Public Financial Statements and Private Firm Equity Financing

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Abstract

We study whether the availability of public financial statements influences the probability of private equity (PE) and venture capital (VC) investment in private firms. Extant research on this topic is limited and, if anything, suggests that the direction of the relation goes the other way around (i.e., that financial reporting transparency is a consequence of private financing). Using two complementary settings with plausibly exogenous differences in financial statement availability, we find that an increase in financial statement availability is associated with an increase in the probability of a private firm obtaining VC/PE financing. Our findings are consistent with financial statements facilitating VC/PE firms' ability to perform an early 'screening' test for potential investment. Our evidence highlights the importance of public financial statements in the decision making of private investors, an important and under-studied segment of the investment market.

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1. Introduction

We study the role of public financial reporting availability in the investment decisions of private equity (PE) and venture capital (VC) firms. PE and VC firms are frequent players in capital markets,[1] primarily targeting private firms for investment, and making investment decisions largely based on financial metrics (Hand 2005; Stromberg 2008; Kaplan and Stromberg 2009).[2] Yet, while the role of public financial reporting in *public* financing has been extensively studied, much less is known of the role of accounting information in *private* financing during the early stages of private firms. Prior literature has found that firms improve their reporting quality in advance of an IPO (Ball and Shivakumar 2008) and specifically that PE backed firms have better transparency relative to non-PE backed firms at the time of IPO (Katz 2009). However, as VC/PE firms have access to private information throughout the investment lifecycle, it is unclear whether they value public financial statements when they invest in a private firm, or whether the higher transparency documented in Katz (2009) reflects an increase in transparency after the PE investment, but prior to the IPO. If anything, existent research did not find evidence that PE firms rely on public disclosures prior to their investment (Beuselinck et al. 2008). We revisit this question by identifying two settings with arguably exogenous variation in public financial reporting availability, and by proposing a previously unexplored potential use for public financial statements in the investment decision making of VC/PE firms.

We hypothesize that VC/PE firms use private firms' public financial statements as a screening tool for potential targets in the pre-investment stage. Our hypothesis is based on evidence that (i) most VC/PE deals are generated by an extensive search and selection process (Chen et al.

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[1] In 2014, PE funds raised over $1 trillion in global funds (https://home.kpmg.com/content/dam/kpmg/qm/pdf/preqin-private-equity-update-kpmg-pe-forum.pdf).
[2] In contrast to M&A players, who are thought to base decisions more off of potential synergies and operations.

2010; Gompers et al. 2016; Teten and Farmer 2010) and (ii) this investment selection process requires financial statement information to run initial financial modeling used to estimate the potential investment return (Gompers et al. 2016).[3] To the extent that financial statement availability lowers the search costs of the PE/VC fund, it may do so in two non-mutually exclusive ways. First, publicly disclosed financial statements attract more attention to a target firm from a VC/PE potential investor ('attention' channel). Second, the contents of the public statements can be used to more easily assess the potential target's prospects and compare it to other potential investments ('information' channel).

Our hypothesis notwithstanding, it is unclear whether the availability of financial reporting information will influence PE/VC investment. On one hand, PE and VC firms have access to private information sources including, but not limited to, direct management communications, which could reduce the need for publicly disclosed financial statements. In addition, the existence of financial intermediaries (such as investment banks) may substitute for public financial information via in house research in the due diligence process. On the other hand, public financial statements can provide a relatively lower cost way for VC/PE managers to decide which firms to engage in direct contact with for further analysis. Ultimately, whether the availability of financial reporting information influences the PE/VC investment decision is an empirical question that we investigate in this paper.

The study of VC/PE firms' use of public financial statements in their investment decisions is subject to at least two important challenges. First, it requires private firm financials to be publicly observable, which is not the case in the US. Second, there is an inherent endogeneity

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[3] Deal sourcing comes from two facets: from the target management or from the VC/PE firm. For both cases public financial statements can be used to run initial financial models in the pre-due diligence process. Gompers et al. (2016) find that PE firms use IRR, MOIC, and comparable company analysis as primary deal evaluation methods (mean response 92.7%, 94.8%, and 71.7% respectively). All of these methods require financial statement modeling.

where the quality of the target firm is an important correlated omitted variable in both the target's decision to disclose and the VC/PE firm's decision to invest. We overcome these challenges by turning to the European setting where (i) private firm financial statements are publicly available and (ii) two complementary regulatory settings provide plausibly exogenous variation in financial statement availability.

In our first setting, we follow recent literature that takes advantage of differences in size-based reporting exemption thresholds among the EU's member countries (e.g., Bernard et al. 2018, Breuer 2018). Specifically, despite private firms being required to publicly report financial statements in nearly all EU countries, smaller firms are often allowed to report heavily abridged financial information (e.g. short balance sheet, no income statement), with the size-based definition of a small firm varying by country. As such, this setting allows for a cross-sectional comparison of firms with higher/lower degree of financial reporting information around size thresholds. Moreover, these size-based thresholds change at different times in different countries during our sample period, allowing for a staggered research design that compares PE activity for full and abridged reporters around each country's thresholds while also including country-year and industry-year fixed-effects.

While the EU setting allows us to test our hypotheses on a large cross-section of countries, we can only test the 'information' channel described above because firms on both sides of the threshold disclose at least some financial information. In other words, this setting allows for different degrees of public financial reporting information *content*, but not for public financial reporting *existence* which is more suited for the 'attention' channel.

We thus turn to a second setting which allows us to examine a shock that affected the public availability of financial reports for private firms. Specifically, following Bernard (2016)

and Breuer et al. (2019), we take advantage of a regulatory change that increased the public availability of German private firms' financial statements around 2006. Although private limited liability firms in Germany had been required to disclose financial statements since the 1980s, the requirement was effectively not enforced, and many firms avoided disclosure, until a court case forced stricter enforcement by the German government starting at the end of 2006 (The Act on Electronic Commercial Registers and Company Registers, EHUG, regulation, or enforcement hereafter). As a result, the public availability of mandatory private firm financial statement information substantially increased after the shock (Bernard 2016; Henselmann and Kaya 2009).[4]

Because search costs are unobservable, we focus on the friction underlying these costs in each setting by performing separate analysis for each of the two investor types (PE and VC). Compared to VC investors, PE investors more often invest in firms at later stages for whom the contents of a more detailed financial report are likely to be more informative, i.e. the 'information' channel is more likely to be in play (e.g. Gompers et al. 2016).[5] On the other hand, VCs more often tend to solicit deals on their own (i.e. without the use of an investment bank) such that the 'attention' channel is likely to be more important (e.g. Teten and Farmer 2010).

We obtain VC/PE deals from Bureau van Dijk's (BvD) Zephyr database. Zephyr is a dataset that records global M&A transactions, including VC/PE investments, with particular emphasis on deals with a European counterpart.[6] We merge this data with financial data from

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[4] For example, according to Bernard et al. (2018), the number of firms in Amadeus, a proxy used for private firm disclosure compliance, increased about 20 times, from 32,748 in 2003 to 642,159 in 2007. The comparable figures for France, on the other hand, were 310,917 and 484,782 firms, in 2003 and 2007 respectively, an only an increase of 1.5 times.

[5] In an untabulated analysis, in our sample, we find that the mean age of PE target firms are 14.98 years (median 9 years), compared to a mean of 3.50 years (median 3 years) for VC target firms. In addition, a median PE target firm has total assets 3.2 times those of a country's full filing threshold versus 0.3x for VC firms.

[6] Another widely used dataset for PE deals is Preqin. We do not use it in our analysis because there are no common identifiers between Preqin and the financial information in the BvD's Amadeus dataset.

BvD's Amadeus dataset, which provides financial statements of both private and public companies across the EU, and is widely used in recent literature (e.g. Benard 2016, Bernard et al. 2018, Breuer 2018). Our primary EU-wide sample includes 29,668,572 firm-years and 12,901 transactions, from 2003 to 2011.

In the EU-wide analysis, we find evidence that having to publicly disclose a full set of financial statements is associated with higher incidence of PE deals. Specifically, treated firms' (i.e., firms required to report full financial statements) likelihood of receiving a PE deal is higher than that of control firms (i.e., firms with abridged financial statements) by 57% of the overall mean incidence rate. In contrast, we do not find such a relationship for VC deals and, if anything, the incidence of VC deals among treated firms is lower than among control firms. These results are consistent with PE funds benefitting most from the increased *contents* of financials around the disclosure thresholds via the 'information' channel. In addition, they also suggest that firms in the disclosure threshold (which tend to center around €3-4 million in total assets for most of our sample) are at a life cycle stage where they are more likely to raise PE financing and less likely to obtain VC capital. In fact, when we consider both PE and VC financing jointly we find that treated firms are more likely to receive PE/VC financing, suggesting that the higher incidence of PE financing more than offsets the lower incidence of VC deals.

Our second set of tests exploits the Germany-EHUG setting, which increased the frequency of private firms complying with the public reporting regime (i.e., it increased the *availability* of public financial statements for private German firms). In addition, we exploit the differential effect among small and large firms, although the prediction is ex-ante unclear. On one hand, because of the size threshold exemption explained above, it increased the availability of financials for all firms, but the amount of financial statement information increased more for firms

above the size threshold. This would predict a stronger effect for large firms. On the other hand, to the extent that small targets require higher search costs, the benefit from financial statement availability may be higher for small firms. For this test, because the enforcement regime applied to all firms, we compare German private firms with private firms in other European countries, and then also contrast the findings between small and large firms.

In the Germany-EHUG analysis, we find evidence that German firms experienced a higher incidence of 31.5% in PE/VC deals, although the effect is primarily driven by VC deals. Specifically, we observe 89.1% increase in VC deals post 2006, in contrast to 3.2% increase in PE transactions during the same period. The results are consistent with our argument that PEs focus on 'information', and VCs focus on 'attention'. In addition, consistent with search costs being higher for small firms, we find that the results are concentrated in small target firms invested by VCs, and are weakest for large, PE invested firms which are most likely to use sophisticated intermediaries that may replace the need for early screening using financial statements.

Overall, the findings across both sets of tests are complementary and are consistent with our prediction that the availability of financial reporting information facilitates private firm investors' decision. However, our findings also paint a somewhat nuanced picture of how financial statements help reduced search costs among PE/VC investors. While PE investments increase in the EU-wide setting which specifically targets the 'information' channel, VC investment is mainly affected in the Germany-EHUG setting which seems to be driven by the 'attention' channel.

We contribute to the literature in a number of ways. First, we provide evidence on the role of public financial statements in the early stages of VC/PE investments. Prior literature has found that firms improve their reporting quality in advance of an IPO (Ball and Shivakumar 2008), and that PE-backed target firms exhibit higher reporting quality than non PE-backed firms at IPO

(Katz 2009). Our results suggest that financial statement information plays a role in a much earlier stage of a private firm's lifecycle. Specifically, our findings suggest financial statement information plays a role even at the PE/VC financing decision. In other words, the availability of public financial statements allows VC investors to better search for potential firms, whereas PE firms choose to invest in more transparent firms because it allows them to better screen their investments in the initial stages.

Moreover, our paper speaks to the literature on the uses of private firm financial statements (Berger and Udell 2006; Berger, Minnis, and Sutherland 2017; Minnis and Sutherland 2017). In particular, in the context of the debate on the benefits and potential uses of mandating private firm financial reporting regulation (e.g. Minnis and Shroff 2017), we show that even in environments with a relatively high amount of alternative (private) information channels, such as VC/PE investing, public financial statements still have a role in facilitating financing. Moreover, given prior literature that has shown that PE firms tend to improve targets' operations (Kaplan 1989; Smith 1990; Cotter and Peck 2001; Katz 2009; Guo et al. 2011), our evidence contributes to showing potential economy-wide benefits of regulating reporting in private firms.

Our research also contributes to the private equity and venture capital literature. As data on VC/PE transactions has become more widely available, the literature has more rigorously attempted to look at the changes that VC/PE firms bring to their portfolio companies (Badertscher et al. 2013; Bernstein and Sheen 2016; Cohn et al. 2014; Katz 2009, Guo, et al. 2011, and many others). Less studied are the determinants of VC/PE investments, which is an important area of private equity research, given VC/PE funds' important role in the economy (e.g. Kaplan and Schoar 2005). Our paper contributes to this stream of research by highlight the role of public financial statement in VC/PE decision making.

2. Institutional Setting and Hypothesis Development

2.1 Institutional Setting

A key challenge in the VC/PE literature is that these investors typically invest in private firms whose financials are largely unobservable in the US. Moreover, to study whether there exists a relationship between public reporting and VC/PE investment we need to obtain exogenous variation in private firm reporting. To address these issues, we turn to the European setting, where firms, regardless of their public/private status, must file public financial statements with the government (Bernard 2016, Bernard et al. 2018, Breuer 2018).

2.1.1 EU Financial Reporting Regulation

Although private limited liability firms in the EU have been required to disclose financial statements since the 1980s (in accordance with EU Directives), member countries provide size-based exemptions to small private firms such that firms below certain country-specific thresholds can provide only abridged versions of their financial statements (see Appendix B for details on each country's thresholds and requirements). These abridged versions provide substantially less detailed information than the full-fledged financials, often requiring only abridged balance sheets but no income statement. Further, these size thresholds are based on three variables: assets, sales, and number of employees. Those firms that are below the threshold in at least two out of the three variables for the past two consecutive years qualify for the exemption.[7]

In addition to variation in the threshold across countries, there is also variation in the threshold within country across time. Specifically, as shown in Appendix B, countries adjust the exemption thresholds over time, largely to keep up with inflation (Bernard et al. 2018). These

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[7] There are further thresholds to distinguish between medium and large firms, but in this paper we only concentrate on the small to medium threshold because the difference in required disclosure is greater between those groups (e.g. Bernard et al. 2018)

sources of variation provide a rich setting to implement a staggered design as described in section 4 below. If VC/PE firms use the public financial statements to find new targets for investment, the incidence of VC/PE investment across countries and time should be higher for firms above the disclosure thresholds as compared to those just below the threshold.

2.1.2 German Financial Reporting Regulation

Although private limited liability firms in Germany had been required to disclose financial statements since the 1980s, the requirement was effectively not enforced. Many firms avoided disclosure until an EU court case forced stricter enforcement at the end of 2006 (The Act on Electronic Commercial Registers and Company Registers, EHUG hereafter). The new regulation bill was announced in April 2005 (Bernard 2016), and went to full effect in January 1, 2007 (therefore firms needed to disclose financial statements from fiscal year 2006). As Figure 1 shows, the result of EHUG was a dramatic increase in the number of firms filing financial statements in Germany as compared to other EU countries (Bernard 2016; Henselmann and Kaya 2009). If VC/PE firms use the public financial statements to find new targets for investment, VC/PE investments should increase in Germany after the new regime because it facilitates the VC/PE firm ability to identify potential investment choices.

2.2 Hypothesis Development

Whereas the effects of VC/PE funds on the target firms they invest in are discussed in the literature (Badertscher et al. 2013; Bernstein and Sheen 2016; Katz 2009; Guo et al. 2011), little is known about the mechanism through which VC/PE funds make their investment decisions.[8]

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[8] An interview with a private equity professional nicely summarizes PE funds' decision making criteria, which resonates with the importance of financial statements mentioned above. He explains that having more detailed and disaggregated financial statements allows the PE fund to fully investigate the sources of revenue and profit. By analyzing these sources, PE funds can better understand where management should focus (strategically) after the PE fund takes over. These projections also serve as a useful basis for price negotiations with the management. He goes on further to say, "having more transparent financial statements helps us detect potential accounting issues or contingent liabilities that can profoundly hurt our investment returns."

Most VC/PE deals are generated by investment banks or VC/PE firms themselves (Chen et al. 2010; Gompers et al. 2016; Teten and Farmer 2010), so that potential investors face significant information asymmetry and need to engage in costly due diligence before making a deal. Moreover, VC/PE managers and analysts evaluate numerous potential investment opportunities before engaging the target management in further discussion through private communication channels. Survey evidence in Gompers et al. (2016) suggest "for every hundred opportunities considered, the average PE investor deeply investigates 15." We refer to this initial process of narrowing down the entire universe of potential opportunities using certain criteria before further proceeding with deep investigation as 'screening'.

We posit that public financial statements can drive VC/PE firms to invest more through enhancing both the breadth and the depth of the screening process. First, prior literature has shown that voluntary disclosure is associated with an increase in the visibility of a firm to potential investors (e.g. Merton 1987; Fishman and Hagerty 1989; Diamond and Verrecchia 1991; Healy, Hutton and Palepu, 1999; Botosan and Harris, 2000). Thus, public financial statements allows VC/PE investors to discover new potential target firms that they may otherwise be unfamiliar with, drawing attention to new firms and thus expanding the breadth of the pool of potential investments. We call this the 'attention' channel.

Second, survey evidence suggests that PE investors make investment decisions using financial metrics such as internal rate of return (IRR) and comparable company analyses as their primary investment screening methods (Gompers et al. 2016). VC/PE investors can use public financial statements as a low-cost way to glean preliminary metrics of interest of a potential target, thereby increasing the depth of knowledge the firm can get before engaging in more costly investigation such as direct contact with management. We call this the 'information' channel.

We hypothesize that private firms' public financial statements can affect the likelihood of VC/PE investment by enhancing the breadth and depth of investors' screening processes.

H1: VC/PE investment increased more for the set of firms subject to increased reporting than for similar control firms.

3. EU-Wide Setting

To test our hypothesis, we first turn to the EU-wide financial reporting regulation setting (e.g., Bernard et al. 2018), where we exploit differences in disclosure exemption thresholds across countries and across time.

3.1 Data and sample selection

We retrieve VC/PE transactions from Zephyr, a dataset managed by Bureau van Dijk (BvD) that archives M&A and VC/PE transactions around the world, comparable to SDC Platinum (SDC). Although less frequently used in the M&A literature,[9] Zephyr is a useful data for our intended settings because (i) it has wider coverage of European transactions compared to SDC (Bollaert and Delanghe 2015), and (ii) has a shared BvD ID with other BvD databases, including Amadeus, which enables us to extract more accurate matches for the financial information on the European target firms. Zephyr data comes from four sources: (i) official sources, (ii) news services, (iii) official company filings, and (iv) advisor data submissions, which is largely similar to SDC sources (Bollaert and Delanghe 2015).

To conduct our main tests, we obtain from Zephyr all 'private equity' and 'venture capital' transactions with companies registered in the EU as target firms, completed from 2003 to 2011 to be consistent with the time period used in Bernard et al. (2018). We count a single transaction with multiple target firms (e.g. acquiring subsidiaries of the main target firm) as separate, since

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[9] Huyghebaert and Luypaert (2010), von Eije and Wiegericnk (2010), Craninckx and Huyghebaert (2011), and De Beule and Duanmu (2012) are recent examples that use Zephyr dataset.

subsidiary disclosures would also have been available to the VC/PE investors. We merge this deal data with Amadeus firm-year financial data for the 11 countries (Austria, Belgium, Denmark, Finland, France, Germany, Ireland, the Netherlands, Sweden, and the UK) for which Amadeus has the highest number of observations, consistent with Bernard et al. (2018).[10] We drop any firm-years with missing asset information from the sample, as this is the most basic information even small private firms have to provide. This results in a dataset of 9,285,617 firms.

We define treatment firms as those that exceed the thresholds specified by their respective countries, and control firms as those that are exempt from reporting based on being under their respective countries' thresholds (see Appendix B for more information on these thresholds by country). For purposes of classifying firms into treatment or control groups, we treat firms that have missing values on sales and employee counts as non-reporters. This process leads to 589,975 treatment and 8,695,642 control firms.

Table 1 shows the number of transactions, the number of unique firms, and the ratio of the two, by each disclosure size criteria. The treatment group (i.e. full financial statements) is shaded in light green, and the control group (i.e. abridged financial statements) is shaded in light orange. Panel A shows the numbers for the entire sample, and panel B reports the numbers in a 15% band around the respective asset thresholds of each country-year. For both samples, full filers have a higher *proportion* of VC/PE transactions than abridged filers.

Table 2 presents the descriptive statistics of the EU-wide setting sample. Panel A reports PE and VC target firm statistics; panel B reports the differences of the statistics between the two groups. As shown panel B, PE target firms are significantly larger for all categories, consistent

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[10] Although 12 countries were downloaded from Amadeus, only 11 countries were left after the merge with Zephyr. It appears that the ID numbers for Italy do not match between Amadeus and Zephyr, which will necessitate some hand collection we plan to include in a future draft.

with the perception that VCs invest in smaller firms (Katz 2009). The mean and median total assets

for PE transactions is 140.02 times and 3.18 times the disclosure threshold, respectively; this

demonstrates that PE transactions show some extreme outliers in terms of target firm size.

Furthermore, this is in contrast to target firms in VC, which demonstrate 3.50 and 0.30 times the

disclosure threshold. The higher variability in PE target firm characteristics suggest the relative

diversity of firms in which PE firms can invest.

3.2 Research Design

We aim to test whether being a treated firm (i.e. a full financial statement firm) is

associated with increased incidence of VC/PE deals as compared to control firms (i.e. abridged

financial statement firm). Table 1 presents the classification mechanism and summary statistics

we used to assign firm-years into treatment and control status. Treatment firm-years, the light

green area in Table 1, are those firm years where the firm was at or above the threshold for at least

two out of the three threshold variables (assets, sales, employee count) in either of the previous

two years. Control firm, the light orange area in Table 1, are those which were below the thresholds

in two or more variables in either of the past two years, with missing values being assumed to be

undisclosed. [11] We initially restrict the sample to firms below €100 million to prevent mega PE

transactions from influencing our results, and estimate the following regression:

$$100 * Deal_{i,t} = \beta_1 Disclosed_{i,t} + \beta_2 VC/PE\ Owned_{i,t} + \beta_3 LN(Total\ Assets)_{i,t} + a_{countryxt}$$

$$+ a_{indxt} \tag{1}$$

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[11] Although the choice to look at two years is somewhat ad-hoc, we use it for two reasons. First, the VC/PE deal origination process takes time to develop, so a lagged measure of reporting is appropriate to measure the effect of public financial statements on deals. Since the deals could take place either at the end of the beginning of a reporting period, we use two lags to ensure that we capture the effect. Second, the full reporting requirement is actually based on being above the thresholds for the past two consecutive years. We follow Bernard et al (2018) in considering a *probabilistic* measure of disclosure, because including the measure based on two previous years severely limits our already small sample of deals. We note considering a single lag instead does not significantly change the inference of our tests.

Where $Deal_{i,t}$ is an indicator variable equal to one if there is a VC/PE transactions for firm i at year t, and zero otherwise. $Disclosed$ is an indicator for the treatment as described above. $VC/PE\ Owned$ is an indicator equal to 1 if the firm is already owned by a VC or PE firm. We control for this indicator because a firm that is already owned by a VC/PE investor is more likely to receive follow-on investment. We also control for the natural log of total assets to ensure we are comparing firms of similar sizes. We use country-year fixed effects to hold constant all time variant and invariant country characteristics, such as the economic or regulatory environments, and industry-year fixed effects to control for time variant/invariant industry characteristics. If full financial statements by firms is associated with increased deal activity, we expect β_1 to be positive. In another set of tests, we limit our sample to a 15% band around the respective firm's total asset threshold and re-estimate equation (1) in order to more rigorously control for size effects.

3.3 Results

Table 3 presents the results of regression (1) for the EU-wide setting. Columns (1), (2), and (3) restrict the sample to firms with total assets of less than €100 million to ensure we do not skew our sample with firms with extremely large firms that should have superior information environment in the first place. Column (1), (2), and (3) present regression results for PE, VC, and Deal (PE/VC combined), respectively. The results show that firms that disclose full financial statements have a statistically significant 0.07% higher chance of a PE deal, and 0.06% higher chance of receiving either PE or VC transactions. Although the raw coefficients are small, they present an economically significant effect on the total incidence of deals in our sample. Table 3 shows that the rate of deals is the full sample is approximately 0.02%. The large coefficients observed in the $VC/PE\ Owned$ indicator imply that firms that have received PE or VC investments are more likely to become targets to other PE/VC investors. This especially is salient

for VC targets, and is consistent with the notion that VC-funded target firms receive multiple rounds of VC investments throughout their growth stage.

One concern would be that, although we control for target firm size in above regressions, full-disclosing firms would still be larger and naturally receive more investments than abridged disclosing firms. To alleviate the concern, we further restrict the sample to a 15% band around the total asset threshold and re-estimate regression (1). Columns (4), (5), and (6) report the results for PE, VC, and PE/VC combined transactions, respectively. We find that full-disclosing firms have a statistically significant 0.02% higher chance of receiving a PE deal. Again, comparing to the overall rate of deals in the corresponding sample, 0.02%, this is economically significant.

4. Germany-EHUG Setting

Next, we examine the Germany-EHUG setting studied in Bernard (2016) and Breuer (2019). Based on this institutional setting, we argue that the increased enforcement is a plausibly exogenous shock to the rate of financial statement observability that is unrelated to the rate of VC/PE investment.[12]

4.1 Data and sample selection

For the Germany-EHUG tests, we again obtain from Zephyr all 'private equity' and 'venture capital' transactions with companies registered in the entire EU as target firms, completed from 2003 to 2008, which center around the EHUG enforcement at the end of 2006. We stop in 2008 to remove any potential concern with the financial crisis affecting VC/PE transactions. This procedure yields 12,901 transactions across the European Union.

Table 4 presents the descriptive statistics of the Zephyr sample for the Germany-EHUG setting. Panel A counts the number of VC/PE transactions for each country, each year, used in the

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[12] The rate of reporting in the pre period could presumably be higher for those firms seeking PE investment. If this is the case, the shock should affect those firms *not* seeking investment more, therefore biasing against us finding results.

German setting. Germany is highlighted in light green. In this paper, we use two post variables, post 2004 and post 2006. We use post 2004 (transactions from 2005 and onwards) to account for early filers after the announcement of the regulation even before it went into effect, and post 2006 to account for effects after the regulation began. Indeed, Panel A shows that the average annual number of VC/PE transactions pre regulation (2003-2006) is 240 deals, and the average number post regulation (2007-2008) is 400, a 67% increase. On the contrary, the rest of EU had 121 annual VC/PE transactions 2003-2006, and 157 annual deals 2007-2008, recording a 30.1% increase.

We include in the sample all countries in the EU for which we can obtain VC/PE data from Zephyr. Table 4 Panel B reports the number of VC/PE transactions each year, disaggregated by small and large categorizations. We define small and large cutoffs by the median total assets of transactions in a given year. Panel B re-confirms the notion VCs tend to invest more in small firms, than PEs do. Panel C counts the number of transactions by one-digit US SIC codes. Services (SIC code 7) comprise the largest portion of the transactions, followed by food, textile, and chemicals (SIC code 3). Panel C shows that the number of VC/PE investments are well represented across both the service and manufacturing industries.

Table 5 reports target firm characteristics of the Zephyr sample used in the Germany-EHUG setting. Panel A presents the target firm total assets, revenue, and the deal size of the entire sample, and Panel B presents the differences between German and non-German target firms. There are some outliers to the right tail, as the mean total assets of the target is approximately €194 million, contrary to €8.5 million for its median value. The mean revenue is €95 million, and the median revenue is around €10.9 million. Similarly, the mean and median deal value is €72 million and €3.9 million, respectively. Similar to the EU-wide setting, the large difference in mean and

median values can be explained by the presence of mega PE transactions, where PE firms take over extremely large target firms with deal size well over billions.

Meanwhile, although there does not seem to be any large differences of total assets between German and non-German target firms, revenue and deal size seem to differ. A t-test of differences of revenue and deal values show that they difference of €45 million and €83 million in revenue and total assets respectively is statistically significant at the 1% significance level.

4.2 Research Design

We conduct the following regression both for the full sample and separately for VC and PE funds:

$$\ln Dealcount_{i,t} = \beta_3 Germany \times Post + a_{country} + a_t \text{ (2)}$$

Where $\ln Dealcount_{i,t}$ is the natural log of number of VC/PE transactions for country i at year t, $Germany$ equals one if the country is Germany, and zero otherwise. We use two $Post$ variable definitions because of the announcement of the EHUG in 2004 and the increase of compliance in 2006. Specifically, we create two variables, $Post2004$ and $Post2006$ equal to one for all years after the 2004 and 2006 to reflect the announcement and the enforcement of the disclosure laws. $Germany \times Post$ is an interaction term between the $Post$ and $Germany$ indicators. We include country fixed effects to accounting for country-specific time invariant characteristics that could influence our outcome variable, such as general regulatory and enforcement regimes. We also include year fixed effects to account for time trends, such as economic conditions, that may influence the results. These fixed effects absorb the main effects of the interaction term.

4.3 Results

Figure 3 shows the changes in Germany's VC/PE transactions pre/post EHUG enforcement. It presents the number of PE and VC transactions pre and post enforcement,

compared to other EU countries (red line) and the five largest EU countries (green line – UK, France, Italy, Spain, and the Netherlands). We observe a stark increase in PE/VC transactions from 2005; we interpret this result from the fact that firms have started to disclose after the announcement but before the regulation came into effect.[13]

Table 6 presents the results for regression (2) in the Germany setting. Panel A reports aggregate VC/PE deal counts in columns (1) and (2), an also splits the sample into VC and PE transactions and counts the annual number of transaction separately, in columns (3)-(6). Panel B further disaggregates the sample by the two types of investors and two sizes of target firms, where small and large firms are defined as those that are below and above the median asset level for the sample, respectively. The results indicate that after the EHUG enforcement, investment in VC-invested small targets is most affected, whereas investment in PE-invested large targets is least affected. This is consistent with firms that are less well-known (proxied for by the small status) and invested in without a third party intermediary (more likely for a VC investment) benefitting the most from the enhanced reporting environment, whereas firms that are relatively more well-known (i.e. large) and invested in with the help of an intermediary (more likely for a PE investment) benefitting the least. We expect the search costs to be lowest for these types of transactions for three reasons; first, larger firms would have a better information environment even without public reporting; in this case, disclosure enforcement law would influence large firms less. Second, PE firms tend to invest in later-stage firms than VC firms do, and later stage firms would also possess a better information environment than early-stage firms.[14] Third, contrary to VC

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[13] This is validated by Figure 1, where the number of disclosing firms dramatically increase from 2005, although the enforcement actually started at the end of 2006. Our results remain robust even when Post2004 is used as the post variable instead of Post2006.

[14] In an untabulated analysis, in our sample, we find that the mean age of PE target firms are 14.98 years (median 9 years), compared to a mean of 3.50 years (median 3 years) for VC target firms.

firms, which mainly source deals independently, many PE firms source their deals via investment banks, especially for larger target firms (Teten and Farmer 2010). Investment banks would serve as intermediaries that provide potential deal opportunities to the PEs, in which case PEs would rely less on public financial statements to find potential target firms.

We find that the coefficient on $Germany \times Post2006$ is statistically significant for aggregate transactions, VC transactions, but not for PE transactions. The results suggest that VC/PE transactions increased by 31.5% post 2006; VC transactions increased by 89.1% post 2006, whereas PE transactions rose only 3.2%. Delving deeper, the statistically significant across all target firm populations except for large PE firms in Table 6 Panel B, while the coefficient on $Germany \times Post2004$ is statistically significant across all target firm populations of VC funds. Columns (1) and (2) of Table 6 Panel B show results for PE and VC transactions involving small firms, i.e. those where the 'attention' channel is likely to be most important because they may be less well-known, increased financial statement availability is associated with an increased number of both VC and PE deals. For large firms, presented in columns (3) and (4), only VC investors see an increase in deal activity after the shock, while the effects are insignificant for PE transactions. This is consistent with the idea that although larger firms may have better information environment, younger firms (that mainly receive investments from VCs than from PEs) may also have had limited attention without public reporting.

5. Conclusion

We study the relationship between financial reporting and VC/PE financing in private firms. While the influence of financial reporting on public firms has been widely studied, the interaction between financial reporting information and equity financing in the early stages of private corporations is much less understood. We argue that financial statement information allow

VC/PE funds to better screen potential private firms, which ultimately translates into lower search costs and higher VC/PE investments. Using two settings that provide arguable exogenous variation in the availability of full public financial statements for private European firms, we find evidence largely consistent with public reporting being associated with higher propensity to receive VC/PE investment through decreasing investors' search costs in both the 'attention' and 'information' channels. Cross-sectional tests using firm size and investor type support this interpretation of our findings.

Our paper contributes to the existing literature by documenting both private firm behavior and VC/PE behavior with respect to public reporting. Extant literature has overlooked VC/PE investments within private firms; studying VC/PE target firms can be interesting, as we might believe that VC/PE firms would not need public financial statements since they have access to multiple channels of information. In terms of studying VC/PE behavior, prior literature has focused mostly on the changes post private equity investment (Badertscher et al. 2013; Bernstein and Sheen 2016; Guo et al. 2011; Katz 2009, and others), whereas we focus on the *determinants* of VC/PE investments. Our findings have important implications for the regulation of private firm reporting, and well as the literature on the consequences of financial reporting and the determinants of private financing.

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Appendix A: Variable definitions

Variable name	Definition
Deal value	Consideration paid for the actual stake acquired.
Ln Dealcount	Natural log of # of transactions for a country in a given year.
PE	Transactions defined as PE transactions in Zephyr. Target firms are larger in size and often (not all) involve majority shareholding stake.
VC	Transactions defined as VC transactions in Zephyr. Mostly target firms are smaller in size and does not involve majority shareholder stake. (see Katz 2009)
Large	PE transactions that are above or equal to the median of the total assets in a given year.
Small	PE transactions that are below the median of the total assets in a given year.
Disclosed	Equals one if a firm-year's lagged or two-lagged firm-year has disclosed; zero otherwise.
ln Total Assets	Natural log of Total Assets of a firm-year.
PE Owned	Equals one if the transaction is a PE-to-PE transaction; zero otherwise. Firm-years without a transaction are also coded as zero.
VC Owned	Equals one if the target firm of the transaction has already received a VC investment in the sample period; zero otherwise. Firm-years without a transaction are also coded as zero.

Appendix B: EU-wide setting disclosure requirement thresholds (retrieved from Bernard et al. 2018)

Country	Since	Total Assets (€)	Sales (€)	Employees
Austria	Jan. 1, 2003	3,125,000	6,250,000	50
	Dec. 31, 2005	3,650,000	7,300,000	50
	Dec. 31, 2008	4,840,000	9,680,000	50
Belgium	Jan. 1, 2003	3,125,000	6,250,000	50
	Dec. 31, 2004	3,650,000	7,300,000	50
Denmark	Jan. 1, 2003	2,689,560	5,379,120	50
	Mar. 31, 2005	3,890,495	7,780,990	50
	Aug. 31, 2009	4,833,504	9,667,008	50
Finland	Jan. 1, 2003	3,125,000	6,250,000	50
	Dec. 31, 2005	3,650,000	7,300,000	50
France	Jan. 1, 2003	267,000	534,000	10
	Dec. 31, 2010	1,000,000	2,000,000	20
Germany	Jan. 1, 2003	3,438,000	6,875,000	50
	Dec. 31, 2004	4,015,000	8,030,000	50
	Dec. 31, 2009	4,840,000	9,680,000	50
Ireland	Jan. 1, 2003	1,904,607	3,809,214	50
Italy	Jan. 1, 2003	3,125,000	6,250,000	50
	Dec. 12, 2006	3,650,000	7,300,000	50
	Nov. 21, 2009	4,400,000	8,800,000	50
Netherlands	Jan. 1, 2003	3,500,000	7,000,000	50
	Dec. 31, 2004	3,650,000	7,300,000	50
	Dec. 31, 2006	4,400,000	8,800,000	50
Spain	Jan. 1, 2003	2,373,998	4,747,996	50
	Dec.31, 2008	2,850,000	5,700,000	50
Sweden	Dec. 31, 2007	2,582,500	5,165,000	50
	Oct. 31, 2011	4,408,000	8,816,000	50
UK	Jan. 1, 2003	2,204,120	4,048,240	50
	Jan. 30, 2004	3,944,080	7,888,160	50
	Apr. 5, 2009	3,755,520	7,488,000	50

Source: Bernard et al. (2018)

Table 1: EU-wide setting - Transaction composition by full-disclosing/limited-disclosing group

This table demonstrates the number of PE/VC transactions, the number of firms, and the proportion of deals to the number of firms within each group. Panel A presents the whole sample and Panel B presents sample within 15% total assets threshold band. Green shade represents observations counted as full-disclosing group; orange shade represents observations counted as limited-disclosing group. If either assets or sales are below the disclosure threshold, an observation is coded as full-disclosing if employees are above the threshold; it is coded as limited-disclosing group if employees are below the threshold or not reported.

Panel A: All samples

# of deals # of firms % of deals		Sales	
		Above	Below Employee Above / Below
Assets	Above	2,282 535,566 0.426%	182 41,528 0.438% 762 617,651 0.123%
	Below Emp Above/Below	13 12,881 0.101% 34 111,604 0.030%	4,467 7,966,387 0.056%

Panel B: 15% Total Asset band

# of deals # of firms % of deals		Sales	
		Above	Below Employee Above / Below
Assets	Above	36 76,859 0.047%	10 8,634 0.116% 47 169,780 0.028%
	Below Emp Above/Below	3 5,069 0.059% 7 41,865 0.017%	230 410,655 0.056%

Table 2: EU-wide setting - Descriptive statistics relative to the disclosure threshold

This table presents descriptive statistics of firm year observations that underwent either a private equity or venture capital transaction in a given year. Total assets, revenue, and employees are presented relative to the disclosure threshold, where the threshold equals to 1. Panel A presents the statistics for PE transaction firms; Panel B reports the statistics for VC transaction firms.

Panel A: PE and VC target firm descriptive statistics relative to disclosure threshold

Statistics	PE transactions			VC transactions		
	Total Assets	Revenue	Employees	Total Assets	Revenue	Employees
N	4,919	3,363	3,139	2,625	1,168	953
Mean	140.015	33.474	9.282	3.504	1.885	1.244
Std	2,551.258	150.784	33.400	15.771	7.413	6.373
Min	0.000	0.000	0.000	0.000	0.000	0.000
Q1	0.649	0.788	0.600	0.087	0.027	0.120
Median	3.179	3.708	1.880	0.296	0.166	0.400
Q3	18.839	14.860	5.300	1.341	1.024	1.100
Max	141,326	3,930	562	442.251	141.679	175.980

Panel B: Target firm characteristics – PE vs VC target firms

	Total Assets			Revenue			Employees		
	PE	VC	Diff	PE	VC	Diff	PE	VC	Diff
N	4,919	2,625		3,363	1,168		3,139	953	
Mean	140.015	3.504	-136.511*** (-2.74)	33.474	1.885	-31.589*** (-7.16)	9.282	1.244	-8.039*** (-7.39)
Median	3.179	0.296	-171.4*** (-37.39)	3.708	0.166	-3.542*** (-31.05)	1.880	0.400	-1.480*** (-23.25)

Table 3: EU-wide disclosure threshold regulation setting main test results

This table presents the regressions of private equity/venture capital deal indicator on *Disclosed* indicator, *PE/VC Owned* indicator, and natural log of total assets. Columns (1), (4) use *PE* transaction indicator as the dependent variable; columns (2), (5) use *VC* transaction indicator as the dependent variable; columns (3), (6) use aggregate *Deal* variable. Band <€100m (columns (1), (2), (3)) show regressions that restrict the sample to firms under €100m total assets; band 15% (columns (4), (5), (6)) show regressions restricted above and below 15% of disclosure asset thresholds;. Deals disc represent the # of deals of which the target firm had disclosed their financials prior (one or two years) to the transaction. Deals non-disc represent the # of deals that had not disclosed prior (one or two years) to the transaction. All regressions include country-year and industry-year fixed effects. Heteroskedasticity-robust standard errors are clustered at the country-year level. *, **, *** indicate statistical significance at 10%, 5%, and 1%, respectively.

Band:	<€100m			15%		
Dependent Variable:	*PE*	*VC*	*Deal*	*PE*	*VC*	*Deal*
	(1)	(2)	(3)	(4)	(5)	(6)
Disclosed	0.069***	-0.013***	0.057***	0.017***	-0.007***	0.005
	(5.17)	(-7.64)	(4.60)	(2.72)	(-2.97)	(1.15)
PE/VC Owned	17.246***	82.652***		19.326***	80.500***	
	(6.12)	(29.29)		(3.32)	(13.87)	
ln Total Assets	0.013***	0.004***	0.019***	0.017	0.032***	0.060***
	(9.55)	(13.62)	(11.48)	(1.29)	(3.52)	(3.43)
N	29,668,572	29,668,572	29,668,572	938,453	938,453	938,453
Adj. R-squared	0.005	0.173	0.001	0.007	0.203	0.001
Deals disc. / Obs	2,236 / 2,220,496	226 / 2,220,496	2,462 / 2,220,496	46 / 130,716	4 / 130,716	50 / 130,716
Deals lim-disc. / Obs	2,683 / 27,448,076	2,399 / 27,448,076	5,082 / 27,448,076	172 / 807,737	111 / 807,737	283 / 807,737
Country x Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry x Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Cluster	C x Y	C x Y	C x Y	C x Y	C x Y	C x Y

Table 4: Germany-EHUG setting number of transactions

This table reports the number of transactions in the Zephyr sample. Panel A presents the number of VC/PE transactions by country and by year used in the EU setting. Panel B presents the number of VC/PE transactions by country and by year used in the German EHUG setting. Panel C reports the number of transactions by VC/PE classification, and by small/large transactions used in the German EHUG setting. Small-large size cutoff (the median target total assets each year) is presented in the left column. Panel D presents the number of transactions by one-digit US SIC code.

Panel A: Germany-EHUG setting - # of transactions by country and by year

| | Year | | | | | | |
	2003	2004	2005	2006	2007	2008	Total
Austria	21	32	26	35	39	23	176
Belgium	40	45	48	74	90	70	367
Germany	163	195	249	351	404	396	1,758
Denmark	50	55	68	58	88	49	368
Spain	149	129	133	170	190	240	1,011
Finland	51	63	71	89	69	67	410
France	230	349	420	443	427	433	2,303
UK	483	566	647	723	856	757	4,032
Greece	4	0	10	5	7	7	33
Ireland	28	36	42	34	30	28	198
Italy	63	77	119	114	99	178	650
Luxembourg	6	5	6	12	12	4	45
Netherlands	72	90	121	141	185	147	756
Portugal	7	13	13	13	22	27	96
Sweden	62	125	108	157	125	123	700
Total	1,429	1,780	2,081	2,419	2,643	2,549	12,901

Panel B: Germany-EHUG setting - # of transactions by VC/PE classification

Year	Small-large size cutoff (€ 000s)	VC Small	VC Large	PE Small	PE Large	Total
2003	8,088	354	232	241	602	1,429
2004	9,921	373	195	369	843	1,780
2005	9,549	376	178	507	1,020	2,081
2006	12,159	471	198	576	1,174	2,419
2007	7,567	464	210	682	1,287	2,643
2008	6,437	499	226	622	1,202	2,549
Total		2,537	1,239	2,997	6,130	12,901

Panel C: Germany-EHUG setting - # of transactions by target firm industry

SIC one-digit	Classification	N
0	Agriculture, Forestry and Fishing	52
1	Mining and construction	297
2	Food, textile, and chemicals	1,688
3	Rubber, metal, and machines	2,831
4	Transportation, Communications, Electric, Gas and Sanitary service	1,064
5	Wholesale and retail trade	1,114
6	Financial services	667
7	Hotel and other services	3,314
8	Health and engineering services	1,845
9	Public Administration	19
	Total	12,891

Table 5: Germany-EHUG setting - Target firm characteristics

This table presents descriptive statistics of the target firms listed in the Zephyr sample. Panel A reports target firms' total assets, revenue, and deal value for the entire sample. Panel B reports target firms' mean and median total assets of Germany and non-Germany target firms, and their differences. Parentheses below mean and median values indicate t-statistics and z-statistics of mean and median differences, respectively. Differences in mean is obtained using a t-test, and differences in median are obtained using two-sample Wilcoxon rank-sum test. All values except N are in € thousands. Total assets and revenue are winsorized at 1%. *,**,*** indicate statistical significance at 10%, 5%, and 1%, respectively.

Panel A: Target firm characteristics – entire sample

(€ 000s)	Total assets	Revenue	Deal value
N	11,078	7,649	5,860
Mean	194,476	94,786	72,093
Std	854,631	303,909	316,965
Min	0	0	1.74
Q1	1,451	1,692	1,100
Median	8,494	10,858	3,900
Q3	49,080	51,282	16,000
Max	10,400,000	3,572,687	6,648,300

Panel B: Target firm characteristics – Germany vs non-Germany targets

(€ 000s)	Total assets			Revenue			Deal value		
	Rest of EU	Germany	Diff	Rest of EU	Germany	Diff	Rest of EU	Germany	Diff
N	9,817	1,261		6,967	682		5,389	471	
Mean	197,996	167,074	-30,921 (-1.21)	90,727	136,252.7	45,526*** (3.74)	65,390	148,778	83,387*** (5.49)
Median	8,497	8,326	-171.4 (-0.62)	10,064	24,425.89	14,362*** (8.18)	3,712	5,100	1,388*** (4.06)

Table 6: Germany-EHUG setting main test results

This table presents regressions of natural log of dealcount (*ln Dealcount*) on interactions of *Germany* indicator and *Post2004/Post2006* indicator. Panel A uses total number of aggregate VC/PE, VC and PE as *dealcount*; Panel B disaggregates VC and PE transactions further into small and large firms. Columns (1) and (2) use the number of small VC transactions as *dealcount*, and PE transactions as *dealcount* in columns (3) and (4); columns (3) and (4), and (5) and (6) use the number of large VC and PE transactions, respectively, as *dealcount*. Small and large are defined by whether a target firm exceeds the median total assets of a target firm in a given year. Heteroskedasticity-robust standard errors are clustered at the country level. T-statistics are in parentheses. *,**,*** indicate statistical significance at 10%, 5%, and 1%, respectively.

Panel A: Effect on aggregate VC and PE transactions

Dep var: *ln Dealcount*	Aggregate		VC		PE	
	(1)	(2)	(3)	(4)	(5)	(6)
Germany x Post2004	0.299***		0.759***		0.074	
	(6.34)		(5.07)		(1.48)	
Germany x Post2006		0.315***		0.891***		0.032
		(4.74)		(6.07)		(0.45)
Observations	89	89	86	86	89	89
Adj. R-squared	0.971	0.971	0.926	0.928	0.961	0.961
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Cluster	Country	Country	Country	Country	Country	Country

Panel B: Effect on VC and PE transactions by size

Dep var: *ln Dealcount*	Small firms				Large firms			
	VC		PE		VC		PE	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Germany x Post2004	1.100***		0.138		0.428**		0.084	
	(5.53)		(1.43)		(2.63)		(1.44)	
Germany x Post2006		1.032***		0.224*		0.675***		0.009
		(5.59)		(1.97)		(4.27)		(0.18)
N	86	86	89	89	72	72	72	72
Adj. R-squared	0.868	0.867	0.856	0.857	0.891	0.895	0.972	0.971
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cluster	Country	Country	Country	Country	Country	Country	Country	Country

Figure 1: # of disclosing firms in Amadeus

Figure 1 plots the number of reported firms in Amadeus. Blue line represents the number of disclosing German firms, green line represents the number of disclosing firms in big 5 EU countries (UK, France, Italy, Spain, and the Netherlands), and red line represents all EU countries excluding Germany.
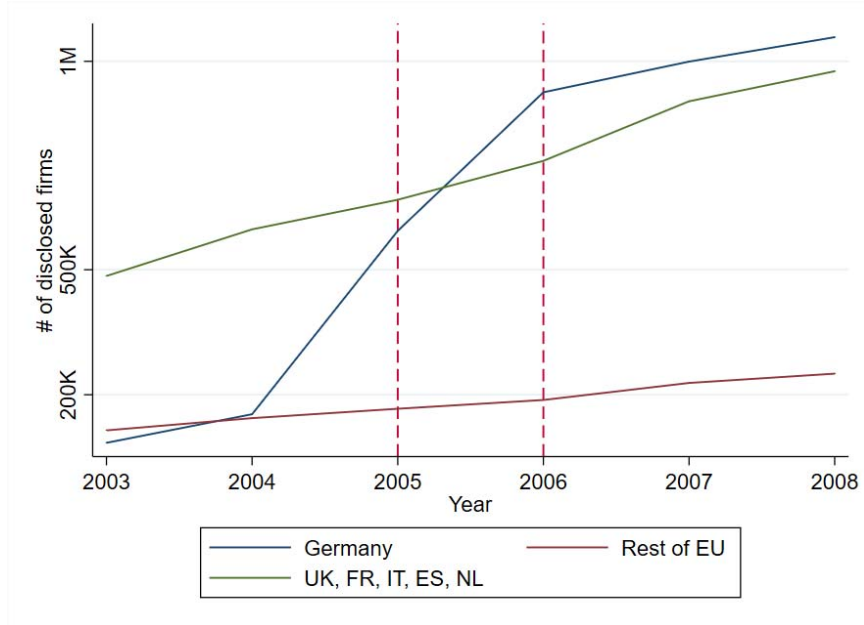
Figure 2: Germany-EHUG setting changes in total # of transactions post EHUG

Figure 2 plots the number of VC/PE transactions pre and post EHUG regulation. Blue line represents the number of transactions with German firms as target firms. Green line represents the number of transactions in big 5 EU countries (UK, France, Italy, Spain, and the Netherlands), and red line represents all EU countries excluding Germany.
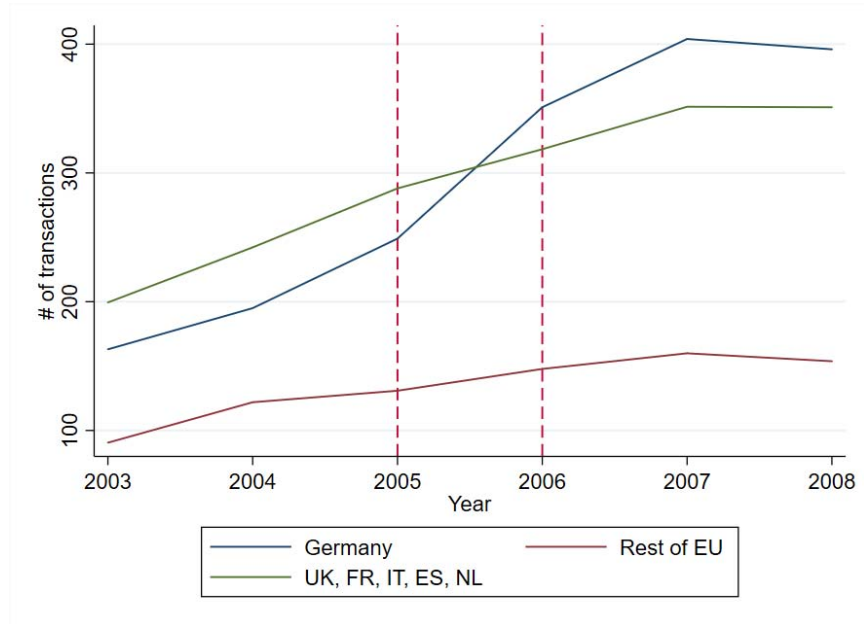
Figure 3: Germany-EHUG setting changes in # of VC/PE transactions post EHUG

Figure 3 plots the number of VC and PE transactions in Germany and other EU countries. Panel A and B plots the annual number of VC and PE transactions, respectively. Blue line represents the number of transactions with German firms as target firms. Green line represents the number of transactions in big 5 EU countries (UK, France, Italy, Spain, and the Netherlands), and red line represents all EU countries excluding Germany.

Panel A: VC transacion

Panel B: PE only