Capital Market Access and Cash Flow Allocation during the Financial Crisis

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Abstract

Being a publicly listed firm is associated with costs and benefits related to investment, financing, and payout policies. To understand how a stock market listing influences the joint decisions on these corporate policies we analyze how European public and matched private firms adjust their cash flow allocation in response to the exogenous bank lending supply shock during the 2007-2009 financial crisis. Our novel empirical design allows us to analyze inter-dependent cash flow allocation adjustments within the cash flow identity. We find that both public and matched private firms heavily reduce their investments, financing, and payouts during the financial crisis. While investment adjustments are identical, public firms net issue more long-term debt to maintain relatively more payouts and repurchase stock. Our results suggest that while a stock market listing relaxes financial constraints, a listing induces managers to cater to shareholders by smoothing payouts and shoring up stock through repurchases. We find that the pressure on public firms to be more stock-market focused is greater in market-based economies. By contrast, in bank-dependent economies, public firms behave more sensibly: they invest relatively more and engage less in smoothing payouts and repurchasing stock.

JEL classification: D22, D92, G31, G32, G34
Keywords: Investment policies, financing policies, private firms, cash flow allocation, capital market access, financial crisis.

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1 Introduction

Being a publicly listed firm is associated with costs and benefits related to corporate policies (investment, financing, and payout). A stock market listing creates a separation between ownership and control that induces costly agency problems such as overinvestment ("empire building"), underinvestment ("quiet life"), or myopia. Information asymmetries about the value of the firm, whose shares are listed on a stock exchange, can be reduced by stricter disclosure requirements and the information aggregation function of the stock market, resulting in lower financing costs. Clearly, a stock market listing affects corporate policies simultaneously and through several channels such as agency problems and information asymmetry.

To understand how a stock market listing influences the joint decisions on corporate policies we analyze how European public and observably similar private firms adjust their corporate policies in response to the exogenous bank lending supply shock during the 2007-2009 financial crisis. The credit contraction provides us with an exogenous variation in external financing supply that allows us to analyze how a stock market listing may reduce financial constraints by comparing public and private firms' ability to raise external debt financing. Following the credit shock firms have to make adjustments to the uses of funds. Do public firms make less adjustment on the real side (e.g. investments) and more on the financial side (e.g. equity issuing or cash holdings), and maintain payouts? Analyzing the adjustment of cash flow allocation of public and private firms allows us to shed light on which of the corporate policies are affected by the stock market listing and whether firm behavior is more driven by financial constraints or rather agency problems and short-termist pressures.

We are interested in cash flow allocation adjustments of public and private firms, i.e. the causal effect of a stock market listing on corporate policies, during the financial crisis. The cash flow identity states that the sources of funds must equal the uses of funds, which shows the interdependent nature of cash flow allocation to investment, financing, and payout. In our

analysis, we apply the Abadie and Imbens (2011, 2006) nearest-neighbor matching (Abadie-Imbens) estimator to identify the causal effect of a stock market listing on cash flow allocation adjustments from 2007 to 2008 and match public and private firms on control variables that influence cash flow allocation and the decision to be publicly listed. The novelty in our empirical design is that we apply the Abadie-Imbens estimator to all endogenous corporate policy variables within the cash flow identity and thus account for the interdependent nature of these policies. We are thus able to analyze how public and private firms differ in cash flow allocation adjustments and also how these differences are interrelated within the cash flow identity.

Our results show that both public and matched private firms differ in their financing and payout decisions but not in their investment policies. In response to the credit contraction, both public and matched private firms make large but identical cuts to their investment. Both, public and private firms decrease their investments equally by -12.3% of lagged total assets. By contrast, they respond differently in their financing and payout policies. Public firms use more of their cash holdings than private firms (their additions to cash holdings are 0.4% smaller than those of private firms). Public firms also issue relatively more long term debt than private firms (the difference in net issuance of long-term debt between public and private firms equals about 1.5%). Public firms also significantly issue less equity (-0.3%) and have a higher cash outflow on account of other uses of funds (-1.7%) which reflects dividends and further uses of funds.

Our empirical results are consistent with public firms being less financially constrained and subject to short-termist pressures. The ability of public firms to net issue more long-term debt indicates that a stock market listing relaxes financial constraints. However, public firms do not use this additional financing to decrease investment less than private firms but instead additionally withdraw more cash and use this cash flow primarily as payout to investors by repurchasing more equity and using more cash outflow from other uses of funds including dividends. Catering to investors at the expense of investments suggests a myopic

nature of stock markets and/or management.

We also examine subsamples of firms conditional on differences in pre-crisis firm size and cash holdings. Firms with low pre-crisis cash holdings or small firms are likely to be more affected by the bank lending supply shock than large firms or firms with high cash holdings at the onset of the crisis. As in our full sample, we find that the stock market listing relaxes financial constraints and corporate policy adjustments are consistent with short-termism. These findings are more pronounced for low cash firms compared to high cash firms and in large firms. Small public and their matched private firms, however, do not differ in their ability to borrow, are thus not different in terms of financial constraints, and are less subject to short-termist pressures as public firms withdraw more cash and repurchase more equity but do not payout more other uses of funds including dividends.

Around the world, we observe declining numbers in IPOs, increases in delistings, and a large number of private firms not going public that could go public as they fulfill listing requirements in their countries or abroad. Countries like Germany are said to be financially under-developed as the size of its stock market seems to be too small as a percentage of GDP. Comparing Germany and the UK, it seems that on average more firms in the UK calculate a positive cost-benefit trade-off of a stock market listing than firms in Germany.

Germany and the UK differ in their institutional characteristics of their financial markets. Germany is said to be a bank-based economy (high bank dependency, relationship banking, small stock market) whereas the UK has a market-based financial markets structure (low bank dependency, arms-length banking, large stock market). Why do more firms go public in the UK than in Germany? Which role does the the structure of the financial market play in a firm's cost-benefit trade-off of a stock market listing. Possibly, the access to the stock market may be beneficial in a banking crisis by providing an alternative source of financing if bank lending is restricted (Levine et al. (2016)).

Our sample includes several European countries that differ in their degrees of bank depen-

dency as an institutional characteristic of financial markets. Firms in highly bank dependent countries could be more affected by the bank lending supply shock due to the bank-oriented structure of financial markets. However, the development of country-level aggregate bank credit volumes suggests that bank lending supply shocks are similar across the countries in our sample. Bank-dependent countries are usually less market-oriented in Europe and thus less subject to short-termist pressures. We conduct our baseline analysis for firms in countries that differ in their pre-crisis bank dependency to analyze the influence of this institutional characteristic on the effect of a stock market listing on corporate policies during the financial crisis. Compared to our full sample results, public firms in market-oriented countries also net issue more long-term debt but decrease investments more than private firms, indicating stronger short-termist pressures. On the other hand, the effect of a stock market listing in highly bank-dependent countries is the opposite. Public firms net issue more long-term debt but decrease investments less than private firms, indicating no short-termist pressures.

We redo our full and subsample analyses for the placebo crisis year 2004. Contrary to our findings for the bank lending supply shock, we do not find that a stock market listing relaxes financial constraints as public and matched private firms do not differ in their net debt issuing during the placebo crisis. This finding suggests that financial constraints are only binding if external financing is restricted. Also small differences in additions to cash holdings and payout policy variables have opposite signs as during the financial crisis and are thus inconsistent with short-termism. We draw very similar conclusions from our tests for differences in bank-dependency during the placebo crisis, especially a stock market listing in bank-dependent countries does not influence corporate policies as responses by public and matched private firms are almost identical.

Our paper contributes to recent literature on the effects of a stock market listing on corporate policies. A stock market listing gives a firm better access to capital and lower cost of capital (e.g., Pagano et al. (1998), Saunders and Steffen (2011)) and leads public firms to rely less on debt financing (Brav (2009)), and to smooth dividends more (Michaely

and Roberts (2011)). Short-termist pressures lead public firms to invest less and be less responsive to changes in investment opportunities than private firms (Asker et al. (2014)). Public firms hoard more cash (Gao et al. (2013), Farre-Mensa (2015)).

Our paper also contributes to the literature how the financial crisis affected corporate policies. Duchin et al. (2010) find that the negative external finance supply shock of the 2008 financial crisis lead to a decrease in investments especially for low cash and for financially constrained firms. Almeida et al. (2011) find that firms with major long-term debt fractions maturing shortly after the onset of the 2007 credit crisis cut their investments significantly more than firms that did not have to refinance large fractions of long-term debt at the same time, where the largest part of the reduction in external funding was absorbed by reducing cash holdings. Based on survey evidence, Campello et al. (2011) find that firms with restricted access to credit (e.g. also private firms) made more use of their credit lines during the 2008 financial crisis than firms with less restricted access to credit (e.g. also public firms). Iyer et al. (2013) show that banks cut lending to firms during the 2007-2009 crisis and that lending to smaller firms were cut more heavily, but large firms were mostly unaffected. Also firms with weaker bank relationships suffered more credit reduction. Buca and Vermeulen (2015) confirm a bank lending supply shock based on their credit tightening indices using the ECB Bank Lending Survey data answered by bank loan officers for European firms. They show that bank-dependent industries cut investments more heavily in response to the reduction in loan supply and increased lending standards. Carvalho et al. (2013) measure bank relationships of listed firms around the world using syndicated bank loan data. Firms having one main lender as opposed to multiple lenders reduced investment more.

Our findings that a stock market listing relaxes financial constraints but induces short-termist pressures if external finance is restricted helps to reconcile the mixed evidence of previous studies. By taking into account the interdependent nature of corporate policies and the exogenous bank lending supply shock, we overcome identification problems of previous studies that analyze isolated corporate policies without an exogenous variation that requires

firms to adjust their cash flow allocations. Also our finding that publicly listed firms suffer from more (less) short-termist pressures in less (more) bank-dependent countries suggests that there is an additional cost (benefit) that firms have to account for in their listing decision.

The rest of the paper proceeds as follows. In Section 2 we explain our empirical design including our empirical cash flow allocation model and our matching estimator. The description of our data sample can be found in Section 3. Section 4 contains our empirical analyses and Section 5 corresponding robustness tests. Section 6 concludes.

2 Empirical Design

We analyze the adjustment of cash flow allocation of public and private firms to understand how interdependent corporate policies are jointly affected by a stock market listing during the financial crisis. In this section, we start by writing down the cash flow identity formulation underlying our empirical model. We then explain the details of how we apply the Abadie and Imbens (2011, 2006) matching estimator to our cash flow identity model and how this novel extension of the estimator identifies the desired interdependent effects of a stock market listing on corporate policies.

2.1 Cash Flow Identity and Cash Flow Allocation

The cash flow identity states that the sources of funds must equal the uses of funds. In absolute terms, the cash flow identity can be written as

$$\underbrace{\widetilde{CHNGCASH}_t + \widetilde{INVEST}_t - \widetilde{LTDISS}_t - \widetilde{STDISS}_t - \widetilde{EQISS}_t - \widetilde{OTHER}_t}_{\text{Uses of funds}} = \underbrace{\widetilde{OCF}_t}_{\text{Source of funds}} . \quad (1)$$

In Equation 1, we define cash flow that is internally generated from operations ($\widetilde{OCF}$) to be an exogenous source of funds that cannot be controlled by the manager. Conditional on the realization of operating cash flow, the manager allocates to the different (endogenous) uses of funds such as changes in cash holdings ($\widetilde{CHNGCASH}$), investments ($\widetilde{INVEST}$), (reduction in) external finance (long term debt issuing ($\widetilde{LTDISS}$), short term debt issuing ($\widetilde{STDISS}$), equity issuing ($\widetilde{EQISS}$)), and other activities ($\widetilde{OTHER}$; e.g. dividends).[1]

Finally, we rewrite the cash flow identity normalized by beginning-of-year total assets (TA_{t-1}) as

$$\underbrace{CHNGCASH_t + INVEST_t - LTDISS_t - STDISS_t - EQISS_t - OTHER_t}_{\text{Uses of funds}} = \underbrace{OCF_t}_{\text{Source of funds}}. \tag{2}$$

2.2 Matching Estimator

2.2.1 Overview

We are interested in cash flow allocation adjustments of public and private firms, i.e. the causal effect of a stock market listing on corporate policies, during the financial crisis. To explain the intuition behind our empirical design, we start by writing down the cash flow identity of Equation (2) in changes from pre-crisis to post-crisis periods

$$\underbrace{\Delta CHNGCASH_{2008} + \Delta INVEST_{2008} - \Delta LTDISS_{2008} - \Delta STDISS_{2008}}_{\text{Uses of funds}}$$
$$\underbrace{-\Delta EQISS_{2008} - \Delta OTHER_{2008}}_{\text{Uses of funds}} = \underbrace{\Delta OCF_{2008}}_{\text{Source of funds}}, \tag{3}$$

where the change in cash flow identity item Y is defined as $\Delta Y_{2008} = Y_{2008} - Y_{2007}$.

[1] Section A.1 in the Appendix contains a detailed description of how we construct our cash flow statement variables.

Caused by the bank lending supply shock during the financial crisis, we expect firms to experience unexpected variations in the access to bank credit that requires the manager of a firm to adjust its corporate policy decisions. Controlling for differences in operating cash flow in Equation (3), the pre-post crisis differences in the uses of funds variables identify the effect of the corporate policy adjustments caused by the exogenous credit contraction. As for the cash flow identity in levels, Equation (3) shows that the changes in the endogenous uses of funds have to equal the change in the exogenous source of funds. We will make use of this property to examine the interdependent effects of the bank lending supply shock on the uses of funds variables.

We expect that public and private firms are differently affected in their cash flow adjustment decisions caused by the bank lending supply shock. We cannot estimate the desired stock market listing effect directly by simply taking the difference of the changes in cash flow identity variables from Equation (3) for all public and private firms. As the stock market listing is not randomly assigned to firms, any estimated difference might be confounded by other observable or unobservable firm characteristics that are correlated with the stock market listing as well as with the changes in cash flow identity variables. For example, large firms could more likely be listed than small firms and cut investment less during the financial crisis than small firms. Not controlling for firm size would then suggest that the effect of a stock market listing on investment policy was positive.

To identify the causal effect of a stock market listing on cash flow allocation adjustments, we use the Abadie and Imbens (2011, 2006) nearest-neighbor matching (Abadie-Imbens) estimator. The Abadie-Imbens estimator is based on a binary-treatment-potential outcome model, where in our case, the treatment indicator is the stock market listing. Following previous research[2], we extend Abadie-Imbens estimation to a quasi difference-in-differences setup

[2]Almeida et al. (2011) use Abadie-Imbens estimation with major long-term debt fractions maturing as treatment indicator and pre-post crisis changes in investments as outcome variables. Similarly, Kahle and Stulz (2013) use several subgroups of firms (e.g. high leverage) as the treated group and pre-post crisis changes in investments, equity and debt issuance, or cash holdings as outcome variables. Campello et al. (2010) use the financial constraints status as treatment indicator and several corporate policy outcome

by using pre-post crisis changes in our uses of funds variables (Equation (3)) as outcomes.

More specifically, we use the Abadie-Imbens estimator for the average treatment effect on the treated (ATT), which is the average stock market listing effect on the cash flow allocation adjustment for our treated public firms group. The ATTs for the uses of funds variables are given by

$$\begin{aligned}
\tau_{2008}^{CHNGCASH} &= E[\Delta CHNGCASH_{2008}^{Public} - \Delta CHNGCASH_{2008}^{Private} | d = Public, X = x] \\
\tau_{2008}^{INVEST} &= E[\Delta INVEST_{2008}^{Public} - \Delta INVEST_{2008}^{Private} | d = Public, X = x] \\
\tau_{2008}^{LTDISS} &= E[\Delta LTDISS_{2008}^{Public} - \Delta LTDISS_{2008}^{Private} | d = Public, X = x] \\
\tau_{2008}^{STDISS} &= E[\Delta STDISS_{2008}^{Public} - \Delta STDISS_{2008}^{Private} | d = Public, X = x] \\
\tau_{2008}^{EQISS} &= E[\Delta EQISS_{2008}^{Public} - \Delta EQISS_{2008}^{Private} | d = Public, X = x] \\
\tau_{2008}^{OTHER} &= E[\Delta OTHER_{2008}^{Public} - \Delta OTHER_{2008}^{Private} | d = Public, X = x], \qquad (4)
\end{aligned}$$

which are defined as the difference between the changes in outcome variables of public (treated) and private (control) firms for each uses of funds variable conditional on being treated $d = Public$ and a set of control variables X for which $X = x$.

2.2.2 Identification

The Abadie-Imbens estimator relies on two assumptions to achieve identification for the ATT. The first assumption (unconfoundedness) is that the stock market listing and the changes in cash flow identity variables are statistically independent, conditional on observable firm characteristics. In other words, the stock market listing assignment to firms is as though it was random, e.g. firm size does not affect the listing status, and thus does not affect changes in cash flow identity variables, when we condition the outcome variable difference between public and private firms on having the same value for observable control variables,

variables during the financial crisis. Villalonga (2004) and Malmendier and Tate (2009) also use Abadie-Imbens estimation in further applications.

e.g. having the same firm size. The idea behind this assumption is that ideally we had to compare the change in each cash flow identity variable of a public firm that we observe with the (counterfactual) change of the very same firm if it was private. Since we cannot observe the counterfactual outcome, we use the outcomes of matched private firms that have the most similar observable characteristics to the public firm under consideration. Technically, the Abadie-Imbens estimator uses the set of covariates X in Equations (4) for the public and the private firm and minimizes the Mahalanobis distance between the covariate vectors between the public and the private firm to find the most similar nearest neighbors.

The second identification assumption is referred to as overlap and requires a positive probability for being in the treatment and in the control group conditional on each value of the control variables. The overlap assumption makes sure that there are treatment and control firms that are similar in terms of the control variables. For example, if all large firms are listed and all small firms are not listed there would be no overlap in terms of firm size and we were not able to estimate the counterfactual control outcomes.

2.2.3 Matching Covariates

To estimate the counterfactual outcomes, control variables for matching should be related to the decision to be publicly listed (treatment indicator) and the outcome variable (Imbens and Wooldridge (2009)). Our control variables X in Equation (4) consist of (continuous) lagged levels of uses of funds variables

$$\{CHNGCASH_{2007}, INVEST_{2007}, LTDISS_{2007}, STDISS_{2007}, EQISS_{2007}, OTHER_{2007}\},$$

the change in operating cash flow (ΔOCF_{2008}), firm size ($SIZE_{2008}$), investment opportunities ($INVESTOPP_{2008}$), age (AGE_{2008}) and exact matching variables 2-digit SIC code ($2DIGITSIC$) and country ($COUNTRY$).[3]

[3]Table A2 in the appendix provides matching covariates definitions.

Our choice of control variables is motivated by previous theoretical and empirical literature on IPO activity and cash flow allocation.[4] The going public decision of a firm is determined by many factors. Theoretical explanations of IPO activity include, for example, life cycle or market timing models that offer empirical predictions about the decision to go public (Ritter and Welch (2002)). Life cycle theories state that it can be optimal for private firms that grow sufficiently large to eventually go public. On the other end, life cycle differences could also affect cash flow allocation behavior. Younger firms facing high growth opportunities could invest more, rely more heavily on equity financing, and pay out less dividends than older firms with less growth opportunities. Market timing theories argue that firms go public in bull market times where equity valuations tend to be relatively higher than in bear markets.

Pagano et al. (1998) analyze determinants of initial public offerings and find firm size and industry market-to-book ratio to be correlated with firms' IPO decision for their Italian firm sample. Helwege and Liang (2009) find that both hot and cold IPO markets are concentrated in industries. La Porta et al. (1997) report wide differences in IPO activity across countries. To account for the decision to be publicly listed (treatment indicator) we include firm size and age, investment opportunities, and industry (2-digit SIC code) and country ($COUNTRY$) as matching covariates. After matching on these variables, our public and matched private firms should be observably similar along these dimensions and thus should not respond differently in their cash flow allocation due to confounding factors that influence the decision to go public.

Due to the cash flow identity, cash flow allocation is inherently interdependent (Gatchev et al. (2010)). Contemporaneous cash flow allocation is potentially affected by lagged cash

[4]Previous literature on public and private firms accounts for the endogeneity of the stock market listing by matching methods (Acharya and Xu (2015), Asker et al. (2014), Gao et al. (2013), Michaely and Roberts (2011), or Saunders and Steffen (2011)). Most of these studies use propensity score matching on pooled firm observations with size and industry as matching covariates. However, propensity score matching does not directly allow for the possibility to match on exact industry classifications. Matching on size and industry might not be sufficient to satisfy unconfoundedness that is also assumed for propensity score matching.

flow allocation. In the presence of adjustment costs, it is unlikely that current and past investment and financing decisions are independent. For the case of staged or major investments, cash flow allocation decisions are likely to be positively correlated over time. To account for the interdependent nature of cash flow allocation, we include lagged levels of all uses of funds variables as matching covariates.

Our last matching covariate is the change in operating cash flow ΔOCF_{2008}.[5] If public and private firms were not matched on the change in operating cash flow, the ATTs in Equation (4) would potentially be confounded by differences in cash flow shocks. Our treatment indicator is the stock market listing status and matching on the change in operating cash flow ΔOCF_{2008} does not violate our identifying unconfoundedness assumption (Section 2.2.2).

The Abadie-Imbens estimator will be biased in finite samples if the matching is not only on exact matching variables but also includes continuous covariates. For this reason, we use the bias corrected version of the Abadie-Imbens estimator, which predicts the potential outcome of the control group for the ATT based on all of our continuous covariates. We match with replacement one control firm to each treated firm and also use robust standard errors that uses two matches for estimation.

2.2.4 Interdependent Treatment Effects

As for the cash flow identity in levels, Equation (3) shows that the changes in the endogenous uses of funds have to equal the change in the exogenous source of funds. This property carries forward to our system of ATTs in Equation (4), conditional on matching on the change in operating cash flow ΔOCF_{2008} and other control variables. The interdependent ATTs do not only show us how public and private firms differ in cash flow allocation adjustments but also how these differences are interrelated within the cash flow identity.

[5] Traditional investment-cash flow sensitivity regressions or the related analyses of Gatchev et al. (2010) and Dasgupta et al. (2011) use contemporaneous operating cash flow as explanatory variables, which is similar to controlling for the change in operating cash flow in our empirical specification.

In Equation (3), the left hand-side of the cash flow identity in changes equals the change in operating cash flow. Matching on the change in operating cash flow and subtracting Equation (3) for private firms from the same equation for public firms gives the following relationship between the ATTs for the matched sample in our empirical specification

$$\tau_{2008}^{CHNGCASH} + \tau_{2008}^{INVEST} - \tau_{2008}^{LTDISS} - \tau_{2008}^{STDISS} - \tau_{2008}^{EQISS} - \tau_{2008}^{OTHER} \equiv 0, \tag{5}$$

because $E[\Delta OCF_{2008}^{Public} - \Delta OCF_{2008}^{Private}] = 0$. To understand the interdependent nature of cash flow allocation adjustments, we make a simple numerical example. A $\tau_{2008}^{INVEST} = +3\%$ indicates that firms having a stock market listing invest 3% more than counterfactual private firms. Assume all remaining ATTs but τ_{2008}^{LTDISS} are zero, then $\tau_{2008}^{LTDISS} = +3\%$ by Equation (5). That is, the higher investment of public firms compared to private firms is financed by higher long term debt issuing of public firms.

3 Data

In this section, we first start with showing how total and bank credit volumes developed during the crisis and present our bank dependency measure. We then describe the sample selection process and provide descriptive statistics for our European public and private firm data.

3.1 Credit Volumes during the Crisis and Bank Dependency

Beyond bank-specific characteristics and macroeconomic factors, institutional characteristics such as national legal frameworks, historical customs and the structure of the domestic banking sector play an important role how banks finance themselves (Rixtel and Gasperini (2013)). The countries in our sample differ in their structures of the banking sector. We capture these differences by our (pre-crisis) bank dependency measure that is the ratio of

bank credit to total credit.[6] Our bank dependency measure is related to measures usually applied in the literature comparing bank-based versus market-based financial systems (Levine (2002)). Panel C of Figure 1 contains our pre-crisis bank dependency measure for each country. It is calculated as the the bank to total credit ratio in 2006-Q4.

Figure 1 shows how aggregate credit financing of the European countries in our sample and the US were affected during the crisis. Looking at aggregated data, a credit contraction is most likely to be visible in a decrease in credit growth. Panel A (Panel B) of Figure 1 contains the quarterly relative changes in total and bank credit volumes for below (above) median bank dependency countries for the period 2007-Q2 to 2009-Q2. In bank dependent countries (Panel A), the quarterly growth in aggregated bank and total credit sharply falls at the onset of the crisis. For example, comparing pre-crisis and post-crisis growth in bank and total credit for France or Greece shows a quick slow down. Both, bank and credit growth are declining similarly in bank dependent countries.

In less bank dependent countries (Panel B), we observe that bank credit growth is also heavily declining. Especially the sharp decrease from 2008-Q3 to 2008-Q4 in the European countries indicates a bank lending supply shock. However, looking at the UK or the Netherlands, other than bank credit substitutes for bank credit as the total credit growth is quite stable (the Netherlands) or increases (the UK).

We conclude that bank lending in all countries in our sample was adversely affected during the financial crisis. This observation is consistent with Ivashina and Scharfstein (2010) or Iyer et al. (2013) who report that banks cut lending to US firms during financial crisis. Buca and Vermeulen (2015) also confirm a bank lending supply shock based on their credit tightening indices using the ECB Bank Lending Survey data answered by bank loan officers for European firms.

[6] We use bank credit (BIS data item *B:P:A, credit to private sector series*) and total credit (BIS data item *A:P:A, credit to private sector series*) from the BIS credit to private sector series. A detailed description of this data series can be found in Dembiermont et al. (2013).

3.2 Sample

The main source of data for public and private firms is the Amadeus (Analyze Major Database from European Sources) database provided by Bureau Van Dijk. It records both balance sheet and income statement information for both listed and unlisted European firms. The data are harmonized by Bureau van Dijk which makes cross-country and pooled country analyses possible.

The Amadeus data accessed online suffers from survivorship bias and contains at most data for the last ten years. If a firm defaults, Bureau van Dijk deletes its data three years thereafter. In order to overcome survivorship bias, we backfill the data using the historical DVDs on a yearly basis between 2003 and 2011. Setting up our base dataset from the 2011 version, we add all firm years from the 2010 DVD that do not show up on the 2011 DVD, and then repeat the process from all previous versions of the database. Using this backfilling procedure we are able to add back all firms and firm years that were deleted until the year 2000. In doing the backfilling, we adjust the Amadeus data for frequent ID changes published by Bureau Van Dijk. This avoids multiple instances of the same firm with different IDs in the dataset.

Amadeus contains dynamic data items such as yearly balance sheet information and static data items such as the stock market listing indicator. Using the backfilling procedure described above, we are able dynamize all the static data items included in the database such as the name of the firm, ownership information, or its listing status. We also obtain additional data including IPO dates, M&A data, or delisting information from Thomson Reuters SDC, Datastream, and BvD's Zephyr. Our stock market listing (public) identifier is based on information about the IPO date, delisting date, and the existence of market values.

The sample period begins in 2000 and ends in 2009. For our analyses of the financial crisis, we keep the firm years 2006, 2007, and 2008. For placebo crisis periods we proceed correspondingly. We exclude firm years with total asset growth or sales growth (our invest-

ment opportunities variable) larger 100%; the lowest and highest 1% of our plug variable $OTHER$; public firms with share types other than ordinary shares; private firm years of public firms that transition from private to public or public to private. We winsorize variables that are not bounded ratios at the 1% and 99% quantile and adjust bounded ratios to their feasible limit values. Following previous studies, we exclude financial firms (SIC code 6), regulated utilities (SIC 49), and government entities (SIC 9) and drop very small firms defined as those with total assets smaller than USD 1 million in assets. We include consolidated and unconsolidated financial statement information as well as subsidiaries of other companies in our sample. After applying all our filters, only firms from the countries Belgium (BE), Germany (DE), Spain (ES), Finland (FI), France (FR), United Kingdom (GB), Greece (GR), Italy (IT), Netherlands (NL), Sweden (SE) have sufficient public and private firm data to apply our matching estimation procedure.

3.3 Descriptive Statistics Matching Covariates and Matching Diagnostics

Table 1 reports descriptive statistics for the matching covariates, described in Section 2.2.3, on which we match public and private firms.[7] Panel A presents descriptive statistics for the unmatched sample. The differences in means tests in column *D.Means* show that public and private firms differ on almost all matching covariates except on investment opportunities ($INVESTOPP_t$). However, most of the reported normalized differences in column *Norm.D.* are smaller than 0.25 in absolute terms. The normalized difference univariately compares the distributional overlap of a covariate between two groups. A normalized difference larger than 0.25 may indicate a bad overlap (Imbens and Wooldridge (2009)) that would violate one of the identification assumptions of our matching estimator.[8] As expected, lagged firm

[7]Table A2 in the appendix provides matching covariates definitions.

[8]The normalized difference is a scale-free measure of the difference in distributions. It is calculated as the difference in averages by treatment status, scaled by the square root of the sum of the variances. For covariate X, it is calculated as Normalized Difference$(X) = \left(\bar{X}_{Public} - \bar{X}_{Private}\right) / \sqrt{S^2_{Public} + S^2_{Private}}$. As

size ($SIZE$) has the largest normalized difference as public firms tend be on average larger than private firms.

Panel B of Table 1 shows descriptive statistics for public and private firms for the matched sample.[9] Many of the univariate differences in means tests are insignificant after matching. All normalized differences are below 0.25 after matching, which indicates a sufficient overlap. Inspecting normalized differences and differences in means for the matching covariates before and after matching is part of our matching diagnostics. Firm size has the largest normalized difference after matching. Figure A2 in the appendix shows Epanechnikov kernel density estimates for the firm size distribution for the public and private firm groups. Comparing the estimated firm size distributions for the unmatched (Panel A) and matched (Panel B) samples shows that overlap has substantially improved after matching.

To assess the quality of matching on the matching covariates simultaneously, we run a logit regression of the public listing status on the matching covariates used in the nearest neighbor matching. From this regression, we calculate implied propensity scores. Figure A1 in the appendix shows Epanechnikov kernel density estimates for the implied propensity scores distribution for the public and private firm groups. Comparing the implied propensity scores distributions for the unmatched (Panel A) and matched (Panel B) samples also shows that overlap for all matching covariates simultaneously has significantly improved after matching.

4 Empirical Results

In this section, we first present our full sample results for cash flow allocation adjustments of public and private firms, i.e. the causal effect of a stock market listing on corporate policies,

opposed to the differences in means test, the normalized difference is independent of the sample size. A higher sample size does not necessarily increase the difficulty of matching on covariates but produces higher t-statistics in the differences in means tests (Imbens and Wooldridge, 2009, p. 24).

[9]The numbers of matched public and private firm pairs per country can be found in Table A1 in the appendix.

during the financial crisis. We then examine subsamples of firms conditional on differences in pre-crisis firm size and cash holdings, which are likely to be differently affected by the bank lending supply shock. Then, we present results for subsamples of firms by country that differ in their degrees of bank dependency to analyze the influence of different financial market structures on public and private firms.

4.1 Full Sample Results

Table 2 contains our matching estimator results for the full sample. The panel ATT contains the average treatment effect on the treated, which is the difference of the public and private firm differences in the uses of funds from 2007 to 2008 (Equation 4). The ATT is the average stock market listing effect on the cash flow allocation adjustment for our treated public firms group. Section 2.2 describes the details of the matching procedure within the cash flow identity.

For example, the adjustment of investment ($INVEST$) from 2007 (13.8% of beginning-of-year total assets) to 2008 (1.7%) is -12.2% (column *Diff*, Panel *Public*). The bias corrected estimated counterfactual investment adjustment for matched private firms from 2007 to 2008 is -12.3% (column *Diff**, Panel *Private*). The difference in differences (Public *Diff* - Private *Diff**) gives the average stock market listing effect on the investment adjustment (Panel ATT). The estimated stock market listing effect is 0.1% and not significantly different from zero and implies that a stock listing has no influence on the investment response to the bank lending supply shock.

*Diff** in the private firm panel is the estimated counterfactual outcome and may deviate from the difference of individual levels due to the bias correction of the matching estimator. For example, the adjustment of investment from 2007 (11.2%) to 2008 (1.5%) is -9.7% as opposed to the estimated adjustment -12.3% (column *Diff**, Panel *Private*). Using the unadjusted investment response for matched private firms would result in a -2.5% difference-

in-differences estimate. The bias correction accounts for differences in the distribution of matching covariates between treatment (public) and control (private) groups. For example, matched private firms have lower average pre-crisis investment levels, one of the matching covariates, than treated public firms (Table 1, Panel B). Since firms with lower average pre-crisis investment levels are expected to reduce average investment less, the difference-in-differences estimate is biased downwards. The bias-corrected ATT estimate of a stock market listing accounts for this imperfect matching of pre-crisis investment levels and the other continuous matching covariates and yields a much larger result than the unadjusted difference-in-differences estimate.

The first column of Table 2 contains the cash flow identity item names and their signs within the cash flow identity (Equation 2).[10] Column *Diff* in Panel *Public* (Table 2) reveals that for public firms the huge decrease in investments (-12.2%) is accompanied with decreases in financing (cash balances (-2.9%), net long term debt issuing (-3.1%), net short term debt issuing (-1.4%), net equity issuing (-2.8%)). In 2007 public firms issue equity (1.7%) whereas in 2008 they repurchase equity (-1.1%). Together with a cash outflow on account of other uses of funds[11] in 2008 (-6.6%, $OTHER$), which reflects dividends and further uses of funds, public firms distributed cash flow to shareholders. Within the cash flow identity, all differences in the uses of funds (outcome) variables have to equal the change in operating cash flow (-1.3%).

A stock listing has no influence on the investment response to the bank lending supply shock. Panel ATT in 2 shows however that a stock market listing has effects on other outcome variables than investment. Due to our empirical design, public and matched private firms are subject to the same operating cash flow (OCF) shock which implies that the ATTs within the cash flow identity add up to zero (Equation 5). For example, public firms significantly

[10] For example, the (average) cash flow identity of public firms in 2007 is $CHNGCASH$ (1.8%) + $INVEST$ (13.8%) - $LTDISS$ (3.1%) - $STDISS$ (1.5%) - $EQISS$ (1.7%) - $OTHER$ (1.6%) = OCF (7.7%).

[11] Section A.1 in the Appendix contains a detailed description of how we construct our cash flow statement variables and analyze the determinants of our plug variable for other uses of funds $OTHER$.

net issue more long term debt than private firms (1.5%). This difference has to be matched in at least one other outcome variable. A stock market listing leads to a significantly larger reduction in cash holdings (-0.4%), a larger decrease in net equity issuing (-0.3%), and a larger cash outflow in other uses of funds (-1.7%).

Our results show that both public and matched private firms heavily reduce their investments, financing, and payouts during the financial crisis. Having a stock market listing does not influence investment spending during the financial crisis as both public and private firms do not differ in their investment response to the bank lending supply shock. However, they respond differently in their financing and payout policies.

Our empirical results are consistent with public firms being less financially constrained and subject to short-termist pressures. The ability of public firms to net issue more long-term debt indicates that a stock market listing relaxes financial constraints. However, public firms do not use this additional financing to decrease investment less than private firms but instead additionally withdraw more cash and use this cash flow primarily as payout to investors by repurchasing more equity and using more cash outflow from other uses of funds including dividends. Catering to investors at the expense of investments suggests a myopic nature of stock markets and/or management.

4.2 Subsample Results

We split our sample into subsamples of firms based on cash holdings and firm size and run our matching estimation again on these subsamples. For example, we define *Low Cash* (*High Cash*) firms as those with cash holdings smaller (larger) than the first (last) quintile (bottom 20% (top 20%)) in the 2007 public firm distribution by country.

4.2.1 Cash Holdings

As in our full sample, we find that the effects of a stock market listing on cash flow allocation adjustments is consistent with a relaxation of financial constraints and the presence of short-termism for low and high cash holdings firms. These findings are more pronounced for low cash firms than for high cash firms.

Panel A of Table 3 presents the matching estimator results for low cash and high cash firms. Both low cash public and private firms increase their cash holdings from 2007 to 2008, possibly driven by a precautionary motive or adjustment to target cash ratios as a response to the financial crisis. Public low cash firms add 0.8% more to their cash balances than matched private low cash firms. Both low cash public and private firms cut investments heavily and more than in our full sample results. The difference between public and private firm investment adjustments is again insignificant. Low cash public firms reduce long term debt issuing by 3.1% less and short term debt by 1.4% more than matched private firms.

On the other hand, high cash public and private firms heavily withdraw from their cash holdings and reduce investments almost by half the amount than low cash public and private firms. The differences in the adjustment of cash holdings and investments between public and private firms is insignificant. Both low cash and high cash public firms have better access to external financing during the financial crisis than their matched private firms.

4.2.2 Firm Size

Small public and matched private firms do not differ in their ability to borrow, are thus not different in terms of financial constraints, and are also subject to short-termist pressures as public firms withdraw more cash and at the same time repurchase more equity.

Panel B of Table 3 presents the matching estimator results for subsets of small firms and large firms. Small public firms withdraw 1.6% more from their cash balances than matched

small private firms. Small public firms reduce net equity issuing by 1.1% more than matched small private firms.

Compared to small public firms, large public firms reduce long term debt issuing by 4.7% less than matched large private firms. Both small and large public and private firms do not adjust investments significantly different.

4.3 Cross-Country Differences and Bank Dependency

Our sample includes several European countries that differ in their degrees of bank dependency as an institutional characteristic of financial markets. We conduct our baseline analysis for firms in countries that differ in their pre-crisis bank dependency to analyze the influence of this institutional characteristic on the effect of a stock market listing on corporate policies during the financial crisis.

Figure 2 shows our matching estimation results separately for each country from our full sample. The figure contains six subgraphs for each of the uses of funds outcome variables from the cash flow identity. Each subgraph contains a scatter plot of the average treatment effects on the treated (ATT) against bank dependency in the year 2006 for each country. The average treatment effect on the treated (ATT) is the difference of the public and private firm differences from 2007 to 2008. All estimation results are given in percentage points. A circle around a dot indicates statistical significance at the 10% level or lower. Our previous full and subsample results indicate that public and private firms do not differ in their adjustments of investments when they are faced with a reduction in external lending supply. The subgraph for the public and private firm differences in investment adjustment in Figure 2 reveals that adjustments are quite heterogeneous for individual countries. Public firms in bank dependent countries such as Germany or Greece reduce investments less than matched private firms. In less bank dependent countries, for example France or Sweden, public firms reduce investments more heavily than matched private firms.

In Table 4, we present matching estimator results conditional on bank dependency. We divide all firms of a country whose bank dependency in 2006 is below (above) median into the group *Below Median Bank Dependency* (*Above Median Bank Dependency*). Consistent with the individual country ATTs from Figure 2, public firms in the above median bank dependency group decrease investments by 2.2% less than matched private firms. Equivalently, public firms in the below median bank dependency group decrease investments by 1.2% more than matched private firms.

In the subgraph for long term debt issuing in Figure 2, public firms in more bank dependent countries are able to reduce long term debt issuing less than matched private firms. The superior access to long term debt financing for public firms holds in almost all countries as all ATTs are larger than zero except for the Netherlands. This finding corresponds with public firms reducing long term debt by 1.1% less in below median bank dependent countries and by 2.0% less in above median bank dependent countries than matched private firms (Table 4). Regarding changes in cash holdings, public firms in less bank dependent countries tend to withdraw more from their cash holdings than matched private firms.

The effect of a stock market listing on corporate policies in market-oriented, less bank-dependent countries is similar to our findings for the full sample, a relaxation of financial constraints and short-termism. Compared to our full sample results, public firms in these countries even cut investments more than private firms, indicating strong short-termist pressures. On the other hand, the effect of a stock market listing in bank-dependent countries does indicate a relaxation of financial constraints but not short-termism as public firms in these countries are able to net issue more long-term debt and use this cash flow to primarily cut investments less than private firms.

5 Robustness

5.1 Placebo/Non-Crisis Periods

Figure 3 shows our matching estimation results for the full sample for each year in the period 2002 to 2009. The figure contains average treatment effects on the treated (ATT) and corresponding differences of public and private firms over time. The figure contains six subgraphs for each of the uses of funds outcome variables from the cash flow identity. Each subgraph contains a time series plot of the average treatment effects on the treated (ATT) in the period 2002 to 2009. The average treatment effect on the treated (ATT) in period t is the difference of the public and private firm differences from $t-1$ to t. The gray area in each subgraph highlights the results in the financial crisis period 2008. A circle around a dot indicates statistical significance at the 10% level or lower.

The figure shows in the investments subgraph that in 2008, public and private firms do not differ in their adjustments. However, they show significantly different investment adjustments in the years 2005 and 2007.[12] In the differences of public and private firms for investments, the crisis year 2008 shows unprecedented reductions in investments compared to other years. Both public and matched private firms reduce investments equally by more than 10%. In 2008 public and private firms reduce long term debt issuing as never before while private firms reduce issuing more than public firms. Without a bank lending supply shock in the year 2005, public firms reduce long-term debt issuing relatively less than private firms and also decrease investment less. Both, public and private firms similarly engage in large equity repurchases. Andriosopoulos and Lasfer (2015) find in their sample of repurchase announcements of European public firms that repurchases peaked in 2005.

We choose the year 2004 as a placebo crisis and rerun our matching estimation results for the full sample and conditional on bank dependency. Table 5 contains our full sample

[12]The public and private firm differences and corresponding ATTs in 2005 are similar across countries and not driven by firms from one particular country.

results. Comparing the placebo crisis with the financial crisis results in 2008 in Table 2 shows that public and private firms do not differ in their long term debt issuing adjustment. Our bank dependency results in the year 2004 in Figure 4 and Table 6 show that the differential investment adjustment has vanished compared to the crisis year 2008. Similarly, public firms do not significantly differ in their long term debt issuing adjustments from their matched private firms.

5.2 Sample Selection

We include firms with consolidated and unconsolidated financial statements in our analysis. Restricting the sample to only consolidated statements shrinks the sample size significantly for both public and private firms. Including unconsolidated statements bears the risk that private subsidiaries with unconsolidated statements of public firms end up in the private firm control group and could be matched with other public firms or the parent firm itself. This kind of match would bias our results to finding no differences between public and private firms. We redo our analysis for firms with consolidated statements only and find qualitatively similar results.

6 Conclusion

Our findings that a stock market listing relaxes financial constraints but induces short-termist pressures if external finance is restricted helps to reconcile the mixed evidence of previous studies. Also our finding that publicly listed firms suffer from more (less) short-termist pressures in less (more) bank-dependent countries suggests that there is an additional cost (benefit) that firms have to account for in their listing decision. Our results may have important implications for managerial decision-making regarding corporate policies or a listing decision and policy makers regarding the design and regulation of financial markets.

A Appendix

A.1 Cash Flow Statement Derivation

There are two ways to obtain a firm's cash flow statement data. First and most accurately, the firm publishes a cash flow statement along with its balance sheet and income statement. Depending on accounting rules that apply, publishing a cash flow statement is voluntary and often only large public firms add it to their financial statements. The second and less accurate way, the cash flow statement is indirectly derived from balance sheet and income statement information. The latter indirect approach has the major advantage that it can be derived for almost every firm publishing minimal financial information. As (actual) cash flow statement information for private firms are very scarce and not included in our Amadeus sample, we have to derive cash flow statement data indirectly.[13] Table A2 shows how we derive the different cash flow statement items for the cash flow identity in Equation (1).

Note that it is impossible to perfectly recover the cash flow statement from balance sheet and income statements. Relying on derived cash flow statement data has two disadvantages. First, we sacrifice accuracy in the cash flow statement items that we are able to derive from the balance sheet and income statement. Second, we have to work with a plug variable ($OTHER$) that measures the net effect of all cash flow statement items that we cannot derive from the balance sheet and income statement and additionally absorbs differences between actual and derived cash flow statement variables.

Our approximation of the cash flow statement is constructed as to best match the actual cash flow statement but remains an approximation. Our goal is to examine the causal

[13]Some separately sold country datasets from Bureau Van Dijk that are also included in the Amadeus dataset contain additional limited cash flow statement items, for example, FAME for UK public and private firms. Michaely and Roberts (2011) use the FAME dataset and analyze dividend policies of public and private firms. The cash flow statement in FAME is not as detailed as in Compustat or Worldscope and does not separately report long term and short term debt issues but only a net financing item. As we are interested in a cross-country comparison of cash flow allocation adjustments with respect to bank dependency and especially on the credit related cash flow statement items such as long term debt vs. short term debt, Amadeus remains the most suitable dataset for our analysis.

effect of a stock market listing on cash flow allocation adjustment during the financial crisis, i.e. to compare changes in cash flow statement variables for public and private firms. By consistently using the same cash flow statement approximation for public and private firms we are able to measure actual differences between public and private firms' cash flow allocation adjustments within our approximation of the cash flow statement.

We do not expect and require our cash flow statement approximation to perfectly measure actual cash flow statements for our analysis. However, to examine how our derived cash flow statement data correspond to actual cash flow statement data, we compare the subset of public firms for which we obtain data in Amadeus and Worldscope. We aggregate cash flow statement items from Worldscope to best match our derived Amadeus cash flow statement variables in Equation (2).

We first examine the differences between the derived (Amadeus) and actual (Worldscope) cash flow statement variables operating cash flow (OCF), changes in cash holdings ($CHNGCASH$), investments ($INVEST$), long term debt issuing ($LTDISS$), short term debt issuing ($STDISS$), and equity issuing ($EQISS$). Median differences are close to zero except investments, which is slightly positive, thus slightly overstating actual investments. Next, we calculate correlations between derived and actual cash flow statement variables, which are all highly positive.

The remaining cash flow statement items from Worldscope that we do not explicitly account for with our derived cash flow statement variables from Amadeus are (1) dividends ($DIVIDENDS$), (2) other net financing activities ($OTHERFIN$), and (3) exchange rate effects ($FXEFFECTS$). The relationship between the unaccounted items and our plug variable for other activities ($OTHER$) is

$$OTHER_t = -DIVIDENDS_t + OTHERFIN_t + FXEFFECTS_t + \epsilon_t,$$

where ϵ is a term that absorbs all other differences between actual and derived cash flow

statement variables. We run a regression of our Amadeus plug variable ($OTHER$) on Worldscope dividends, other net financing activities, and exchange rate effects while controlling for differences between derived (Amadeus) and actual (Worldscope) cash flow statement variables and firm and year fixed effects. The regression results confirm a significantly negative coefficient on dividends and significantly positive coefficients on other net financing activities and exchange rate effects, where estimated coefficients are larger one. The differences between derived (Amadeus) and actual (Worldscope) cash flow statement variables are also significant but smaller than one. As a result, our plug variable is more driven by dividends, other net financing activities, and exchange rate effects than by differences between derived and actual cash flow statement variables.

Median dividends to lagged total assets is much larger than that of exchange rate effects or other net financing activities. Given our regression results and magnitudes of cash flow statement variables, our plug variable other is mostly driven by dividends and the median difference between derived and actual investment. Higher dividend payments decrease $OTHER$ and higher differences between derived and actual investment increase $OTHER$.

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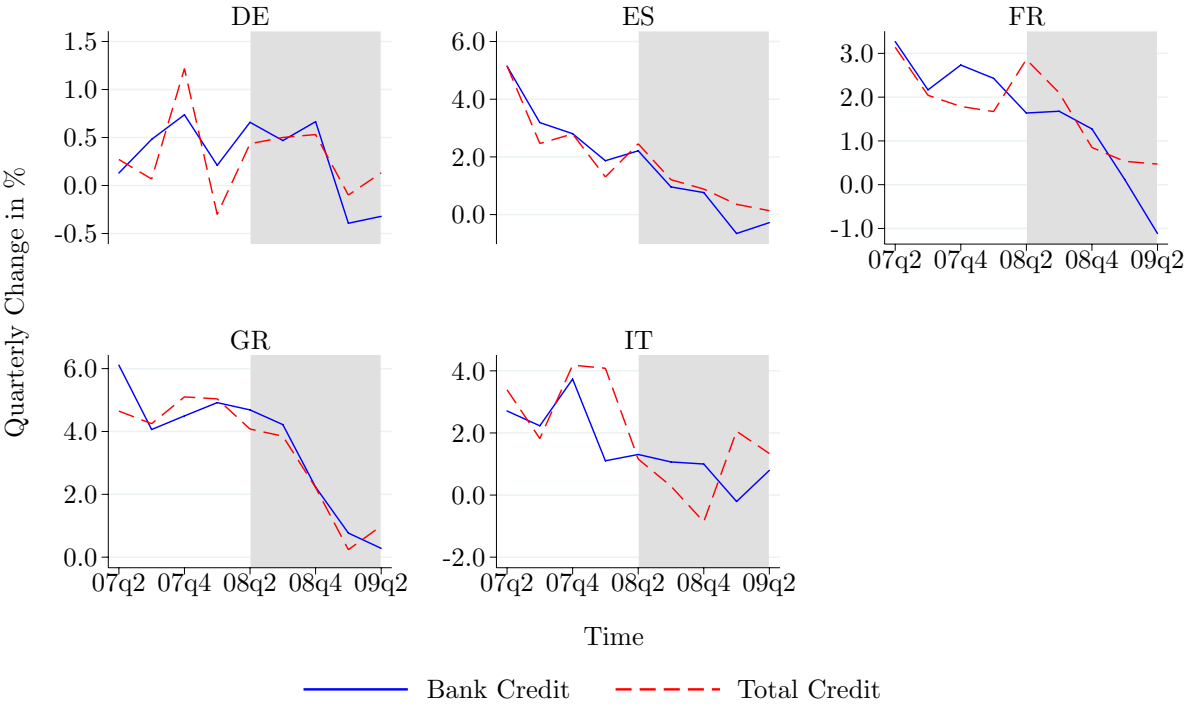
Figure 1: Credit Volumes and Bank Dependency

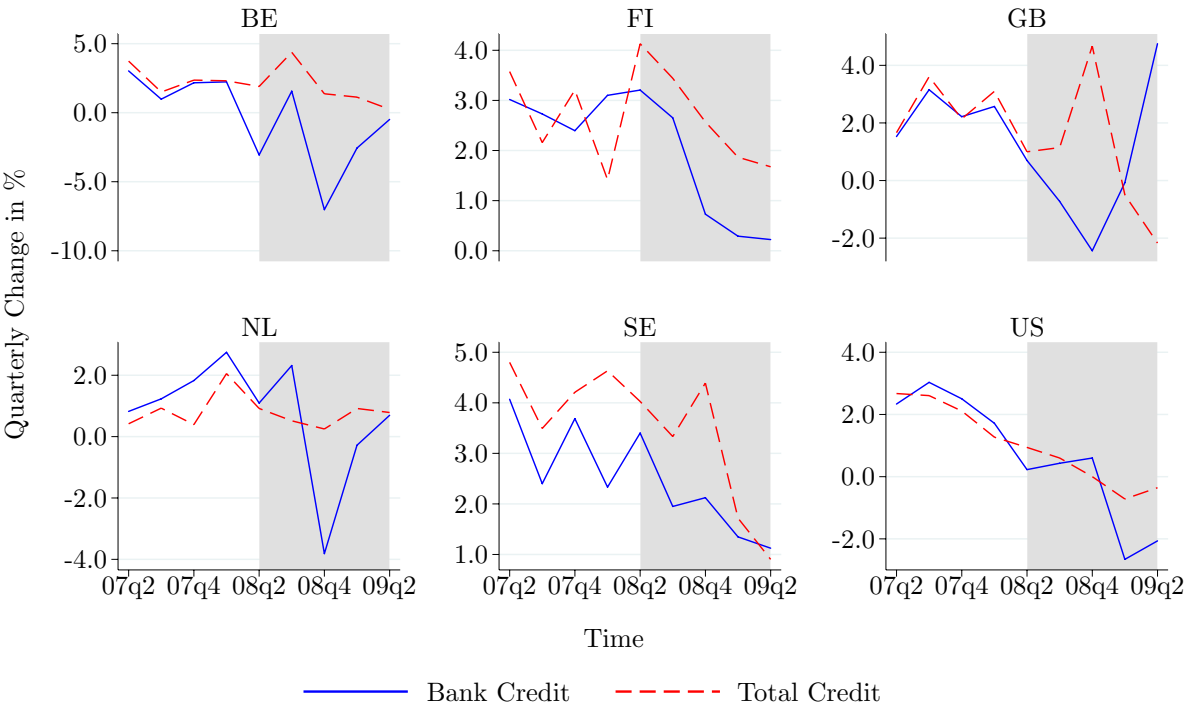
This figure shows how credit financing of the European countries in our sample and the US were affected by the financial crisis. The figure consists of three panels. Panel A (Panel B) contains the quarterly relative changes in total and bank credit volumes for below (above) median bank dependency countries for the period 2007-Q2 to 2009-Q2. The total credit volumes are total credit to the private non-financial sector, BIS data item *B:P:A, credit to private sector series* and the bank credit volumes are credit to private non-financial sector by domestic banks, BIS data item *B:P:A, credit to private sector series*. The gray bar in each subfigure of Panels A and B indicate the period 2008-Q2 to 2009-Q2. Panel C contains our pre-crisis bank dependency measure for each country. It is calculated as the the bank to total credit ratio in 2006-Q4.

Panel A: Total Credit and Bank Credit Volumes for Above Median Bank Dependency



Continued: Credit Volumes and Bank Dependency

Panel B: Total Credit and Bank Credit Volumes for Below Median Bank Dependency



Continued: Credit Volumes and Bank Dependency

Panel C: Bank Dependency

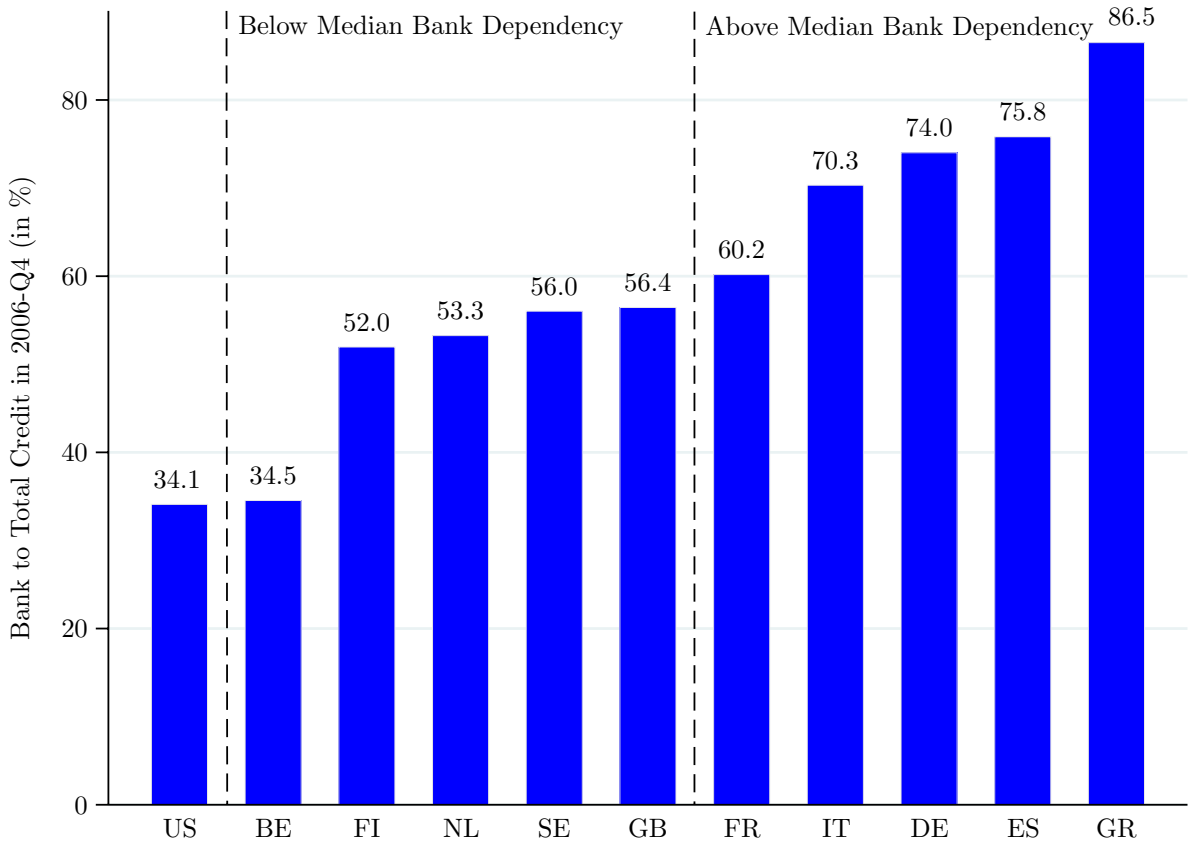


Figure 2: Bank Dependency

This figure shows our matching estimation results separately for each country from our full sample. Section 2.2 describes the details of the matching procedure within the cash flow identity. The figure contains six subgraphs for each of the uses of funds outcome variables from the cash flow identity. Each subgraph contains a scatter plot of the average treatment effects on the treated (ATT) against bank dependency in the year 2006 for each country. We define bank dependency as the ratio of bank credit (BIS data item *B:P:A, credit to private sector series*) to total credit (BIS data item *A:P:A, credit to private sector series*). The average treatment effect on the treated (ATT) is the difference of the public and private firm differences from 2007 to 2008. Outcome variables are normalized by beginning-of-year total assets in every year. All estimation results are given in percentage points. A circle around a dot indicates statistical significance at the 10% level or lower.

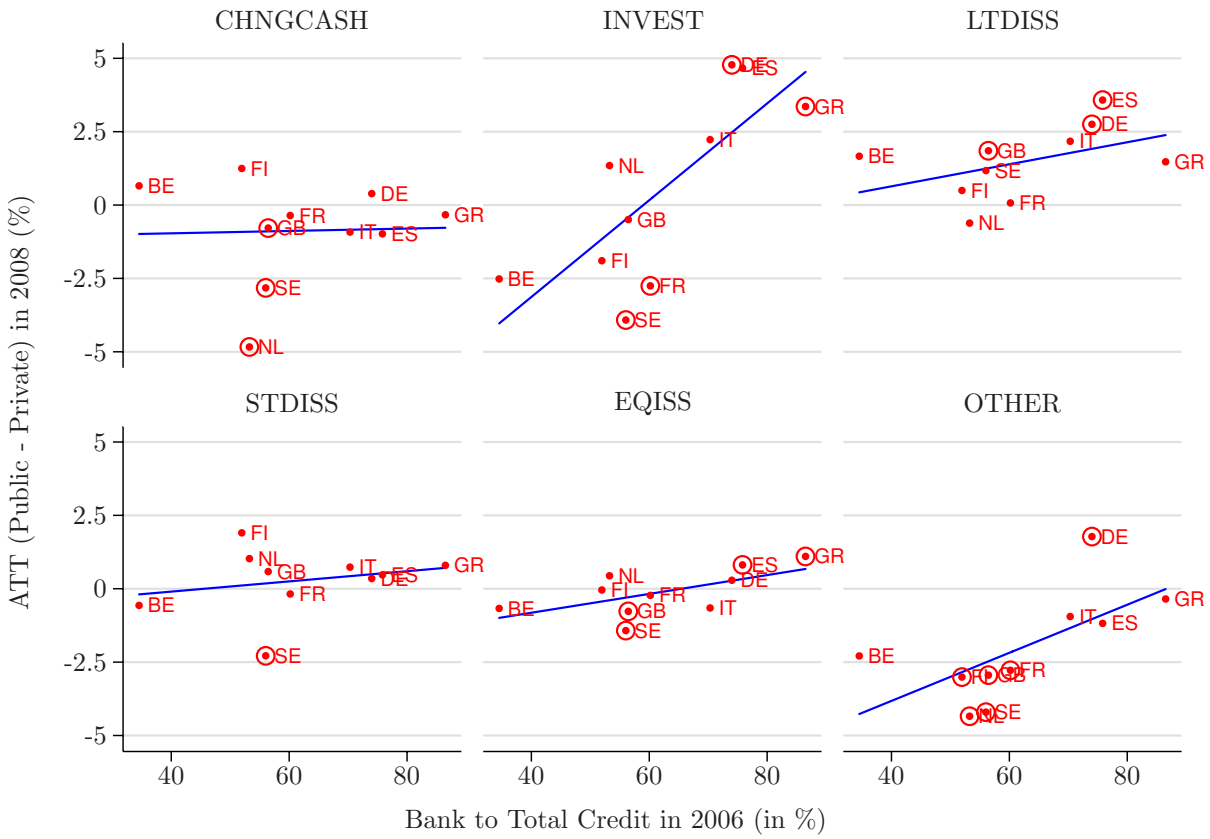
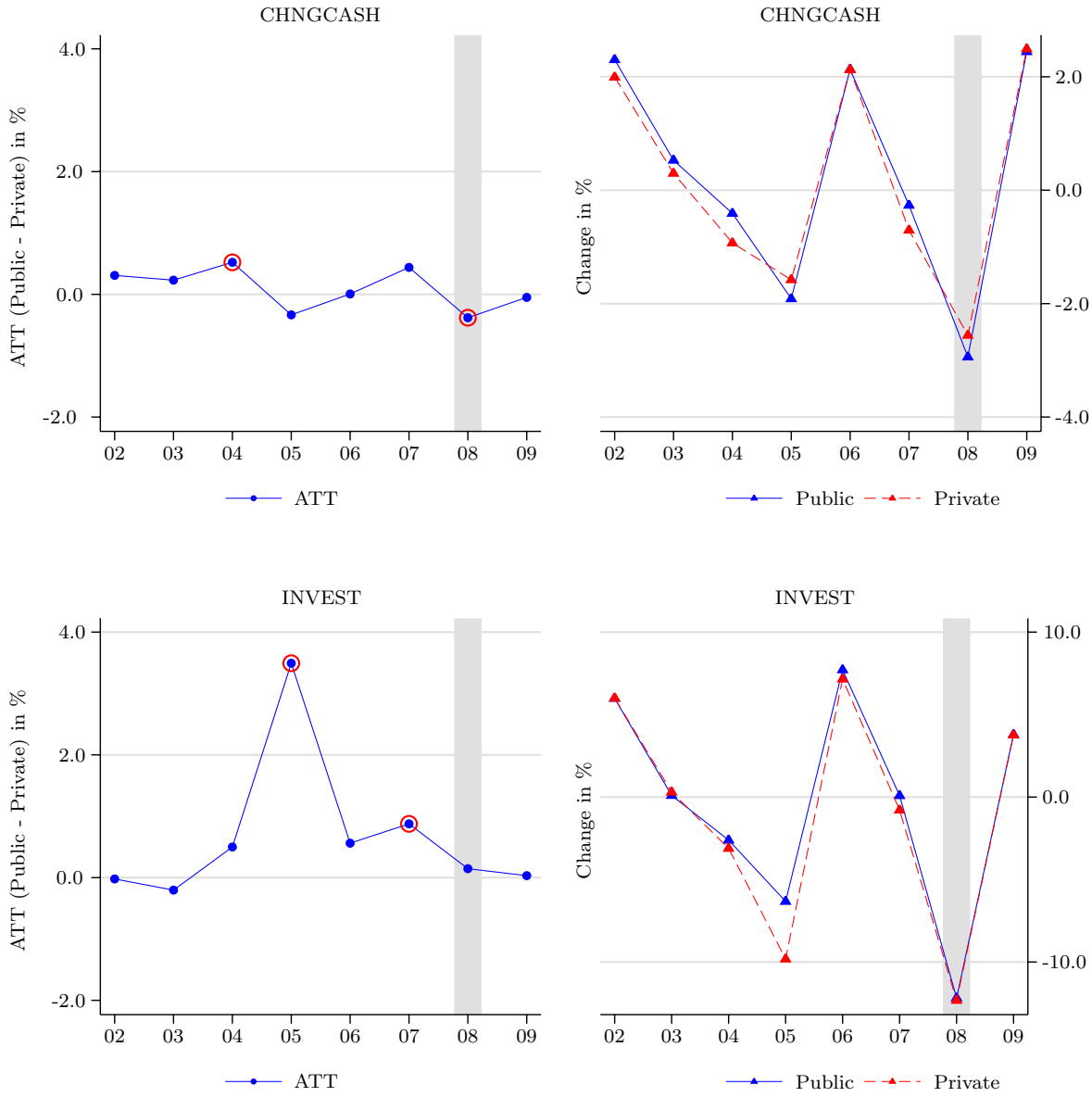
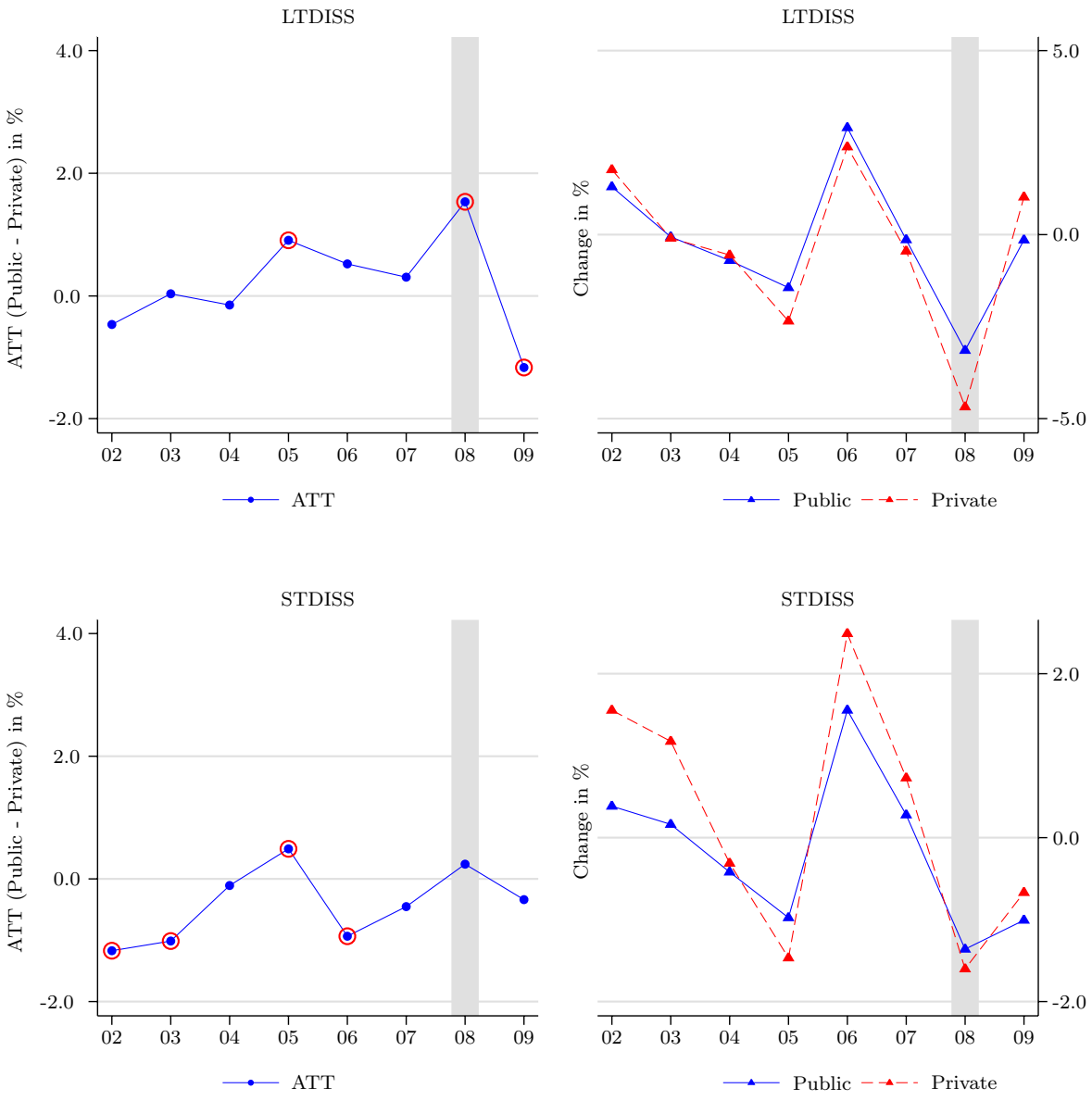


Figure 3: Full Sample Results Over Time

This figure shows our matching estimation results for the full sample for each year in the period 2002 to 2009. For each uses of funds variable average treatment effect on the treated (ATT) over time are reported on the left hand side. On the right hand side, the corresponding differences in uses of funds variables of public and matched private firms over time are reported. Section 2 describes the details of the matching procedure within the cash flow identity. On the left hand side, each graph contains a time series plot of the average treatment effects on the treated (ATT) in the period 2002 to 2009. The average treatment effect on the treated (ATT) in period t is the difference of the public and private firm differences from $t-1$ to t. On the right hand side, each graph contains a time series plot of the differences from $t-1$ to t of public and private firms in the period 2002 to 2009. Outcome variables are normalized by beginning-of-year total assets in every year. All estimation results are given in percentage points. On the left hand side, a circle around a dot indicates statistical significance at the 10% level or lower.



Continued: Full Sample Results Over Time



Continued: Full Sample Results Over Time

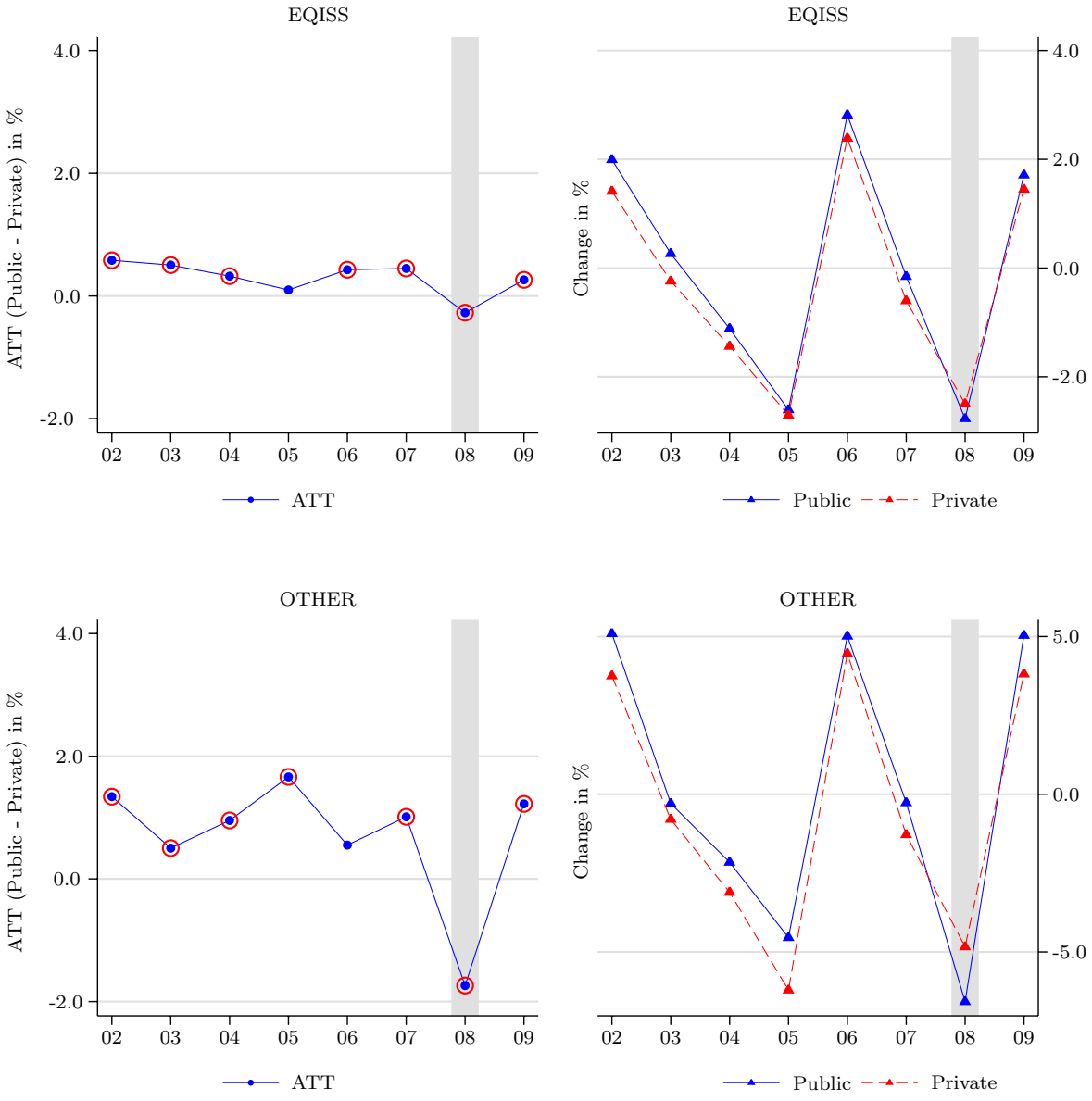


Figure 4: Bank Dependency in 2004

This figure shows our matching estimation results separately for each country from our full sample. Section 2.2 describes the details of the matching procedure within the cash flow identity. The figure contains six subgraphs for each of the uses of funds outcome variables from the cash flow identity. Each subgraph contains a scatter plot of the average treatment effects on the treated (ATT) against bank dependency in the year 2002 for each country. We define bank dependency as the ratio of bank credit (BIS data item *B:P:A, credit to private sector series*) to total credit (BIS data item *A:P:A, credit to private sector series*). The average treatment effect on the treated (ATT) is the difference of the public and private firm differences from 2003 to 2004. Outcome variables are normalized by beginning-of-year total assets in every year. All estimation results are given in percentage points. A circle around a dot indicates statistical significance at the 10% level or lower.

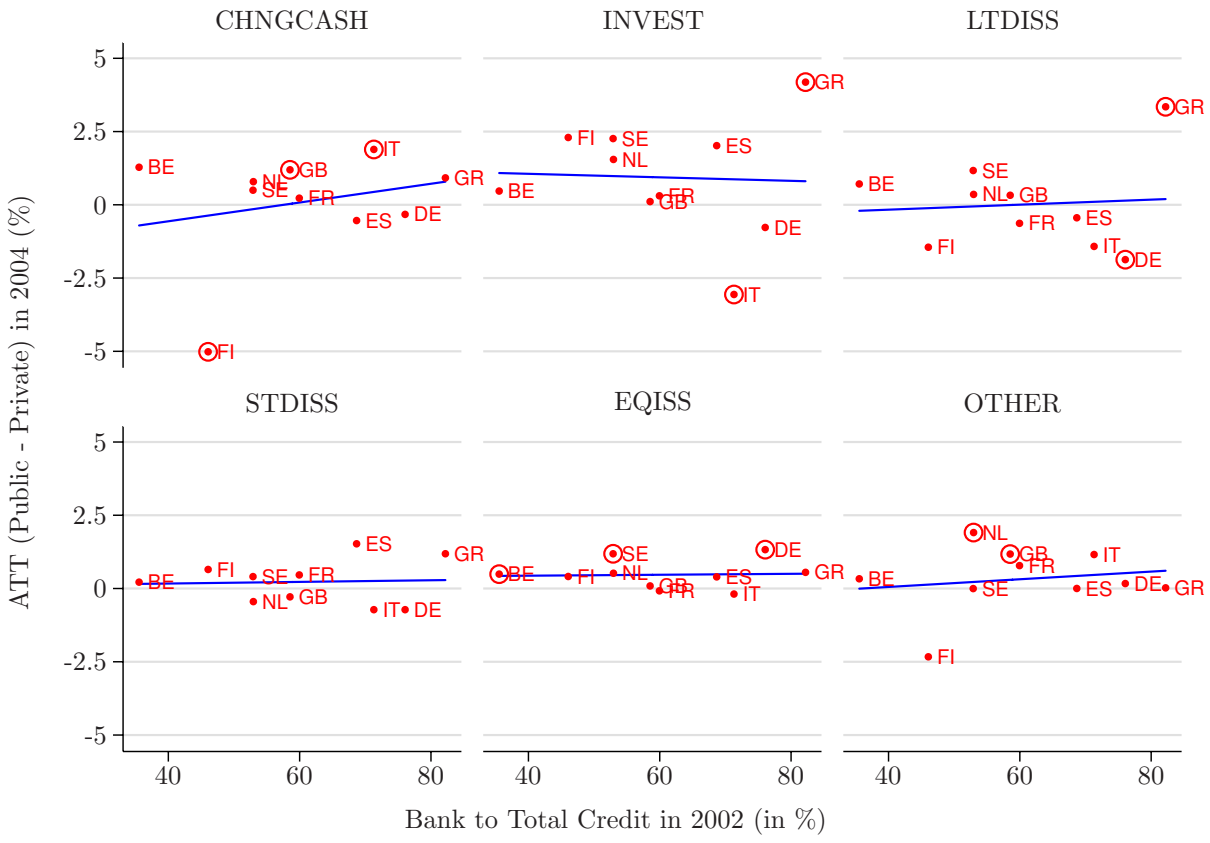


Table 1: Descriptive Statistics for Matching Covariates

This table presents descriptive statistics for the unmatched sample (Panel A) and the matched sample (Panel B) of public and private firms for the financial crisis period 2007 to 2008. The table reports means (*Mean*), standard deviations (*Std.*), differences in means (*D.Means*), and normalized differences (*Norm.D.*) for matching covariates. The row denoted *No. Firms* gives the number of public and private firms, respectively. Due to matching with replacement, one private firm can be matched multiple times. The row denoted *Uni. Prv. Firms* gives the number of unique private firms within the number of all matched private firms. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels for the differences in means tests.

Panel A: Unmatched Sample

	Public		Private		Differences	
	Mean	Std.	Mean	Std.	D.Means	Norm.D.
$CHNGCASH_{2007}$	1.8	9.0	1.0	8.9	-0.8^{***}	0.06
$INVEST_{2007}$	13.8	14.7	10.0	13.1	-3.9^{***}	0.19
$LTDISS_{2007}$	3.1	10.7	2.2	11.9	-0.9^{**}	0.05
$STDISS_{2007}$	1.5	8.5	2.8	10.8	1.3^{***}	-0.09
$EQISS_{2007}$	1.7	3.8	1.3	3.3	-0.4^{***}	0.09
$OTHER_{2007}$	1.6	11.3	0.6	10.5	-1.0^{***}	0.06
ΔOCF_{2008}	-1.3	21.2	2.3	26.6	3.6^{***}	-0.10
$SIZE_{2008}$	11.2	1.8	9.5	1.1	-1.7^{***}	0.63
$INVESTOPP_{2008}$	-6.8	22.9	-7.0	26.0	-0.2	0.01
AGE_{2008}	36.3	31.7	20.7	18.0	-15.6^{***}	0.39
No. Firms	1808		55 695			

Panel B: Matched Sample

	Public		Private		Differences	
	Mean	Std.	Mean	Std.	D.Means	Norm.D.
$CHNGCASH_{2007}$	1.8	9.0	1.6	6.9	-0.2	0.02
$INVEST_{2007}$	13.8	14.7	11.2	11.3	-2.6^{***}	0.14
$LTDISS_{2007}$	3.1	10.7	2.3	7.8	-0.8^{**}	0.06
$STDISS_{2007}$	1.5	8.5	1.4	6.0	-0.1	0.01
$EQISS_{2007}$	1.7	3.8	1.3	3.1	-0.4^{***}	0.08
$OTHER_{2007}$	1.6	11.3	1.1	7.5	-0.5	0.04
ΔOCF_{2008}	-1.3	21.2	-0.4	17.1	0.9	-0.03
$SIZE_{2008}$	11.2	1.8	10.7	1.5	-0.5^{***}	0.21
$INVESTOPP_{2008}$	-6.8	22.9	-7.9	18.1	-1.1	0.04
AGE_{2008}	36.3	31.7	31.1	28.5	-5.3^{***}	0.12
No. Firms	1806		1806			
Uni. Prv. Firms			1494			

Table 2: Full Sample Results

This table presents our matching estimator results for the full sample. Section 2.2 describes the details of the matching procedure within the cash flow identity. The first column contains the names of the outcome variables and operating cash flow that represent the cash flow identity. The signs in front of each variable indicate the cash flow identity relationship. The panel *Public* (*Private*) contains level values for the years 2007 and 2008 as well as the difference (*Diff*) from 2007 to 2008. *Diff** in the private firm panel is the estimated counterfactual outcome and may deviate from the difference of individual levels due to the bias correction of the matching estimator. The panel *ATT* contains the average treatment effect on the treated, which is the difference of the public (*Diff*) and private (*Diff**) firm differences from 2007 to 2008. Outcome variables are normalized by beginning-of-year total assets in every year. All estimation results are given in percentage points. The row denoted by *No. Obs.* gives the number of matched public and private firm pairs. Due to matching with replacement, one private firm can be matched multiple times. The row denoted *No. Uni. Prv.* gives the number of unique private firms within the number of all matched private firms. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels.

	Public			Private			ATT
	2007	2008	Diff	2007	2008	Diff*	Diff
CHNGCASH	1.8	−1.2	−2.9***	1.6	−1.0	−2.6***	−0.4*
+ INVEST	13.8	1.7	−12.2***	11.2	1.5	−12.3***	0.1
− LTDISS	3.1	0.0	−3.1***	2.3	−1.6	−4.7***	1.5***
− STDISS	1.5	0.2	−1.4***	1.4	−0.2	−1.6***	0.2
− EQISS	1.7	−1.1	−2.8***	1.3	−0.7	−2.5***	−0.3**
− OTHER	1.6	−5.0	−6.6***	1.1	−3.3	−4.8***	−1.7***
= OCF	7.7	6.4	−1.3	6.7	6.3	−1.3	0.0
No. Obs.	1806						
No. Uni. Prv.	1494						

Table 3: Subsample Results

This table presents our matching estimator results for subsamples conditional on differences in pre-crisis cash holdings and firm size. Section 2 describes the details of the matching procedure within the cash flow identity. The first column contains the names of the outcome variables and operating cash flow that represent the cash flow identity. The signs in front of each variable indicate the cash flow identity relationship. We divide public firms into groups of differences in cash holdings (Panel A) and firm size (Panel B) in the year 2007 and match similar private firms. See Panel B of Table A2 for details of variables construction. We define *Low Cash* (*High Cash*) firms as those with cash holdings smaller (larger) than the first (last) quintile (bottom 20% (top 20%)) in the 2007 public firm distribution by country. We equivalently proceed with firm size categorizing firms into *Low* and *High* groups. The panel *Public* (*Private*) contains level values for the years 2007 and 2008 as well as the difference (*Diff*) from 2007 to 2008. *Diff** in the private firm panel is the estimated counterfactual outcome and may deviate from the difference of individual levels due to the bias correction of the matching estimator. The panel ATT contains the average treatment effect on the treated, which is the difference of the public (*Diff*) and private (*Diff**) firm differences from 2007 to 2008. Outcome variables are normalized by beginning-of-year total assets in every year. All estimation results are given in percentage points. The row denoted by *No. Obs.* gives the number of matched public and private firm pairs. Due to matching with replacement, one private firm can be matched multiple times. The row denoted *No. Uni. Prv.* gives the number of unique private firms within the number of all matched private firms. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels.

Continued: Subsample Results

Panel A: Cash Holdings

Low Cash

	Public			Private			ATT
	2007	2008	Diff	2007	2008	Diff*	Diff
CHNGCASH	−1.2	1.3	2.5***	−0.9	0.7	1.7***	0.8***
+ INVEST	13.6	−1.9	−15.5***	11.6	0.6	−14.8***	−0.6
− LTDISS	3.9	−0.1	−4.0***	2.4	−2.6	−7.1***	3.1***
− STDISS	2.5	−0.8	−3.3***	2.1	−0.1	−1.9*	−1.4*
− EQISS	1.6	−1.0	−2.5***	1.1	−1.2	−3.3***	0.8
− OTHER	1.0	−4.6	−5.5***	0.2	−1.7	−3.1***	−2.4**
= OCF	3.5	5.8	2.4	4.7	6.9	2.4	0.0
No. Obs.	255						
No. Uni. Prv.	224						

High Cash

	Public			Private			ATT
	2007	2008	Diff	2007	2008	Diff*	Diff
CHNGCASH	8.3	−6.5	−14.8***	9.3	−5.1	−14.4***	−0.4
+ INVEST	10.7	2.5	−8.1***	7.5	2.5	−7.9***	−0.2
− LTDISS	1.5	0.3	−1.2	0.3	−1.0	−2.3***	1.2*
− STDISS	0.7	0.9	0.2	0.4	−0.2	−0.8	1.0**
− EQISS	2.4	−1.9	−4.3***	1.4	−1.2	−3.4***	−0.9*
− OTHER	2.8	−6.3	−9.1***	1.3	−6.6	−7.2***	−1.9*
= OCF	11.6	3.0	−8.6	13.5	6.3	−8.6	0.0
No. Obs.	236						
No. Uni. Prv.	204						

Continued: Subsample Results

Panel B: Firm Size

Small Firms

	Public			Private			ATT
	2007	2008	Diff	2007	2008	Diff*	Diff
CHNGCASH	1.1	−2.5	−3.7***	1.3	−1.0	−2.0**	−1.6**
+ INVEST	11.2	2.2	−9.1***	9.1	1.6	−10.6***	1.5
− LTDISS	1.3	−0.3	−1.7*	0.5	−0.6	−1.9**	0.2
− STDISS	0.9	−0.8	−1.8**	1.1	−1.3	−2.1**	0.3
− EQISS	3.2	−1.8	−4.9***	2.1	−0.8	−3.9***	−1.1**
− OTHER	3.4	−1.9	−5.3***	1.2	−2.3	−5.8***	0.5
= OCF	3.5	4.5	1.0	5.3	5.7	1.0	0.0
No. Obs.	247						
No. Uni. Prv.	223						

Large Firms

	Public			Private			ATT
	2007	2008	Diff	2007	2008	Diff*	Diff
CHNGCASH	1.4	−0.6	−2.0**	0.7	−1.1	−2.1***	0.2
+ INVEST	14.7	1.5	−13.2***	12.5	−1.4	−15.7***	2.5
− LTDISS	3.8	0.4	−3.4***	3.0	−3.9	−8.0***	4.7*
− STDISS	1.6	0.1	−1.5	1.7	−0.2	−2.4***	1.0
− EQISS	0.5	−0.7	−1.2***	0.7	−0.8	−1.2***	0.0
− OTHER	0.6	−5.9	−6.5***	1.3	−3.2	−3.6***	−2.9**
= OCF	9.5	6.9	−2.6	6.5	5.7	−2.6	0.0
No. Obs.	171						
No. Uni. Prv.	89						

Table 4: Bank Dependency

This table presents our matching estimator results conditional on differences in bank dependency. We divide all firms of a country whose bank dependency in 2006 is below (above) median into the group *Below Median Bank Dependency* (*Above Median Bank Dependency*). We define bank dependency as the ratio of bank credit (BIS data item *B:P:A, credit to private sector series*) to total credit (BIS data item *A:P:A, credit to private sector series*). Section 2 describes the details of the matching procedure within the cash flow identity. The first column contains the names of the outcome variables and operating cash flow that represent the cash flow identity. The signs in front of each variable indicate the cash flow identity relationship. The panel *Public* (*Private*) contains level values for the years 2007 and 2008 as well as the difference (*Diff*) from 2007 to 2008. *Diff** in the private firm panel is the estimated counterfactual outcome and may deviate from the difference of individual levels due to the bias correction of the matching estimator. The panel *ATT* contains the average treatment effect on the treated, which is the difference of the public (*Diff*) and private (*Diff**) firm differences from 2007 to 2008. Outcome variables are normalized by beginning-of-year total assets in every year. All estimation results are given in percentage points. The row denoted by *No. Obs.* gives the number of matched public and private firm pairs. Due to matching with replacement, one private firm can be matched multiple times. The row denoted *No. Uni. Prv.* gives the number of unique private firms within the number of all matched private firms. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels.

Below Median Bank Dependency

	Public			Private			ATT
	2007	2008	Diff	2007	2008	Diff*	Diff
CHNGCASH	1.3	−1.5	−2.8***	1.6	−1.2	−1.9***	−0.9***
+ INVEST	14.8	−1.5	−16.3***	12.0	−0.2	−15.0***	−1.2**
− LTDISS	3.1	−0.9	−4.0***	2.6	−1.9	−5.1***	1.1**
− STDISS	1.2	−0.4	−1.6***	1.1	−0.8	−2.0***	0.4
− EQISS	1.1	−1.5	−2.6***	0.9	−0.7	−1.9***	−0.7***
− OTHER	1.7	−7.7	−9.3***	1.1	−4.4	−6.3***	−3.1***
= OCF	9.0	7.5	−1.6	7.8	6.6	−1.6	0.0
No. Obs.	904						
No. Uni. Prv.	756						

Above Median Bank Dependency

	Public			Private			ATT
	2007	2008	Diff	2007	2008	Diff*	Diff
CHNGCASH	2.3	−0.9	−3.1***	1.6	−0.8	−3.1***	0.0
+ INVEST	12.9	4.8	−8.1***	10.7	3.1	−10.3***	2.2***
− LTDISS	3.1	0.8	−2.3***	2.1	−1.1	−4.3***	2.0***
− STDISS	1.8	0.7	−1.1**	1.6	0.3	−1.3***	0.2
− EQISS	2.4	−0.6	−3.0***	1.7	−0.8	−3.3***	0.3*
− OTHER	1.5	−2.3	−3.8***	0.9	−2.0	−3.5***	−0.3
= OCF	6.4	5.4	−1.0	6.0	5.9	−1.0	0.0
No. Obs.	902						
No. Uni. Prv.	744						

Table 5: Full Sample Results in 2004

This table presents our matching estimator results for the full sample. Section 2.2 describes the details of the matching procedure within the cash flow identity. The first column contains the names of the outcome variables and operating cash flow that represent the cash flow identity. The signs in front of each variable indicate the cash flow identity relationship. The panel *Public* (*Private*) contains level values for the years 2003 and 2004 as well as the difference (*Diff*) from 2003 to 2004. *Diff** in the private firm panel is the estimated counterfactual outcome and may deviate from the difference of individual levels due to the bias correction of the matching estimator. The panel *ATT* contains the average treatment effect on the treated, which is the difference of the public (*Diff*) and private (*Diff**) firm differences from 2003 to 2004. Outcome variables are normalized by beginning-of-year total assets in every year. All estimation results are given in percentage points. The row denoted by *No. Obs.* gives the number of matched public and private firm pairs. Due to matching with replacement, one private firm can be matched multiple times. The row denoted *No. Uni. Prv.* gives the number of unique private firms within the number of all matched private firms. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels.

	Public			Private			ATT
	2003	2004	Diff	2003	2004	Diff*	Diff
CHNGCASH	2.1	1.7	−0.4	1.8	1.1	−0.9***	0.5**
+ INVEST	12.4	9.8	−2.6***	11.9	8.8	−3.1***	0.5
− LTDISS	1.7	1.0	−0.7*	1.8	1.3	−0.6*	−0.1
− STDISS	0.9	0.5	−0.4	1.4	0.8	−0.3	−0.1
− EQISS	2.5	1.4	−1.1***	2.0	1.0	−1.4***	0.3***
− OTHER	3.2	1.1	−2.2***	2.7	0.2	−3.1***	1.0***
= OCF	6.0	7.4	1.4	5.7	6.6	1.4	0.0
No. Obs.	1986						
No. Uni. Prv.	1631						

Table 6: Bank Dependency in 2004

This table presents our matching estimator results conditional on differences in bank dependency. We divide all firms of a country whose bank dependency in 2002 is below (above) median into the group *Below Median Bank Dependency* (*Above Median Bank Dependency*). We define bank dependency as the ratio of bank credit (BIS data item *B:P:A, credit to private sector series*) to total credit (BIS data item *A:P:A, credit to private sector series*). Section 2 describes the details of the matching procedure within the cash flow identity. The first column contains the names of the outcome variables and operating cash flow that represent the cash flow identity. The signs in front of each variable indicate the cash flow identity relationship. The panel *Public* (*Private*) contains level values for the years 2003 and 2004 as well as the difference (*Diff*) from 2003 to 2004. *Diff** in the private firm panel is the estimated counterfactual outcome and may deviate from the difference of individual levels due to the bias correction of the matching estimator. The panel *ATT* contains the average treatment effect on the treated, which is the difference of the public (*Diff*) and private (*Diff**) firm differences from 2003 to 2004. Outcome variables are normalized by beginning-of-year total assets in every year. All estimation results are given in percentage points. The row denoted by *No. Obs.* gives the number of matched public and private firm pairs. Due to matching with replacement, one private firm can be matched multiple times. The row denoted *No. Uni. Prv.* gives the number of unique private firms within the number of all matched private firms. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels.

Below Median Bank Dependency

	Public			Private			ATT
	2003	2004	Diff	2003	2004	Diff*	Diff
CHNGCASH	1.7	1.7	0.0	1.5	0.9	-0.7^{**}	0.8^{**}
+ INVEST	11.7	9.4	-2.3^{***}	11.4	8.8	-2.7^{***}	0.4
− LTDISS	1.6	0.7	-0.9^{*}	1.8	0.8	-0.9^{**}	0.0
− STDISS	0.2	0.5	0.3	0.9	0.9	0.6	−0.2
− EQISS	1.9	1.4	-0.6^{***}	1.5	0.9	-0.9^{***}	0.3^{***}
− OTHER	2.9	1.0	-1.8^{***}	2.8	0.4	-2.9^{***}	1.0^{**}
= OCF	6.8	7.5	0.7	5.9	6.6	0.7	0.0
No. Obs.	1005						
No. Uni. Prv.	821						

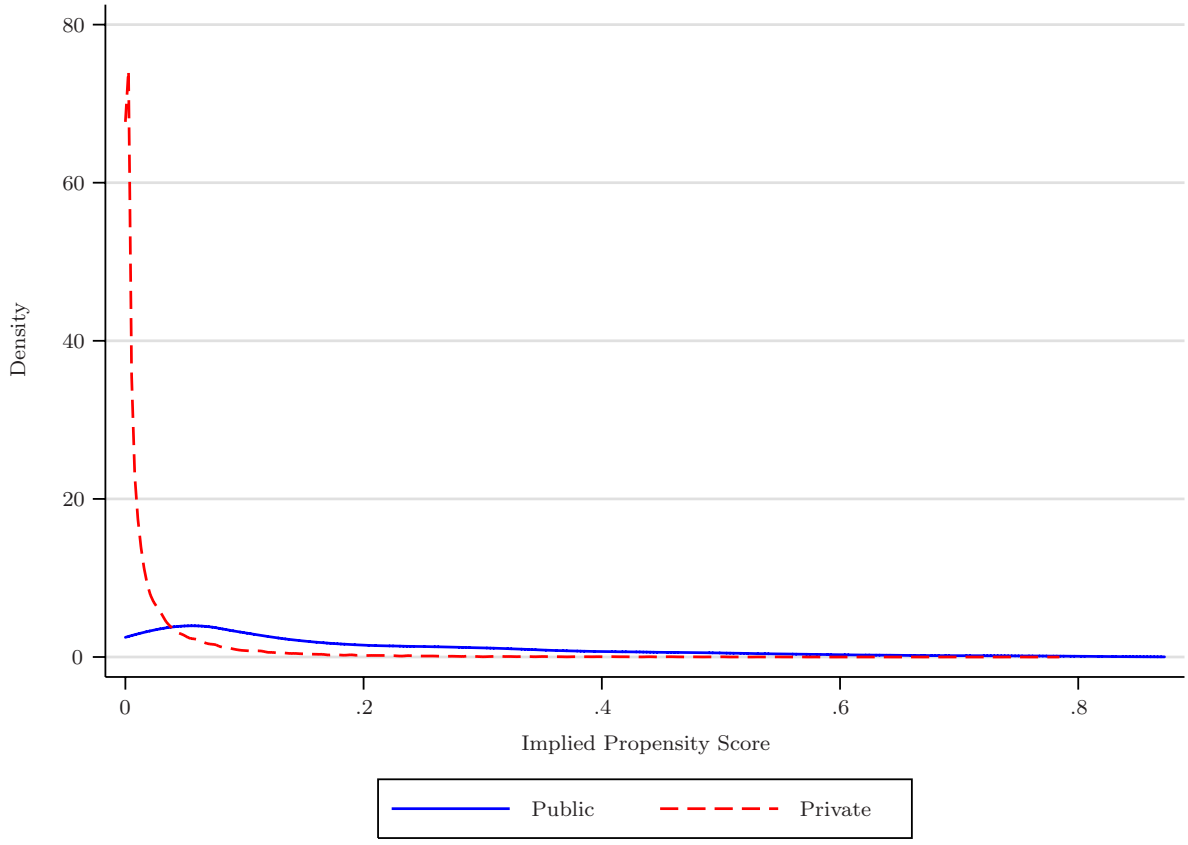
Above Median Bank Dependency

	Public			Private			ATT
	2003	2004	Diff	2003	2004	Diff*	Diff
CHNGCASH	2.5	1.6	-0.9^{**}	1.8	1.5	-1.1^{***}	0.2
+ INVEST	13.1	10.2	-2.9^{***}	12.4	8.9	-3.6^{***}	0.7
− LTDISS	1.8	1.3	−0.5	1.7	1.7	−0.1	−0.4
− STDISS	1.8	0.6	-1.2^{***}	1.9	0.2	-1.5^{***}	0.3
− EQISS	3.2	1.5	-1.7^{***}	2.4	1.1	-2.0^{***}	0.3^{*}
− OTHER	3.6	1.2	-2.5^{***}	2.5	0.1	-3.2^{***}	0.7
= OCF	5.2	7.3	2.1	5.7	7.1	2.1	0.0
No. Obs.	981						
No. Uni. Prv.	819						

Figure A1: Implied Propensity Scores

This figure shows Epanechnikov kernel density estimates for the implied propensity scores distribution for the public and private firm groups. Panel A (B) shows estimated distributions for the unmatched (matched) sample. Implied propensity scores are predicted values from a logit regression of the public listing status on the matching covariates used in the nearest neighbor matching from Section 2.

Panel A: Unmatched Sample



Continued: Implied Propensity Scores

Panel B: Matched Sample

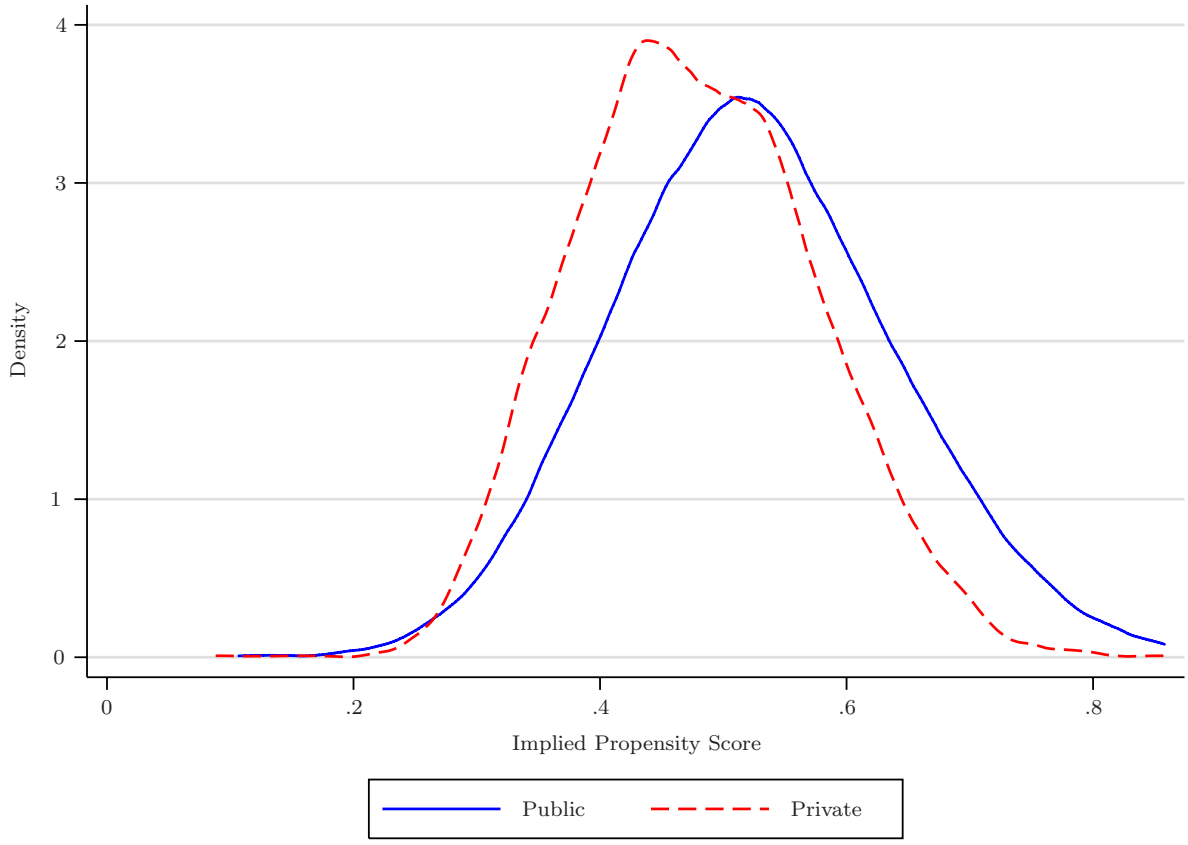
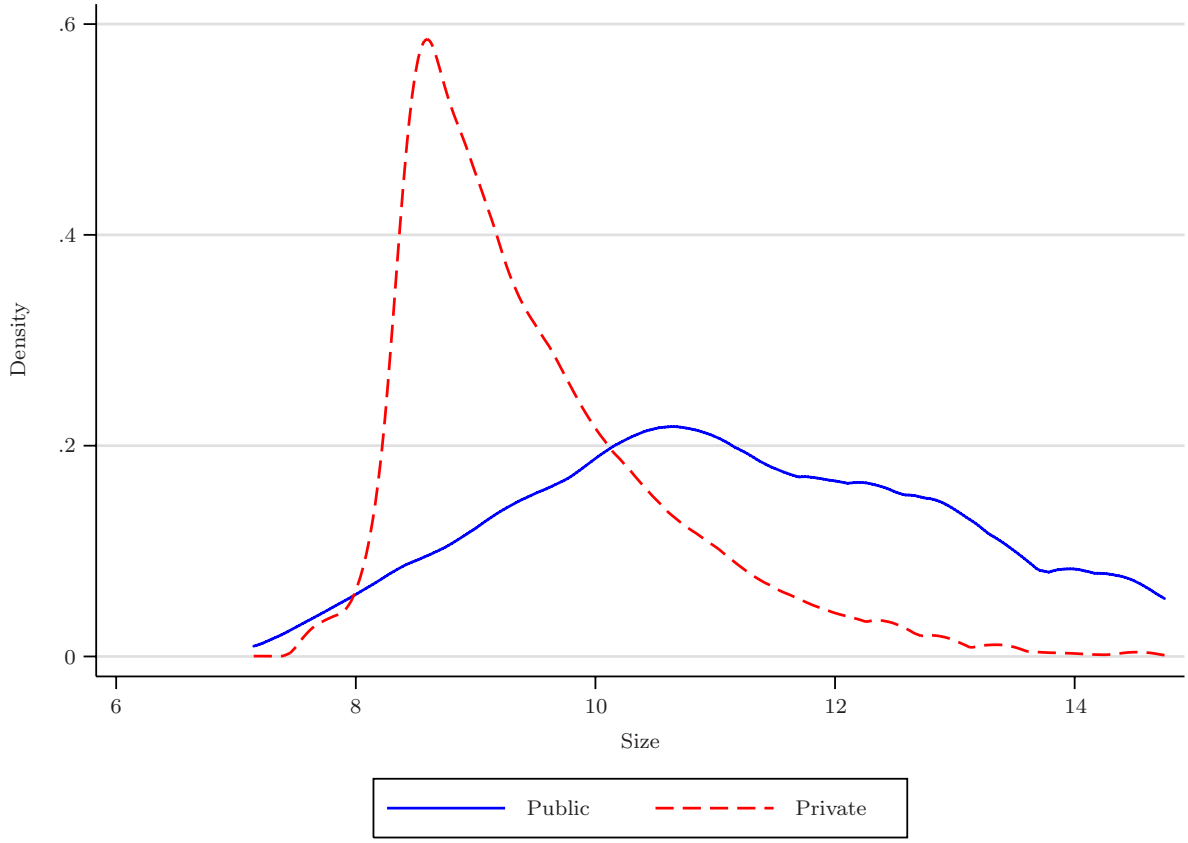


Figure A2: Size Overlap

This figure shows Epanechnikov kernel density estimates for the firm size distribution for the public and private firm groups. Panel A (B) shows estimated distributions for the unmatched (matched) sample.

Panel A: Unmatched Sample



Continued: Size Overlap

Panel B: Matched Sample

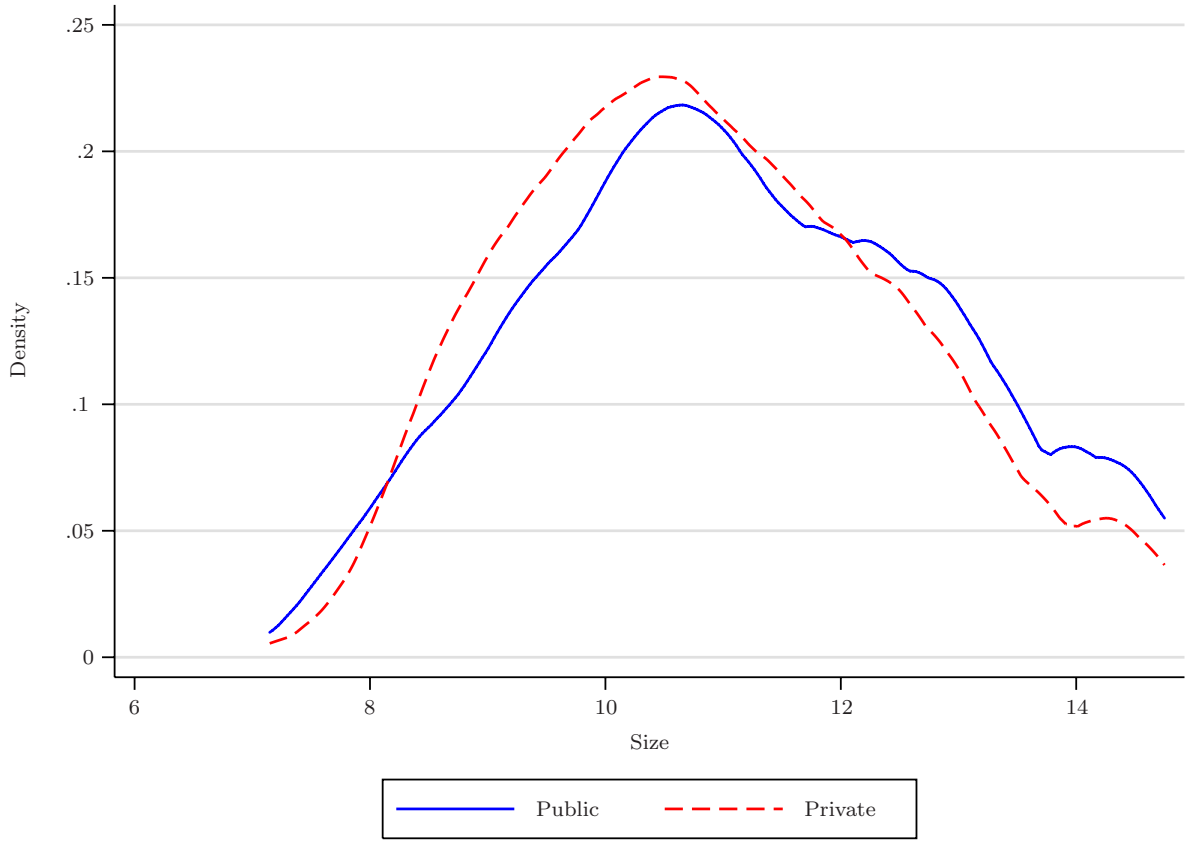


Table A1: Country Distribution for Matched Sample

Panel A (B) presents the country distribution for the matched sample in the year 2008 (2004). The column *Freq.* contains the number of matched pairs by country.

Panel A: Crisis Period (2008)

Country Initials	Freq.
BE	57
DE	280
ES	52
FI	61
FR	347
GB	653
GR	150
IT	73
NL	48
SE	85
Total	1806

Panel B: Placebo Crisis Period (2004)

Country Initials	Freq.
BE	50
DE	291
ES	89
FI	52
FR	355
GB	732
GR	135
IT	111
NL	104
SE	67
Total	1986

Table A2: Variables Construction

This table contains details of the variables construction including BvD codes and their definitions. Panel A contains our derivation of the cash flow statement based on balance sheet and income statement items. Panel B contains details of the construction of firm characteristics used for grouping in Section 4.2 or as matching covariates.

Panel A: Cash Flow Identity Variables

Description (Variable)	Formula [BvD Code]	BvD Definition
Operating activities		
Net income	Net income [PL]	Net income for the year. Before deduction of minority interests if any (profit after taxation + extraordinary and other profit).
+ Depreciation	Depreciation [DEPR]	Total amount of depreciation and amortization of the assets.
+ Δ Accounts payable	Δ Accounts payable [CRED]	Change in debts to suppliers and contractors (trade creditors).
− Δ Accounts receivable	Δ Accounts receivable [DEBT]	Change in trade receivables (from clients and customers only).
− Δ Inventory	Δ Inventory [STOK]	Change in total inventories (raw materials + in progress + finished goods)
+ Other non-cash items	Δ Other non-current liabilities [ONCL]	Change in other long term liabilities (trade debts, group companies, pension loans, etc.) + provisions + deferred taxes.
	− Δ (Other current assets [OCAS] less cash and cash equivalents [CASH])	Change in all other current assets such as receivables from other sources (taxes, group companies), short term investment of money.
	+ Δ Other current liabilities [OCLI]	Change in other current liabilities such as pension, personnel costs, taxes, intragroup debts, accounts received in advance, etc.
= (1) Cash from operating activities ($\widetilde{OCF}$)		
Investment activities		
Gross Investment	Δ Fixed Assets [FIAS]	Change in total amount (after depreciation) of non current assets (intangible assets + tangible assets + other fixed assets).
	+ Depreciation [DEPR]	Total amount of depreciation and amortization of the assets.
= (2) Cash from investing activities ($\widetilde{INVEST}$)		
Financing activities		
Long term debt Issuance ($\widetilde{LTDISS}$)	Δ Long term debt [LTDB]	Change in long term financial debts (e.g. to credit institutions (loans and credits), bonds).
+ Short term debt Issuance ($\widetilde{STDISS}$)	Δ Loans [LOAN]	Change in short term financial debts (e.g. to credit institutions + part of long term financial debts payable within the year, bonds, etc.).
+ Equity Issuance ($\widetilde{EQISS}$)	Δ Capital [CAPI]	Change in issued share capital (authorized capital).
= (3) Cash from financing activities		
Other activities		
= (4) Cash from other activities ($\widetilde{OTHER}$)	(5) − ((1) − (2) + (3))	
Change in cash holdings		
= (5) Δ Cash holdings ($\widetilde{CHNGCASH}$)	Δ Cash and cash equivalent [CASH]	Change in the amount of cash at bank and in hand of the company.
= (1) − (2) + (3) + (4)		

Continued: Variables Construction

Panel B: Firm Characteristics

Description (Variable)	Formula [BvD Code]	BvD Definition/Description
Size (SIZE)	log(Total assets [TOAS])	Log of deflated total assets (USD CPI, Base 1983).
Investment Opportunities (INVESTOPP)	(Operating revenue [OPRE$_t$] / Operating revenue [OPRE$_{t-1}$]) - 1	Growth rate of operating revenue.
Age (AGE)	Current year - year of incorporation	Age of the firm.
2-digit SIC code (2DIGITSIC)	First two digits of SIC code	Industry classification - US SIC.
Country (COUNTRY)	Country	Country of the firm's headquarter.
Cash Holdings	Cash and cash equivalent [CASH] / Total assets [TOAS]	Level of cash holdings to total assets.