***	-0.007***	-0.006***
	(-3.51)	(-3.35)	(-3.49)	(-3.55)	(-3.49)	(-3.19)
s2LB	-0.001	0.000	-0.001	0.023***	-0.002	-0.001
	(-0.27)	(0.05)	(-0.26)	(-0.30)	(-0.46)	(-0.30)
s1REM	-0.001	-0.001	-0.001	-0.001	-0.000	-0.001
	(-0.18)	(-0.26)	(-0.14)	(-0.16)	(-0.05)	(-0.23)
s1REM $\times$ s2LB	-0.005	-0.004	-0.006	-0.032***	-0.004	-0.003
	(-0.44)	(-0.34)	(-0.49)	(-0.45)	(-0.37)	(-0.24)
cons	0.108***	0.077***	0.108***	0.104***	0.104***	0.061***
	(12.27)	(8.68)	(14.30)	(11.87)	(12.90)	(4.47)
Controls:						
Company FE	NO	NO	NO	NO	NO	NO
Country FE	NO	NO	NO	NO	NO	NO
Equity	YES	NO	NO	NO	NO	YES
Debt	NO	YES	NO	NO	NO	YES
Distribution	NO	NO	YES	NO	NO	YES
Taxes	NO	NO	NO	YES	NO	YES
Sanctions	NO	NO	NO	NO	YES	YES
N	2,807	2,807	2,807	2,807	2,807	2,807
AIC	-8,944	-8,986	-8,945	-8,943	-8,956	9,033
BIC	-8,885	-8,926	-8,886	-8,884	-8,897	8,926
R^2	0.101	0.114	0.101	0.100	0.105	0.134

Remark: Controls are assigned following the definition(s) on page 109. s1REM is used as *Signal 1* and s2LB as *Signal 2*. The Hausman-test strongly suggests the use of fixed effects ($p < 0.0000$) (Hausman, 1978).
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table B.27: Regression: Real estate market and Lehman Brothers (Approach 2) (panel 2).

casHOL	(19)	(20)	(21)	(22)
size	-0.008***	-0.008***	-0.008***	-0.007***
	(-8.06)	(-8.93)	(-8.99)	(-7.80)
totLEV	-0.033***	-0.038***	-0.035***	-0.030***
	(-4.36)	(-4.81)	(-4.11)	(-3.84)
retAST	-0.036*	-0.024	-0.031	-0.035
	(-1.65)	(-1.08)	(-1.76)	(-1.60)
retSAL	-0.007***	-0.006***	-0.007***	-0.007***
	(-3.44)	(-3.21)	(-3.41)	(-3.45)
s2LB	-0.001	-0.001	-0.001	-0.002
	(-0.44)	(-0.21)	(-0.45)	(-0.47)
s1REM	-0.000	-0.001	-0.001	-0.001
	(-0.07)	(-0.20)	(-0.09)	(-0.15)
s1REM × s2LB	-0.004	-0.002	-0.006	-0.004
	(-0.34)	(-0.21)	(-0.38)	(-0.37)
cons	0.106***	0.076***	0.107***	0.086***
	(11.78)	(7.76)	(12.70)	(7.53)
Controls:				
Company FE	NO	NO	NO	NO
Country FE	NO	NO	NO	NO
Equity	YES	NO	NO	NO
Debt	NO	YES	NO	NO
Distribution	NO	NO	YES	NO
Taxes	NO	NO	NO	YES
Sanctions	YES	YES	YES	YES
N	2,807	2,807	2,807	2,807
AIC	-8,958	-9,013	-8,962	-8,966
BIC	-8,887	-8,943	-8,891	-8,894
R^2	0.107	0.124	0.108	0.109

Remark: Controls are assigned following the definition(s) on page 109. s1REM is used as *Signal 1* and s2LB as *Signal 2*. The Hausman-test strongly suggests the use of fixed effects ($p < 0.0000$) (Hausman, 1978).

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table B.28: Regression: Real estate market and Lehman Brothers (Approach 3) (panel 1).

casHOL	(23)	(24)	(25)	(26)	(27)	(28)
size	-0.008***	-0.008***	-0.008***	-0.008***	-0.008***	-0.008***
	(-6.48)	(-7.91)	(-6.96)	(-7.68)	(-7.77)	(-6.18)
totLEV	-0.026***	-0.029***	-0.026***	-0.025***	-0.020**	-0.022**
	(-2.98)	(-3.31)	(-3.15)	(-2.97)	(-2.34)	(-2.48)
retAST	-0.032	0.037	0.027	0.030	-0.025	0.030
	(1.20)	(1.40)	(1.03)	(1.14)	(0.95)	(1.10)
retSAL	-0.007***	-0.008***	-0.007***	-0.008***	-0.008***	-0.007***
	(-3.19)	(-3.02)	(-3.09)	(-3.20)	(-3.17)	(-2.95)
s2LB	-0.004	0.004	-0.004	-0.004	-0.005*	-0.006**
	(-1.35)	(-1.25)	(-1.28)	(-1.39)	(-1.71)	(-2.05)
s1REM	-0.001	-0.002	-0.001	-0.001	-0.001	-0.003
	(-0.35)	(-0.50)	(-0.31)	(-0.34)	(-0.29)	(-0.64)
s1REM × s2LB	-0.001	-0.002	-0.000	0.001	0.004	0.004
	(0.08)	(0.07)	(-0.02)	(0.09)	(0.30)	(0.26)
cons	0.104***	0.084***	0.101***	0.103***	0.108***	0.117***
	(9.47)	(7.47)	(10.44)	(10.00)	(12.40)	(5.86)
Controls:						
Company FE	NO	NO	NO	NO	NO	NO
Country FE	NO	NO	NO	NO	NO	NO
Equity	YES	NO	NO	NO	NO	YES
Debt	NO	YES	NO	NO	NO	YES
Distribution	NO	NO	YES	NO	NO	YES
Taxes	NO	NO	NO	YES	NO	YES
Sanctions	NO	NO	NO	NO	YES	YES
N	2,293	2,293	2,293	2,293	2,293	2,293
AIC	-7,323	-7,349	-7,330	-7,322	-7,345	7,407
BIC	-7,265	-7,291	-7,272	-7,265	-7,288	7,304
R^2	0.091	0.101	0.094	0.091	0.100	0.130

Remark: Controls are assigned following the definition(s) on page 109. s1REM is used as *Signal 1* and s2LB as *Signal 2*. The Hausman-test strongly suggests the use of fixed effects ($p < 0.0000$) (Hausman, 1978).
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

TABLE B.29: Regression: Real estate market and Lehman Brothers (Approach 3) (panel 2).

casHOL	(29)	(30)	(31)	(32)
size	-0.008***	-0.008***	-0.008***	-0.007***
	(-6.67)	(-7.86)	(-7.23)	(-6.71)
totLEV	-0.023***	-0.024***	-0.017**	-0.018**
	(-2.63)	(-2.70)	(-2.03)	(-2.05)
retAST	0.027	0.030	-0.024	-0.027
	(1.02)	(1.11)	(0.91)	(0.99)
retSAL	-0.008***	-0.007***	-0.007***	-0.007***
	(-3.22)	(-2.94)	(-3.10)	(-3.12)
s2LB	0.005	-0.005	-0.006**	-0.005*
	(0.72)	(-1.61)	(-1.97)	(-1.73)
s1REM	-0.001	-0.002	-0.002	-0.002
	(-0.30)	(-0.43)	(-0.46)	(-0.36)
s1REM × s2LB	-0.012	-0.004	-0.007	0.004
	(-1.56)	(0.31)	(0.23)	(0.27)
cons	0.108***	0.097***	0.116***	0.108***
	(12.40)	(8.52)	(12.80)	(6.75)
Controls:				
Company FE	NO	NO	NO	NO
Country FE	NO	NO	NO	NO
Equity	YES	NO	NO	NO
Debt	NO	YES	NO	NO
Distribution	NO	NO	YES	NO
Taxes	NO	NO	NO	YES
Sanctions	YES	YES	YES	YES
N	2,293	2,293	2,293	2,293
AIC	-7,350	-7,380	-7,375	-7,350
BIC	-7,281	-7,311	-7,306	-7,282
R^2	0.103	0.115	0.113	0.104

Remark: Controls are assigned following the definition(s) on page 109. s1REM is used as *Signal 1* and s2LB as *Signal 2*. The Hausman-test strongly suggests the use of fixed effects ($p < 0.0000$) (Hausman, 1978).
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

TABLE B.30: Comparison of results for `s1REM` and `s2LB` in Approach 2 (Case (2), (3) and (4)).

No.	Controls	p-value			Test	
		`s1REM`	`s2LB`	`s1REM`×`s2LB`	p-value	coefficient
(13)	Equity	0.729	0.177	0.934	0.832	-0.003
(14)	Debt	0.920	0.718	0.850	0.760	-0.003
(15)	Distribution	0.888	0.797	0.797	0.557	-0.007
(16)	Taxes	0.872	0.762	0.649	0.574	-0.006
(17)	Sanctions	0.960	0.646	0.714	0.602	-0.006
(18)	All, except firm/country	0.818	0.766	0.813	0.737	-0.004
(19)	Equity/Sanctions	0.947	0.660	0.733	0.625	-0.005
(20)	Debt/Sanctions	0.840	0.831	0.832	0.775	-0.003
(21)	Distribution/Sanctions	0.932	0.653	0.705	0.594	-0.006
(22)	Taxes/Sanctions	0.883	0.641	0.714	0.599	-0.006

Remark: Values in the table represent p-values of regressions (13) to (22). P-values below 0.05 (**) are highlighted in italic and p-values below 0.01 (***) are highlighted in bold and italic. Note, the test in the last two columns is to check whether there is a cash effect ($\beta_5 + \beta_7 = 0$).

TABLE B.31: Comparison of results for `s1REM` and `s2LB` in Approach 3 (Case (2), (3) and (4)).

No.	Controls	p-value			Test	
		`s1REM`	`s2LB`	`s1REM`×`s2LB`	p-value	coefficient
(23)	Equity	0.797	0.957	0.735	0.740	-0.004
(24)	Debt	0.618	0.212	0.942	0.840	-0.003
(25)	Distribution	0.756	0.201	0.982	0.762	-0.004
(26)	Taxes	0.736	0.164	0.927	0.831	-0.003
(27)	Sanctions	0.774	0.087	0.767	0.933	-0.001
(28)	All, except firm/country	0.520	*0.040*	0.793	0.854	-0.003
(29)	Equity/Sanctions	0.767	0.080	0.746	0.953	-0.001
(30)	Debt/Sanctions	0.664	0.107	0.755	0.964	-0.001
(31)	Distribution/Sanctions	0.646	*0.049*	0.816	0.834	-0.003
(32)	Taxes/Sanctions	0.719	0.084	0.785	0.908	-0.002

Remark: Values in the table represent p-values of regressions (23) to (32). P-values below 0.05 (**) are highlighted in italic and p-values below 0.01 (***) are highlighted in bold and italic. Note, the test in the last two columns is to check whether there is a cash effect ($\beta_5 + \beta_7 = 0$).

Table B.32: Regression: Residential property prices and Lehman Brothers (Approach 1) (panel 1).

casHOL	(33)	(34)	(35)	(36)	(37)	(38)
size	-0.013***	-0.008***	-0.008***	-0.008***	-0.008***	-0.008***
	(-2.72)	(-7.45)	(-8.75)	(-9.28)	(-8.91)	(-9.02)
totLEV	-0.057***	-0.028***	-0.027***	-0.032***	-0.026***	-0.028***
	(-3.73)	(-3.64)	(-3.87)	(-4.35)	(-3.99)	(-4.24)
retAST	0.003	-0.022	-0.019	-0.011	-0.018	-0.019
	(0.16)	(-1.12)	(-0.92)	(-0.53)	(-0.86)	(-0.91)
retSAL	-0.002	-0.005***	-0.006***	-0.006***	-0.006***	-0.006***
	(-1.52)	(-3.39)	(-3.48)	(-3.24)	(-3.43)	(-3.50)
s2LB	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
	(-0.30)	(-0.19)	(-0.38)	(-0.35)	(-0.33)	(-0.39)
s1RPP	0.003	0.003	0.002	0.002	0.001	0.001
	(1.03)	(0.80)	(0.66)	(0.54)	(0.39)	(0.27)
s1RPP × s2LB	-0.011	-0.015***	-0.018***	-0.018***	-0.019***	-0.019***
	(-1.53)	(-3.29)	(-3.79)	(-3.81)	(-3.97)	(-3.98)
cons	0.147***	0.085***	0.106***	0.099***	0.104***	0.082***
	(4.41)	(9.28)	(12.78)	(13.96)	(14.30)	(9.63)
Controls:						
Company FE	YES	NO	NO	NO	NO	NO
Country FE	NO	YES	NO	NO	NO	NO
Equity	NO	NO	YES	NO	NO	NO
Debt	NO	NO	NO	YES	NO	NO
Distribution	NO	NO	NO	NO	YES	NO
Taxes	NO	NO	NO	NO	NO	YES
Sanctions	NO	NO	NO	NO	NO	NO
N	3,174	3,174	2,975	2,975	2,975	2,975
AIC	-12,686	-10,510	-9,595	-9,621	-9,596	-9,619
BIC	-12,643	-10,382	-9,534	-9,561	-9,536	9,559
R^2	0.081	0.157	0.094	0.102	0.095	0.102

Remark: Controls are assigned following the definition(s) on page 109. s1RPP is used as *Signal 1* and s2LB as *Signal 2*. The Hausman-test strongly suggest the use of fixed effects ($p < 0.0000$) (Hausman, 1978). The between R^2 is 0.117 and within R^2 is 0.081.
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table B.33: Regression: Residential property prices and Lehman Brothers (Approach 1) (panel 2).

casHOL	(39)	(40)	(41)	(42)	(43)	(44)
size	-0.008***	-0.008***	-0.008***	-0.008***	-0.008***	-0.008***
	(-9.58)	(-7.37)	(-8.96)	(-9.13)	(-9.07)	(-8.73)
totLEV	-0.026***	-0.032***	-0.028***	-0.033***	-0.025***	-0.027***
	(-3.73)	(-4.17)	(-3.80)	(-4.38)	(-3.55)	(-3.93)
retAST	-0.025	-0.020	-0.025	-0.018	-0.023	-0.026
	(-1.18)	(-0.98)	(-1.17)	(-0.86)	(-1.10)	(-1.26)
retSAL	-0.006***	-0.005***	-0.002***	-0.006***	-0.006***	-0.006***
	(-3.41)	(-3.18)	(-3.44)	(-3.14)	(-3.38)	(-3.47)
s2LB	-0.002	-0.001	0.004	-0.001	-0.001	-0.002
	(-0.49)	(-0.40)	(-0.46)	(-0.45)	(-0.40)	(-0.56)
s1RPP	0.004	0.001	0.004	0.004	0.002	0.002
	(0.99)	(0.28)	(1.04)	(-1.10)	(0.68)	(0.62)
s1RPP × s2LB	-0.017***	-0.016***	-0.017***	-0.016***	-0.018***	-0.018***
	(-3.67)	(-3.49)	(-3.56)	(-3.44)	(-3.84)	(-3.74)
cons	0.099***	0.114***	0.103***	0.089***	0.098***	0.070***
	(12.79)	(10.42)	(11.96)	(11.70)	(12.56)	(7.40)
Controls:						
Company FE	NO	NO	NO	NO	NO	NO
Country FE	NO	NO	NO	NO	NO	NO
Equity	NO	YES	YES	NO	NO	NO
Debt	NO	YES	NO	YES	NO	NO
Distribution	NO	YES	NO	NO	YES	NO
Taxes	NO	YES	NO	NO	NO	YES
Sanctions	YES	YES	YES	YES	YES	YES
N	2,975	2,975	2,975	2,975	2,975	2,975
AIC	-9,605	-9,714	-9,605	-9,641	-9,607	-9,642
BIC	-9,545	-9,606	-9,533	-9,569	-9,535	-9,570
R^2	0.097	0.135	0.099	0.110	0.099	0.110

Remark: Controls are assigned following the definition(s) on page 109. s1RPP is used as *Signal 1* and s2LB as *Signal 2*. The Hausman-test strongly suggests the use of fixed effects ($p < 0.0000$) (Hausman, 1978).
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

TABLE B.34: Regression: Size, real estate market and Lehman Brothers (Approach 1) (panel 1).

	(45)		(46)		(47)	
casHOL	*u*	*c*	*u*	*c*	*u*	*c*
size	0.006***	-0.029***	0.005**	-0.027***	0.005***	-0.029***
	(2.73)	(-7.11)	(2.32)	(-6.60)	(2.53)	(-7.23)
totLEV	-0.004	-0.047***	-0.018	-0.048***	-0.017**	-0.041***
	(-0.43)	(-3.68)	(-1.46)	(-3.76)	(-2.03)	(-3.29)
retAST	-0.062**	0.024	-0.062**	0.021	-0.074**	0.030
	(-2.06)	(0.67)	(-1.99)	(0.58)	(-2.43)	(0.81)
retSAL	-0.001	-0.008***	-0.001	-0.008***	-0.001	-0.008***
	(-0.85)	(-2.81)	(-0.56)	(-2.77)	(-0.79)	(-2.79)
s2LB	-0.005	0.005	-0.003	-0.005	-0.004	-0.006
	(-1.23)	(0.63)	(-0.97)	(0.58)	(-1.19)	(0.71)
s1RPP	0.006	-0.014	0.007	-0.012	0.008*	-0.017
	(1.18)	(-1.24)	(1.53)	(-1.08)	(1.76)	(-1.50)
s1RPP $\times$ s2LB	-0.014**	-0.046***	-0.015***	-0.037**	-0.012**	-0.044***
	(-2.45)	(-2.88)	(-2.81)	(-2.52)	(-2.38)	(-2.76)
cons	-0.022	0.222***	-0.009	0.187***	-0.000	0.216***
	(-1.20)	(10.05)	(-0.47)	(8.92)	(-0.02)	(9.87)
Controls:						
Company FE	NO	NO	NO	NO	NO	NO
Country FE	NO	NO	NO	NO	NO	NO
Equity	YES	YES	NO	NO	NO	NO
Debt	NO	NO	YES	YES	NO	NO
Distribution	NO	NO	NO	NO	YES	YES
Taxes	NO	NO	NO	NO	NO	NO
Sanctions	NO	NO	NO	NO	NO	NO
N	958	742	958	742	958	742
AIC	-3,819	-1,880	-3,812	-1,843	-3,827	-1,881
BIC	-3,770	-1,834	-3,763	-1,889	-3,778	-1,835
R^2	0.033	0.187	0.023	0.196	0.039	0.187

Remark: Groups are assigned by using the top/bottom three deciles of totAST, and controls are assigned following the definition(s) on page 109. s1RPP is used as *Signal 1* and s2LB as *Signal 2*. The Hausman-test strongly suggests the use of fixed effects ($p < 0.0000$) (Hausman, 1978).
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table B.35: Regression: Size, real estate market and Lehman Brothers (Approach 1) (panel 2).

	(48)		(49)		(50)	
casHOL	*u*	*c*	*u*	*c*	*u*	*c*
size	-0.006***	-0.030***	0.005**	-0.028***	0.005**	-0.028***
	(2.66)	(-7.54)	(2.53)	(-6.68)	(2.56)	(-6.87)
totLEV	-0.020**	-0.038***	-0.017*	-0.042***	-0.026**	-0.040***
	(-2.13)	(-3.06)	(-1.79)	(-3.31)	(-2.00)	(-3.11)
retAST	-0.052*	0.026	-0.076**	0.014	-0.068**	0.041
	(-1.68)	(0.70)	(-2.49)	(0.36)	(-2.17)	(1.11)
retSAL	-0.000	-0.007***	-0.001***	-0.008***	-0.000	-0.006***
	(-0.28)	(-2.61)	(-0.85)	(-2.82)	(-0.02)	(-2.29)
s2LB	-0.003	0.007	-0.004	0.005	-0.005	0.008
	(-0.84)	(0.80)	(-1.13)	(0.53)	(-1.22)	(0.97)
s1RPP	0.005	-0.011	0.008	-0.012	0.006	-0.014
	(1.14)	(-0.94)	(1.78)	(-0.97)	(1.32)	(-1.16)
s1RPP × s2LB	-0.016***	-0.043***	-0.011*	-0.039**	-0.010*	-0.034**
	(-3.00)	(-2.85)	(-1.71)	(-2.53)	(-1.71)	(-2.22)
cons	-0.021	0.321***	-0.006	0.215***	0.013	0.304***
	(-1.22)	(7.00)	(-0.37)	(10.62)	(0.77)	(6.88)
Controls:						
Company FE	NO	NO	NO	NO	NO	NO
Country FE	NO	NO	NO	NO	NO	NO
Equity	NO	NO	NO	NO	YES	YES
Debt	NO	NO	NO	NO	YES	YES
Distribution	NO	NO	NO	NO	YES	YES
Taxes	YES	YES	NO	NO	YES	YES
Sanctions	NO	NO	YES	YES	YES	YES
N	958	742	958	742	958	742
AIC	-3,821	-1,856	-3,823	-1,876	-3,881	-1,927
BIC	-3,772	-1,902	-3,775	-1,830	-3,793	-1,844
R^2	0.032	0.210	0.035	0.182	0.106	0.252

Remark: Groups are assigned by using the top/bottom three deciles of totAST, and controls are assigned following the definition(s) on page 109. s1REM is used as *Signal 1* and s2LB as *Signal 2*. The Hausman-test strongly suggests the use of fixed effects ($p < 0.0000$) (Hausman, 1978).
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

TABLE B.36: Regression: REIT (Model specification).

casHOL	(33)	(51)	(52)
size	-0.013***	-0.013***	-0.014***
	(-2.72)	(-2.85)	(-2.95)
totLEV	-0.057***		
	(-3.73)		
$\texttt{totLEV}^2$		-0.043***	
		(-3.44)	
$\texttt{totLEV}^4$			-0.039***
			(-2.79)
retAST	0.003		
	(0.16)		
$\texttt{retAST}^2$		0.175	
		(1.55)	
$\texttt{retAST}^4$			2.715
			(1.26)
retSAL	-0.002	-0.002	-0.001
	(-1.52)	(-1.56)	(-1.40)
s2LB	0.001	-0.001	-0.001
	(0.30)	(-0.40)	(-0.54)
s1RPP	0.003	0.003	0.003
	(1.03)	(1.14)	(1.19)
s1RPP × s2LB	-0.011	-0.010	-0.010
	(-1.53)	(-1.49)	(-1.43)
cons	0.147***	0.135***	0.134***
	(4.41)	(4.06)	(3.98)
Controls:			
Company FE	YES	YES	YES
Country FE	NO	NO	NO
Equity	NO	NO	NO
Debt	NO	NO	NO
Distribution	NO	NO	NO
Taxes	NO	NO	NO
Sanctions	NO	NO	NO
N	3,174	3,174	3,174
AIC	-12,686	-12,656	-12,631
BIC	-12,643	-12,614	-12,588
R^2	0.081	0.077	0.074

Remark: Controls are assigned following the definition(s) on page 109. s1RPP is used as *Signal 1*. s2LB is used as *Signal 2* in every regression. The Hausman-test strongly suggests the use of fixed effects ($p < 0.0000$) (Hausman, 1978).
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Appendix C

Data Appendix

Table C.1: Sources of data samples (1).

Title	Data	Author/Organization	Chapter	Page(s)	Comment
Dates of banking crises	Dates of events	Von Hagen and Ho (2007), Caprio and Klingebiel (1996a,b), Kaminsky and Reinhart (1999), Reinhart and Rogoff (2009), Demirgüç-Kunt and Detragiache (1998)	2.5	31	
Lehman Brothers and the US-equity market	Stock market data (S&P 500 Composite Price Index; MSCI World USD Price Index)	Thomson Reuters Datastream, SEC (2008)	2.5	36	Access Date: 07.02.2017
Real GDP and total credit in the US	Real GDP, Bank Credit of All Commercial Banks	Board of Governors of the Federal Reserve System (US) and US. Bureau of Economic Analysis	2.6	38	retrieved from Federal Reserve Bank of St. Louis. Access Date: 16.12.2016
- - -	- - -	- - -	- - -	- - -	- - -
Europe: Accounting and firm-level market data	Bloomberg	Bloomberg L.P.	3.1.2*,3.2	47*,64-95	Access Date: 25.09.2013
US: Accounting and firm-level market data	Compustat database	S&P's	3.1.2*,3.2	47*,64-95	Access Date: 23.02.2016
Various inflation rates		International Monetary Fund, International Financial Statistics, World Bank	3.1.2*,3.2	47*,64-95,	retrieved from Federal Reserve Bank of World Bank. Access Date: 03.01.2017
Signal 2	Data on banking crisis events	Reinhart and Rogoff (2009), Reinhart (2010), Reinhart and Rogoff (2014)	3.1.2*	47*,64,64-95	
Industry Classification Benchmark	Industry classification in Bloomberg	FTSE International Limited; Frank Russell Company	3.1.2*	48*	
Global Industry Classification Standard	Industry classification in Compustat	MSCI Inc.; S&P Dow Jones Indices LLC	3.1.2*	48*	
Domestic listed companies	Number of listed firms for United States, Canada and Mexico: 1997 to 2014	The World Bank	15	60	Access Date: 01.02.2013; latest update: 25.01.2018

Remark: The table consists of third party data which has been visualized in a different way or which has been used in my own empirical analysis. The different chapters are separated by a dashed line. (* first mentioning of/ reference to the data)

TABLE C.1: Sources of data samples (2).

Title	Data	Author/Organization	Chapter	Page(s)	Comment
GDP (current US$)	GDP in current US$ for United States, Canada and Mexico: 1997 to 2014	The World Bank	16	60	Access Date: 01.02.2013; latest update: 25.01.2018
Signal 1	Various stock market indices (sorted by country name): ATX, BEL20, CROBEX, CYFT, OMXC20, OMXH25, PAX, DAX, ATHEX, ISEQ20, FTSE MIB, AEX, OBX, WIG, PSI20, SBITOP, IBEX, OMXS30, SMI and S&P500	Thomson Reuters Datastream	3.1.2*,3.2	53*,64-95	Access Date: 23.02.2017
Signal 1	MSCI International United States Real Estate Price Index, MSCI International Europe Industry Group - Real Estate	Thomson Reuters Datastream	3.1.2*	53*,64-95	Access Date: 23.02.2017
Composite Indicator of Systemic Stress	Index to measure financial stress in Europe	European Central Bank, Holló et al. (2012)	3.1.2*,3.2	47*,58,64-95	Access Date: 27.02.2017
St. Louis Fed Financial Stress Index	Index to measure financial stress in the US	Federal Reserve Bank of St. Louis (2017)	3.1.2*,3.2	47*,58,64-95	Access Date: 27.04.2017
- - -	- - -	- - -	- - -	- - -	- - -
Accounting and firm-level market data	Compustat database	S&P's	4.1.2*,4.2	99*,114-136	Access Date: 23.02.2016
Various inflation rates		International Monetary Fund, International Financial Statistics, World Bank	4.1.2*,4.2	99*,114-136	retrieved from Federal Reserve Bank of World Bank. Access Date: 03.01.2017
Signal 1	Various real estate indices (sorted by region): Thomson Reuters Asia Pacific Real Estate Index, MSCI International Australia Industry Group - Real Estate Price, FTSE EPRA/NAREIT Belgium/Luxembourg Index, S&P/TSE Canadian Real Estate Index, MSCI International Europe Real Estate Price, FTSE EPRA/NAREIT France Index (...)	Thomson Reuters Datastream a. o.	4.1.2*, 4.2	102*,114-136	Access Date: 13.10.2017

Remark: The table consists of third party data which has been visualized in a different way or which has been used in my own empirical analysis. The different chapters are separated by a dashed line. (* first mentioning of/ reference to the data)

Table C.1: Sources of data samples (3).

Title	Data	Author/Organization	Chapter	Page(s)	Comment
Signal 1	(...) Hang Seng REIT Index, S&P Malaysia REIT Index, Dow Jones Middle East & Africa Select REIT Index, FTSE EPRA/NAREIT Netherlands Index, SGX Real Estate 20 Index, Thomson Reuters South Africa Real Estate Index, Thomson Reuters Thailand Commercial REITs Index, FTSE 350 Real Estate Index and Dow Jones US Real Estate Index	Thomson Reuters Datastream,	4.1.2*, 4.2	102*,114-136	Access Date: 13.10.2017
Signal 1	Various indices of residential property prices for Australia, Belgium, Canada, Euro Area, France, Hong Kong, Japan, Malaysia, Netherlands, New Zealand, Singapore, South Africa, Bangkok/Thailand, Turkey, United Kingdom and USA	Bank for International Settlements	4.1.2*, 4.2	102*,114-136	retrieved from Federal Reserve Bank of St. Louis. Access Date: 13.10.2017
Regulations	EPRA Global REIT Survey 2007-2014, Progress on REIT Regimes in Europe 2006, European REIT Regimes and the Impact of the EC Treaty Freedoms 2005, EPRA Global REIT Survey 2004 and EPRA REIT Survey 2003	European Public Real Estate Association, Loyens & Loeff, Ernst & Young, Jones Day and Loyens Winaday Loyens	4.1.2*, 4.2	106*,114-136	retrieved from EPRA. Access Date: 13.10.2017

Remark: The table consists of third party data which has been visualized in a different way or which has been used in my own empirical analysis. The different chapters are separated by a dashed line. (* first mentioning of/ reference to the data)

TABLE C.2: Adapted from Bloomberg: Accounting definitions.

Item	Name	Label change	Definition
BS010	Cash and near cash items	cash	Cash in vaults and deposits in banks: including short-term investments (maturity < 90 days) and excluding restricted cash.
BS015	Total Current Assets	curAST	Summation of cash & cash equivalents, marketable securities & other short-term investments, accounts & notes receivable, inventories, and other current asstets.
BS035	Total assets	totAST	The total of all short- and long-term assets as reported on the balance sheet.
BS050	Current Liabilities	curLIA	The summation of accounts payable, short-term borrowings, and other short-term liabilities.
CF017	Capital Expenditures/Property Additions	capEXP	Purchase of (tangible) fixed assets. Excludes purchases of investments.
IS010	Sales, revenue, turnover	sales	Total of operating revenues less various adjustments to gross sales. Adjustments: returns, discounts allowances, excise taxes, insurance charges, sales taxes, and value added taxes. Includes revenues from financial subsidiaries in industrial companies if the consolidation includes those subsidiaries throughout the report. Excludes inter-company revenue and revenues from discontinued operations. Includes subsidies from federal or local government in certain industries.
IS050	Net income/net profit (loses)	netINC	The profit after all expenses have been deducted. Includes the effects of all one-time, non-recurring, and extraordinary gains, losses, or charges.
RR005	Total liabilities	totLIA	The sum of all current and non-current liabilities.
RR007	Total Shareholders Equity	totEQU	Total equity is computed as follows:common equity plus minority interest plus preferred equity.
RR010	Total Common Equity	comEQU	Total common equity is calculated using the following formula: share capital and APIC plus retained earnings.
RR902	Current market capitalization	marCAP	Total current market value of all of a company's outstanding shares stated in the pricing currency.

Remark: The table displays information given by the Bloomberg system. The main definitions are only altered for convenience. Value are denoted in denoted in Euro and converted per year-end exchange rate. Prior to the introduction of the Euro, currency are converted at a fixed rate (Author's assumption). Label changes are listed in the third column.

TABLE C.3: Adapted from Compustat: Accounting definitions.

Item number or mnemonic	Name	Label change	Definition
A162/CH	Cash	cash	A162 is calculated as the sum of bank drafts, cash, checks, demand certificates of deposit, demand deposits, letters of credit, and money orders.
A6/AT	Assets - Total	totAST	The total of all short- and long-term assets as reported on the balance sheet.
A5/LCT	Current Liabilities	curLIA	The total of all short-term debt including the current portion of long-term debt.
A128/CAPX	Capital Expenditures	capEXP	Item A128 is defined as the cash outflow used for additions of property, plant and equipment.
A12/SALE	Sales (Net)	sales	Gross sales minus cash discounts, trade discounts, and returned sales and allowances for which credit is given to customers.
A172/NI	Net Income (Loss)	netINC	This item represents the income or loss reported by a company after expenses and losses have been subtracted from all revenues and gains for the fiscal period including extraordinary items and discontinued operations.
LT	Liabilities - Total	totLIA	This item represents current liabilities plus long-term debt plus other non-current liabilities, including deferred taxes and investment tax credit.
TEQ	Stockholders' Equity - Total	totSTE	This item represents the common equity, preferred equity and non-redeemable non-controlling interest of a company.
A60/CEQ	Common Equity - Total	comEQU	This item represents the common shareholders' interest in the company. This item includes 1. Common stock outstanding (including treasury stock adjustments) 2. Capital surplus 3. Retained earnings 4.Treasury stock adjustments for both common and non-redeemable preferred stock.
SPDRC	S&P Domestic Long-Term Issuer Credit Rating	ratDLT	The rating reflects a current opinion of the overall creditworthiness of an issuer and is not limited to the repayment of individual obligations.
SPDRM	S&P Domestic Short-Term Issuer Credit Rating	ratDST	See SPDRC.
A19/DVP	Cash Dividends	divPCA	This item represents the total amount of the preferred dividend requirement on cumulative preferred stock and dividends paid on non-cumulative preferred stock of the company during the year.

Remark: The table displays information given by the Compustat system. The main definitions are only altered for convenience. Value are denoted in denoted in Dollar. Label changes are listed in the third column.

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