Entrepreneurial Wealth Concentration and Firm Performance*

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Abstract

Using Danish registry data, we examine how entrepreneurial wealth concentration—the extent to which an entrepreneur's personal wealth is tied to their business—affects firm performance. We exploit minority shareholder divorces as an exogenous shock to concentration, as entrepreneurs often buy out minority stakes following a divorce. Our findings show that increased concentration lowers the average return on equity, reduces its variability, and decreases the firm's default probability. Firms also experience declines in sales, employment, assets, debt, and leverage. These results suggest that greater wealth exposure to the business leads entrepreneurs to adopt lower-risk, lower-return strategies, dampening economic growth and job creation. A conservative counterfactual exercise indicates that capping all entrepreneurs' stakes at 51% would increase average ROE by 5 percentage points and boost employment and sales by 6%.

Keywords: Entrepreneurship, diversification, idiosyncratic risk, firm performance.

JEL Codes: D23, G32, L25, L26, O16

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1 Introduction

We study the effects of entrepreneurs' wealth concentration on business performance. We define entrepreneurial wealth concentration as the value of the stock holding in the business over the total value of the entrepreneur's wealth. When entrepreneurs allocate a significant portion of their total wealth to their business, they become vulnerable to the associated idiosyncratic risk. This affects their entrepreneurial choices. In particular, when facing projects with different risk/return profiles, undiversified entrepreneurs might shift the firm strategy toward low-risk/low-return projects to reduce exposure to idiosyncratic risk. While individually rational, this is a sub-optimal strategy from a social point of view: a social planner would choose projects only based on expected returns, as idiosyncratic risk cancels out in the aggregate.

Quantifying the effects of wealth concentration is important. In fact, there is evidence that private equity owners - and particularly entrepreneurs - tend to hold a large share of personal wealth in the firm they own (Moskowitz and Vissing-Jørgensen, 2002). Moreover, owners of family firms tend to forgo the benefits of diversification to maintain control of the firm and enjoy private benefits of control (Burkart, Panunzi, and Shleifer, 2003). Finally, private equity accounts for a large share of total equity globally. All this suggests that the cost of entrepreneurial under-diversification may be large. But how large? This is the question we contribute to answer in this paper.

There is no robust causal evidence on the effects of under-diversification, arguably because providing it is challenging. Ownership structure and entrepreneurs' wealth concentration in their business are endogenous decisions and reverse causality arguments may easily be driving any correlation. For instance, high expected return firms may attract external capital, allowing the entrepreneur to reduce the wealth concentration in the firm—a negative correlation that reflects the heterogeneity in growth opportunities across firms. To identify the effect of concentration on the firm risk-return combination we rely on the plausible assumption that if a minority shareholder receives a shock that pushes them to liquidate their share in the firm, the majority shareholder is likely to purchase these shares. This is driven by a desire to avoid the uncertainty of an external, unknown party entering the firm or the risk of losing control if another minority shareholder acquires the stake. When buying the shares, the majority shareholder's exposure to the firm inevitably increases. To manage this increased exposure to the company's idiosyncratic risk, they can steer the company towards safer, lower growth strategies.

We use the divorce of a minority shareholder as a shock to the concentration of the majority shareholder. When a household experiences a divorce, the two spouses lose the family economies of scale in household expenditures, resulting in a standard of living for each of the separated members that is lower than when they were married. Although it varies according to sex, family characteristics and the public safety net, the effect of divorcing on the living standards of the members of the couple is estimated to be substantial (Bratberg and Tjøtta, 2008; Bonnet, Bertrand, and Solaz, 2021). The loss is significant even in a country with a generous welfare system like Denmark, from which our data are sourced. According to Hussain and Knagas (2009), divorce leads to an average income reduction of approximately 30% for women and 24% for men. The drop in income can prompt the minority shareholder to liquidate her position in the firm. The majority shareholder might prefer to avoid having to deal with new, possibly unfamiliar shareholders. In addition, incumbent shareholders have an informational advantage in assessing the value of the firm, making transactions between existing shareholders easier vis-a-vis those involving external investors. The majority shareholder is therefore the most likely acquirer.

We assume that the majority shareholder chooses the firm strategy and thus its risk-return combination. Owning a minority share, the minority shareholder is unlikely to affect this choice directly when exiting the firm upon selling their stake. To substantiate this assumption, we show that our results remain unchanged when we focus on firms where the minority shareholder has never been employed by the firm, nor has ever served on its board, or when we focus on majority shareholders owning the absolute majority of shares. Furthermore, although one can imagine scenarios where the exit of a minority shareholder impacts the firm's returns—such as when their observations and insights positively influenced decision-making—it is not evident why this should consistently alter the firm's risk profile.

An important property of our approach is that the shock we use does not affect the overall wealth of the entrepreneur. Instead, it just induces a change in the composition of the majority shareholder's wealth from other personal wealth (financial assets, housing wealth, etc.) to own-business wealth. Shocks to the overall wealth, such as lottery wins or changes in the prices of real estate, can change the shareholder concentration in the firm, but would likely fail the exclusion restriction. Increases in personal wealth can relax the entrepreneur's liquidity constraints, thus affecting firm performance above and beyond their effects on the change in concentration. Our shock affects entrepreneurial concentration without changing the overall wealth of the entrepreneur.

We implement this strategy using registry data from Statistics Denmark for the years 2006 to 2017. We have access to the population of Danish individuals and limited liability companies, including firm ownership information. Following the literature, we estimate the value of the private firms by computing the book-to-market value for listed companies and apply these multiples to private firms (Bach, Calvet, and Sodini, 2020). Statistics Denmark directly supplies information on the market value of all other components of an individual wealth. Using register information on divorces, we identify firms in which a minority shareholder undergoes a divorce. In our period of analysis, we observe 1,174 firms (for 11,458 firm-year observations) experiencing a minority shareholder's divorce, accounting for 6% of firms with more than one shareholder. We then check if, following the divorce of a minority shareholder, the majority shareholder's wealth concentration increases and if the firm's risk/return combination is affected by this change. We use the level of ROE (defined as net income over the book value of equity) as the preferred measure of return and its time-series variability as a measure of risk. We estimate a staggered difference-in-differences model in which the event is the divorce of the minority shareholder, and the dependent variables are the average returns and return variability pre- and post-event. To address the negative weight issue that may arise with staggered and heterogeneous treatment effects over time, we rely on the Callaway and Sant'Anna (2021)'s methodology and use not-yet-treated units as controls for treated ones. We run both staggered event studies - which allow for testing for the absence of pre-trends - as well as estimate the average treatment effect (ATE). We start providing evidence that our instrument works well. First, we show that, following the divorce of a minority shareholder, the number of shareholders decreases by 0.23 on the average of the post-event period and approximately by 0.70 after 8 years. This aligns with our expectation that divorce is an event that absorbs significant financial resources, pushing the minority shareholder to sell their equity. Next, we show that the equity share of the majority shareholder increases post-event by around 4 percentage points and by more than 11 percentage points after 8 years, in line with the hypothesis that they buy the minority shareholder's stake. The effect at the end of the period amounts to 21% of the average equity share of the majority shareholder in the sample, which is 0.52 . As a consequence, their wealth concentration increases post-event by about 20 percentage points over 8 years, a substantial value, given that concentration by definition is bounded between zero and one and that the average concentration is 35%. In all cases, we do not detect any evidence of pre-trends. The analysis therefore indicates that our instrument is both exogenous and highly relevant.

We apply the same framework to ROE and its variability. To measure risk, we compute the

standard deviation of ROE for each firm separately for the years pre- and post-divorce. ROE decreases by approximately 8 percentage points post-event, which compares to an average value over the whole sample of 26%. As our theory predicts, variability, measured by ROE standard deviation, also decreases by about 0.07, compared to an average value of 0.41. No evidence of a pre-trend emerges.

A key issue in the dispersion analysis is that lower variability does not imply necessarily imply lower risk, given the drop in mean returns. If the leftward shift dominates the variance reduction, pre-divorce returns may first-order stochastically dominate post-divorce ones. We address this issue in two ways. First, we perform quantile regression analysis. We find that after a minority shareholder's divorce, firms perform better at the lower end of the ROE distribution. Specifically, the 10^{th} percentile for these firms is 5% higher than that of yet-to-be-treated firms, compared to an overall mean return of -10% at that percentile. Things are opposite at the 90^{th} percentile. This result is extremely robust to changes in the sample and estimation technique. This rules out the possibility that, after treatment, firms do uniformly worse over the whole distribution of return on equity. Second, we look at the extensive margin of risk, that is, at the default probability. In fact, from the main shareholder's perspective, the most disruptive outcome is firm failure, and our theory predicts that when becoming more exposed entrepreneurs should reduce risk and thus default rates. And this is what we find. In our preferred specification, firms that experience the divorce of a minority shareholder have a default probability over the entire observation period that is 4% lower than other firms. This compares to an overall default rate of 14%. In this case too, we show that the results are robust to changes in the estimation technique, time periods and definition of default. In summary, a minority shareholder's divorce increases the majority shareholder's wealth concentration, leading to safer strategies. This lowers the firm's risk-return profile: average ROE and dispersion decline, the lower ROE percentile rises while the upper one falls, and the default probability decreases.

We conjecture that strategies that imply lower risk and lower returns generally imply a reduction in the firm's growth prospects, for example, cutting risky but promising investments. We therefore repeat the same analysis for sales, employment, and assets. Following the divorce, firms settle on a path of substantially lower and less volatile growth along all three dimensions. No evidence of pre-trend emerges, again supporting our identification assumption. The effects are substantial.

Entrepreneurs who choose to mitigate risk by scaling down their operations are likely to

forego investment opportunities, thereby lowering their investment requirements. Consistently, we find that after the divorce the debt level drops by more than 20 percentage points over 8 years. Since equity is unaffected, the firm leverage also drops by more than 10 percentage points after 8 years. Given that leverage is a major determinant of corporate risk and equity returns variability (Myers, 1977), a reduction in leverage further supports the hypothesis that the firm becomes less risky. We conclude that an increase in wealth concentration significantly reduces the risk-return combination chosen by the entrepreneur.

To evaluate the aggregate impact of high concentration, we conduct a counterfactual exercise. We consider all firms with more than one shareholder and cap the majority shareholder's stake at 51%, modifying their wealth concentration accordingly. We then recompute counterfactual average ROE, employment and sales under the reduced concentration. We find that average ROE increases by 5 percentage points, from 21% to 26%, employment increases by 5.5 log points and sales by 6 log points. Values increase substantially if we only consider firms in which the majority shareholder is above 51%, that is, those "treated" by the experiment, or if we include firms with only one shareholder. Overall, we conclude that the effects of reducing the majority shareholder's concentration are substantial.

Our paper contributes to the literature on the effects of entrepreneurial finance on firm performance. A vast body of literature exists on financial constraints, primarily focusing on the availability of financial resources for entrepreneurs. For example, the classical moral hazard model of Holmstrom and Tirole (1997) points to the fact that the entrepreneur must have enough own resources to secure outside finance. In the absence of such resources, positive net present value (NPV) projects are not undertaken. We point to a different mechanism. The fact that entrepreneurs must supply their own resources implies that they might end up being highly exposed to the firm idiosyncratic risk. The resulting wealth concentration can lead to socially inefficient choices in terms of the risk/return strategies. Our substantial estimate of the decline in ROE following an exogenous increase in wealth concentration suggests that the social costs of entrepreneurs response could be significant. We also contribute to the debate on the productivity differences between family-owned and other firms. The literature points to inferior managerial capacity of family firms (Bennedsen, Nielsen, Pérez-González, and Wolfenzon, 2007; Bloom and Van Reenen, 2007). We stress that, even controlling for capacity, family ownership might deliver a worse performance because of the high concentration that maintaining control entails.

There is limited literature on the effects of diversification on firm performance. Faccio,

Marchica, and Mura (2011) show that firms with more diversified owners undertake more risky investments than those owned by un-diversified shareholders. Anderson, Duru, and Reeb (2012) reach similar conclusions when comparing family and non-family firms. Panousi and Papanikolaou (2012) show that investment in firms with managers more exposed to high-powered incentive contracts is more sensitive to idiosyncratic risk. Michelacci and Schivardi (2013) show that, in countries with a larger presence of family firms, sectors with high idiosyncratic risk grow relatively less, arguably because entrepreneurs make more conservative choices. None of these papers observe the complete personal wealth of shareholders to precisely measure concentration or use random variation in diversification to obtain causal estimates.

The rest of the paper is organized as follows. Section 2 outlines the identification strategy and empirical design, while Section 3 describes the data. Section 4 presents the findings, highlighting the increase in wealth concentration following a minority shareholder's divorce and demonstrating the firm's shift to a lower risk-return combination. Section 5 examines the mechanisms driving this shift. Section 6 performs the counterfactual exercise and Section 7 concludes.

2 Identification and empirical design

We aim to evaluate the effect of the majority shareholder's wealth concentration in firm j on the risk-return profile of the firm. The idea is that more concentrated owners are more risk-averse and tend to adopt a more conservative business strategy. Specifically, we are interested in two relationships: the effect of concentration on the firm return and risk profile.[1] We measure concentration as the ratio between the value of firm j times the profit share of the majority shareholder and the majority shareholder's total wealth.[2] Of course, we cannot simply relate returns and risk to concentration, as concentration itself is a choice variable. Moreover, performance can have feedback effects on diversification. For example, a firm with better prospects might attract more external capital, allowing the entrepreneur to diversify its portfolio. One needs exogenous variability in the concentration. This is what we discuss next.

[1] Appendix Section A presents a simple model that formalizes these ideas.

[2] The detailed definitions of these variables can be found in Section Notation and Variables Definition.

2.1 Identification

Finding sources of random variation in the concentration of majority shareholders is difficult. A first possibility is to use shocks to the total wealth of the majority shareholder, such as lottery wins, changes in real estate prices, or even shocks to the firm's value. Unfortunately, any exogenous variation in the majority shareholder's overall wealth will likely violate the exclusion restriction. There are various channels through which changes in the majority shareholder's wealth can impact firm performance. The most straightforward is that the majority shareholder can invest the additional wealth directly in the firm. Wealth changes also affect the majority shareholder's capacity to obtain credit for the firm they control, relaxing the firm's liquidity constraints.

An alternative is to look for an event that shifts the majority shareholder's wealth allocation between that invested in the firm and in other assets, keeping the overall majority shareholder's wealth fixed. We focus on a shock that directly impacts a *minority shareholder* and indirectly pushes the majority shareholder to increase their participation in the firm: the divorce of a minority shareholder. When a household undergoes a divorce, it loses the family economies of scale in expenditures, and the combined standard of living of the separated members becomes lower than when they were married.[3] Divorce increases the likelihood that the affected shareholder wants to sell their share to cover the liquidity needs. The majority shareholder might buy the minority shareholder's participation to avoid the uncertainty entailed by an external investor entering the company or the risk of losing control if another minority shareholder buys. In doing so, their wealth concentration in the firm rises, heightening their exposure to its risk. To manage this increased exposure, they can choose safer strategies.

We now discuss in detail the assumptions underlying our identification strategy (See Appendix B for a formal discussion).

1) **The divorce of a minority shareholder being as good as random.** We assume that the probability of a firm experiencing the divorce of a minority shareholder depends structurally on the number of shareholders, the shareholders' age structure (which can be

[3]Estimates of the effect of divorce on the living standards of couple members vary depending on gender, family characteristics, and the public safety net (Bratberg and Tjøtta, 2008; Bonnet et al., 2021). Nevertheless, these effects are significant even in a country with an extensive welfare system like Denmark. According to Hussain and Knagas (2009), divorce leads to an average income reduction of around 30% for women and 24% for men.

approximated by the majority shareholder's age), and a random factor. By conditioning for the number of shareholders and the majority shareholder's age, we exploit the as good as random variation that leads to a divorce event among one of the firm's minority shareholders. Given the controls, the divorce of a minority shareholder satisfies the absence of selection into the treatment: no firm characteristics predict the divorce of a minority shareholder. By claiming that the instrument for the divorce of a minority shareholder is exogenous, we rule out the possibility that the firm's expected outcome can influence the minority shareholder's divorce probability.

2) **The first stage mechanism.** The divorce of a minority shareholder increases the likelihood that the majority shareholder will buy the shares of that minority shareholder. Divorce is expensive and entails a negative wealth shock to the minority shareholder, leading some minority shareholders to sell their participation in the firm to finance the divorce. At the same time, the majority shareholder might want to avoid new minority shareholders. In addition, the shares of non-listed firms are highly illiquid due to information asymmetries regarding the firm's valuation, making them difficult to sell to individuals who are not already shareholders of the firm. As a result, the divorce of a minority shareholder increases the probability that the majority shareholder will increase their stake in the firm.

3) **The Exclusion Restriction.** We assume that there is no direct effect of the divorce of a minority shareholder on the firm's risk-return profile. This assumption is based on the fact that the minority shareholders do not influence the firm's risk-return decisions because they hold minority stakes. In some cases, a minority shareholder might also work for the firm or sit on the firm's board, in which case the divorce might effect work performance. First, while one might expect some negative effects on average returns, it is unclear why they should reduce firm riskiness. Second, we will show that our results are unaffected when excluding these cases.

2.2 Empirical model

We estimate the effect of the shock to concentration using Diff-in-Diff and event study estimators. These estimators compare changes in an outcome variable pre-post event for treated units with changes of the same variable over the same period for units that have not (yet) undergone treatment. Our treatment occurs in different periods for different units. A growing body of established literature highlights significant estimation challenges associated with Diff-in-Diff models with staggered treatment timing. In particular, if the treatment

effect is heterogeneous, standard two-way fixed effects estimators can be severely biased due to the "negative weights" problem. The literature has proposed various estimators that address this problem (see, for example, De Chaisemartin and D'Haultfoeuille, 2020; Goodman-Bacon, 2021; Borusyak and Jaravel, 2024; Athey and Imbens, 2022; Callaway and Sant'Anna, 2021; Sun and Abraham, 2021).

We use the Difference-in-Difference event study design with staggered adoption proposed by Callaway and Sant'Anna (2021). The method uses firms that are not yet treated as controls for treated firms. This approach avoids the issue of negative weights and the need to select a control group of firms that are never treated. We argue that our setting satisfies the assumptions needed to consistently estimate the effects of the treatment: irreversibility of the treatment, random sampling, limited treatment anticipation, and conditional parallel trends based on "Not-Yet-Treated" groups. Divorce is very rarely reversed. We assume that neither the majority shareholder nor the firm's expected outcomes influence the probability of a minority shareholder's divorce. We also assume parallel trends between groups experiencing the divorce of a minority shareholder at time t and groups that are "not-yet-treated" at time $t + k$, conditional on controls.

Callaway and Sant'Anna (2021) propose to first estimate the treatment effects separately for each cohort (i.e., firms undergoing treatment in the same year) and year post treatment and then aggregate these cohort-time estimates to obtain aggregate estimators. To obtain the event study estimator $\theta(e)$ for e periods after the event, we aggregate the group-time average treatment effect by year after treatment as simple averages. As the preferred summary measure of the treatment effect, we follow again Callaway and Sant'Anna (2021) and use θ^{O}_{sel}, computed as the average of the overall effect for each individual cohort. We experiment with different aggregation methods, finding that the results are robust.

To assess risk, we use the variability of the performance. In this case, we need multiple periods to measure variability. This variable is therefore not suitable for event studies analysis. Consider a performance measure r_{jt}. We define firm risk as the firm level, over time variability of such performance. A more variable performance implies a less stable cash flow for the entrepreneur. Moreover, a highly variable performance is more likely to lead the firm to financial distress. We measure variability as the standard deviation of returns, calculated

separately for the pre- and post-divorce periods:

$$\text{sd(r)}_{jPRE} = \sqrt{\frac{1}{(n_{jPRE}-1)} \sum_{t=T_j^{Min}}^{T_j-1} (r_{jt} - \bar{r}_{jPRE})^2} \tag{1}$$

$$\text{sd(r)}_{jPOST} = \sqrt{\frac{1}{(n_{jPOST}-1)} \sum_{t=T_j+1}^{T_j^{Max}} (r_{jt} - \bar{r}_{jPOST})^2} \tag{2}$$

where T_j is the year of the divorce of a minority shareholder of firm j, n_{jPRE} (n_{jPOST}) is the number of periods for which firm j is observed pre (post) divorce, T_j^{Min} (T_j^{Max}) is the first (last) year in which firm j is observed, $\bar{r}_{jPRE}$ ($\bar{r}_{jPOST}$) is the average performance pre-divorce (post-divorce). For each firm, therefore, we have two measures of risk, one pre- and another post-divorce. We drop the year of the divorce in all calculations.

To analyze the effect of the divorce of a minority shareholder on firm variability, we run a two-way fixed effect linear regression of the following form:

$$\text{sd(r)}_{j\tau} = \beta \mathbb{1}_{\{\tau=POST\}} + \gamma_j + \theta \times C_{i,t} + \epsilon_{j,t} \tag{3}$$

where $\tau = \{PRE, POST\}$, $\mathbb{1}_{\{\tau=POST\}}$ is an indicator function for the post-divorce period, γ_j are firm fixed effects, and C_j represents fixed controls added in specifications where we do not control for firm fixed effects. A reduction in firm risk after the divorce implies that $\beta < 0$.

3 The data

In this section, we describe the data sources, illustrate the variables' construction, and supply descriptive statistics for the key variables.

3.1 Data Sources

We use Danish registry data from 2006 to 2017. Specifically, we exploit data on balance sheet information, firm ownership structure, households' full wealth holdings, and individual household divorce history. Each variable is recorded annually. We define shareholders at the household level, aggregating all shares owned by household members. Therefore, the divorce of a minority shareholder means that the divorce has occurred in a household that owns a minority share in the firm. The majority shareholder is the household that holds the relative majority of the company's shares.

The criteria for a firm in the Danish firm register to be included in our data are: 1) the firm is either a closely held company, a limited liability company, or a partnership; 2) the firm has been observed at least once with 1 employee and positive turnover; and 3) the firm has been observed in the data more than twice. These inclusion criteria are necessary to exclude sole proprietorships, unincorporated businesses, or legal entities created for fiscal purposes only.

We construct shareholdings using the data from Experian, a private data provider, augmented with data from the Central Business Register, supervised by the Ministry of Industry, Business and Financial Affairs. Firms can be owned either directly by individuals or indirectly through other firms. In cases of firm ownership, we trace the ownership hierarchy to assign control rights to individual owners. At each step, we identify the controlling shareholder of firm j_1 as the entity holding the majority of its shares and attribute to that shareholder the shares of other firms owned by j_1. This process is repeated until only individual owners remain. For cases in which we cannot trace back the firm's majority shareholder to an individual owner, we drop the firm from the sample. In addition to the ownership share, we also compute the profit shares, obtained by multiplying ownership shares along the ownership chain. For example, if individual i owns 70% of firm j_1 which owns 40% of firm j_2, individual i owns 28% of j_2's profits.

3.2 Variables Definition

In this section we describe the variables we construct to carry out our analysis.

Value of the firm. Our sample comprises unlisted firms. We obtain a measure of the market value of the firm by applying a multiple evaluation. Specifically, the value of the firm is computed as follows:

$$\text{Value}_{jt} = \text{Equity}_{jt} \times \text{PB}_{s,t} \tag{4}$$

where Equity_{jt} is the book value of equity of firm j at time t, and $\text{PB}_{s,t}$ is the price-to-book value multiple for sector s to which firm j belongs in period t. The multiple is obtained as the ratio between the sum of the market capitalization of listed companies in Denmark belonging to sector s in period t, and the sum of their shareholders' equity at book value. Details on the market multiples method used can be found in Appendix C.

Household's total wealth. Total Wealth gross of total debt is defined as the sum of bank deposits, stocks, bonds, estimated housing value,[4] and the value of ownership of private businesses. For each business j, the value of the business is $\text{Share}_{ijt} * \text{Value}_{jt}$, where Share_{ijt} is the share of business j owned by household i. Net Total Wealth is defined as Total Wealth net of mortgages, bank loans, and other loans.

Wealth share concentration. We define Wealth share concentration as the share of household i's wealth due to the ownership of firm j:

$$\text{Conc}_{ijt} = \frac{\text{Share}_{ijt} * \text{Value}_{jt}}{\text{Total Wealth}_{it}} = \frac{\text{Share}_{ijt} * \text{Value}_{jt}}{\text{Share}_{ijt} * \text{Value}_{jt} + \text{Other Wealth}_{it}}, \tag{5}$$

where Share_{ijt} is the profit share of the household i in firm j at time t, Value_{jt} is the value of firm j at time t and Other Wealth_{it} is the entrepreneur's wealth different from the wealth deriving from the ownership of the firm. We use gross wealth as our preferred measure of wealth, calculated without subtracting household debt. In fact, net wealth (obtained by subtracting household debt) has a negative left tail,[5] making the measure of concentration meaningless. Note that this is inconsequential for our estimates, because, as explained in Section 2.2, we use event study estimates based on the year of divorce of a minority shareholder, which do not use directly wealth concentration.

3.3 Descriptive Statistics

Appendix Table D1 presents descriptive statistics for firms. As our identification strategy relies on the divorce of a minority shareholder, we restrict the sample to firms observed at least once with more than one shareholder. Danish firms satisfying this criterion in 2006-2017 are 20,519 for 145,578 firm-year observations. We further restrict the sample to firms that experience the divorce of a minority shareholder during the period of observation, as we use as control not yet treated firms. We end with 1,174 firms (around 6% of the total) for 11,458 firm-year observations. Descriptive statistics for the firms that experience the divorce of a minority shareholder (hereafter referred to as *Main Sample*) are displayed in Table 1. Unsurprisingly, firms in the *Main Sample* are on average bigger than the firms in the overall sample. Indeed, the probability of the divorce of a minority shareholder depends

[4]Since the tax evaluation of the house in the Danish archives is approximately 60% of the real value, we impute the market value of the house based on property trades.

[5]The reason is that housing values tend to be underestimated, while mortgages on housing are precisely reported, leading to an underestimation of wealth when household debt is taken into account. Indeed, the 1st percentile of the distribution of wealth net of all debt is negative, amounting to -549,538 dollars.

positively on the number of shareholders. The average number of shareholders for firms in the *Main Sample* is 2.9. The median firm has approximately 11.5 employees (8.5 in the overall samples), is 11 years old, has 384,000 dollars in equity, 1 million dollars in assets, and a turnover of 1,5 million dollars.[6]

Table 1: Descriptive Statistics: Firms in the estimation sample

	Mean	Median	10 p.	90 p.	Obs.
Emp.	24	11.5	2	51.5	11,366
Age	13	11	2	28.5	11,458
# Shareholders	2.9	3	1	4.2	11,458
Equity	7,374	384	54	2,864	11,458
Assets	10,445	1,089	188	6,884	11,458
Net Profits	1,179	72	-31	549	11,455
Turnover	3,413	1,499	150	8,056	11,458
Value	10,223	603	71	1,721	11,458
ROE	0.26	0.20	-0.11	0.77	11,227
Debt	3,234	541	76	3843	11268
Leverage	0.57	0.59	0.22	0.87	11458
	Firm Level Standard Deviation:				
ROE	0.41	0.21	0.05	1.1	827
ROE res.	0.29	0.20	0.06	0.68	827
log(Turnover)	0.31	0.22	0.07	0.66	660
log(Emp.)	0.23	0.17	0.02	0.46	834
log(Assets))	0.33	0.24	0.07	0.75	676

The Table reports descriptive statistics for firms included in the estimation, that is, those for which there is a divorce in the minority shareholder household. Values are in thousand dollars evaluated at the average 2015 exchange rate (1 dollar for 6.74 Danish Krone). All percentiles are computed as averages around the percentile, in compliance with Statistics Denmark's confidentiality regulations. Value are in thousands.

We present descriptive statistics for the majority shareholders in Table 2. When we use information at the individual level (rather than at the household level), such as age, we refer to the first family member listed in the data. In the data, the first family member is male 75% of the time. The average age is 51. The majority shareholder's firm equity share ranges between 25% (10th p) and 91% (90th p), with a mean of 52%. While we also consider majority shareholders who own less than 51% of the capital, half of our sample is comprised of absolute majority shareholders, as the median majority shareholder holds 50%

[6]All percentiles are computed as averages around the percentile, in compliance with Statistics Denmark's confidentiality regulations. All values displayed in the tables are computed starting from 2015 Danish Crowns converted to dollars at the average 2015 exchange rate: 1 dollar for 6.74 DKK.

of the firm's equity shares. We will show that our results hold when focusing on absolute majority shareholders.

Table 2: Descriptive Statistics: Majority Shareholder in the estimation sample

	Mean	Median	10 p.	90 p.	Obs.
Age	51	49	36	67.5	11,225
Equity Shares	0.52	0.50	0.25	0.91	11,458
Conc.	0.35	0.27	0.03	0.81	11,225
Conc. D.	0.34	0.41	.03	1	11,225
Total Wealth	6,409	1,257	375	5,490	11,225
Total Wealth D	5,846	832	94	4,585	11,225
Mkt. Val. to Wealth	0.79	0.57	0.08	1.74	11,225

Values are in thousands Dollars. They were originally computed in 2015 Danish Crown. Average 2015 Dollar to DKK exchange rate: 1 dollar for 6.74 Danish Krone. Debt to Cap. reads as debt to debt plus equity ratio, Shares reads Equity Shares, Mkt. V. to Wealth reads Firm Market value to majority shareholder wealth ratio. All percentiles are computed as averages around the percentile, in compliance with Statistics Denmark's confidentiality regulations. The letter D stands for net of debt and Mkt. Val. to Wealth reads as firm market value to wealth ratio.

3.4 Firm Market Value to Wealth Ratio

The divorcing minority shareholder might own equity in the firm valued beyond what the majority shareholder can afford to purchase. Conversely, it could be that acquiring the share of the minority shareholder has a negligible impact on the majority shareholder's concentration. We assess these occurrences using the ratio of the firm's market value to the majority shareholder's total wealth, referred to as VTW hereafter. Equation (6) shows that, keeping total wealth constant, every additional unit of equity shares acquired by the majority shareholder increases concentration exactly by the VTW:

$$\frac{\partial \text{Conc}_{ijt}}{\partial \text{Share}_{ijt}} = \frac{\text{Value}_{jt}}{\text{Total Wealth}_{it}} \equiv \text{VTW} \tag{6}$$

When VTW is very high, the majority shareholder might be reluctant to acquire the minority shareholder's shares, both because it would entail a large increase in concentration and because they might not have the resources to do so. The last row of Table 2 displays descriptive statistics of VTW. The 90th percentile is 1.74, indicating that the majority shareholder's total wealth is significantly lower than the firm's value. Consequently, purchasing 1 percent of the firm's shares raises concentration by 1.74 percentage points. For majority shareholders with a VTW exceeding the 90th percentile, acquiring the divorcing minority shareholder's stake would, on average, require 70% of the majority shareholder's *gross* total

wealth, making it unlikely that the majority shareholder buys. Interestingly, Panel (a) of Appendix Figure D2 shows that, for these firms, the divorce of a minority shareholder causes a decrease in firm equity. This could be because the minority shareholder is paid off directly by reducing the firm's equity value through a buyback.

When VTW is very low, the acquisition of the minority shareholder shares is going to cause only a negligible increase in the majority shareholder wealth concentration, which, in turn, might not trigger a change in the firm's strategy. For majority shareholders with an VTW below the 10th percentile (0.08), acquiring the divorcing minority shareholder's stake would, on average, increase concentration by less than 1%. Panel (b) of Appendix **??** Figure D2 shows that following the divorce of a minority shareholder, firm equity increases. A possible explanation is that, once the minority shareholder's stake is acquired, a wealthy (relative to the firm value) majority shareholder decides to invest more in the firm, setting in motion changes in the firm strategy unrelated to the mechanism we are focusing on.

Based on this evidence, we exclude firms-households pairs that the year before the divorce had an VTW below the 10th or above the 90th percentile of the distribution of VTW.

4 Results

In this section, we present the results. We start by showing that the divorce of a minority shareholder increases the majority shareholder's equity share and concentration. Next, we analyze the evolution of firm performance in terms of returns and risk pre- post-divorce of a minority shareholder.

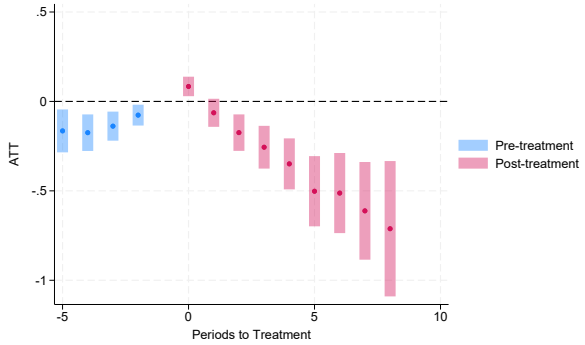
4.1 The first stage: Minority shareholders' divorce as a shock to concentration

In this section, we determine if the evidence supports the economic mechanism illustrated in Section 2.1 discussing identification. We hypothesize that a divorce pushes the minority shareholder to liquidate their share to cover the costs of the separation. The majority shareholder is the most likely acquirer, both to avoid undesired shareholders and because the shareholders are equally informed about the company's value, and more informed than potential outsiders. When a minority shareholder divorces, we should see on average a decrease in the number of shareholders, an increase in the equity share of the majority shareholder and an increase in their wealth concentration in the firm.

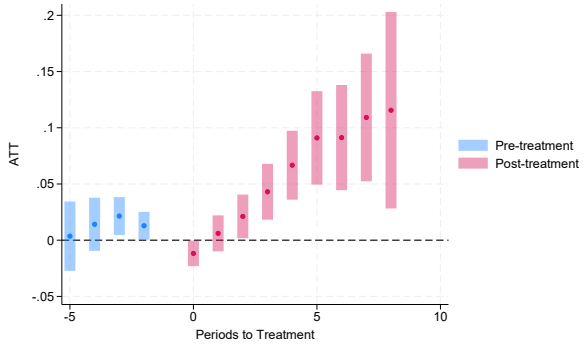
Figure 1 tests this hypothesis. Panel (a) reports the event study coefficients obtained applying the Callaway and Sant'Anna (2021) estimation method ($\theta(e)$ illustrated above, where e is the distance from the divorce in terms of years) for the number of shareholders. We find that the number of shareholders gradually decreases after the divorce, reaching almost -0.75 after 8 years. The estimates are significantly different from zero already 2 years after the divorce, and remain always significant despite the increase in the standard errors, due to the smaller number of data points available for periods further away from the divorce date. We also find a small, positive trend in the pre-event period.[7]

Figure 1: Number of Shareholders, Majority Shareholder's Equity Share and Wealth Concentration

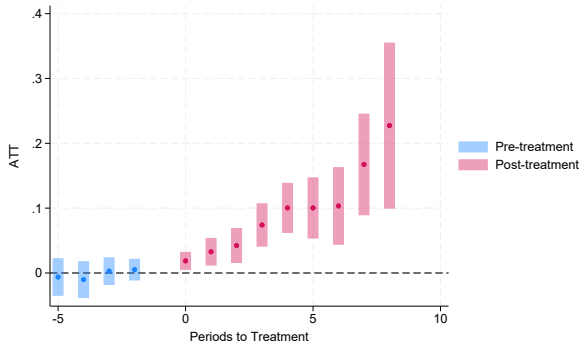
(a) Number of Shareholders



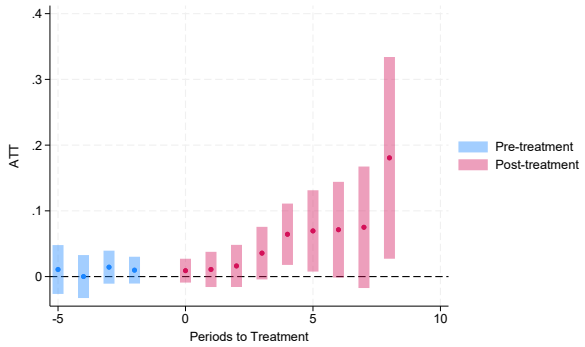
(b) Equity share



(c) Wealth Concentration



(d) Wealth Concentration Net of Debt



Note: The figure plots event study coefficients using the Callaway and Sant'Anna (2021) estimator. We control for the number of shareholders, the age of the majority shareholder, and the market value relative to the majority shareholder's wealth in the year prior to the divorce. Panel (a) plots the results for the number of firm shareholders, Panel (b) plots the results for the majority shareholder's equity shares in the firm, Panel (c) plots the results for the majority shareholder's wealth concentration in the firm, and Panel (d) plots the results for the majority shareholder's concentration in the firm, computed net of debt.

[7]This might be because we require that the firm has more than one shareholder in the year of the divorce so that we capture some firms going from one to more than one shareholder in the previous years.

Panel (b) plots the equity share of the majority shareholder. The share increases monotonically after the divorce, reaching an average value of 10% higher after height years. The increase is the mirror image of the decrease in the number of shareholders shown in panel (a), consistent with the idea that the majority shareholder liquidates the minority shareholder buying their shares. Importantly, we find no evidence of any pre-trend: the difference between treated and controls is small before the divorce.[8]

Panel (c) shows that the wealth concentration of the majority shareholder increases substantially after the divorce, by more than 20% by the end of the period. This is a very substantial increase when compared with an average wealth concentration of 35% and a median of 27% (see Table 2). In line with the evidence for the equity share, we find that there is no difference in the evolution of concentration before the divorce. Finally, Panel (d) shows the evolution of concentration computed net of debt, finding a similar pattern.

Table 3 reports the ATE regression coefficients, which represent the average effect of the treatment in the post-divorce period. As explained above, we use Callaway and Sant'Anna (2021) θ^O_{sel}, computed as the average of the overall effect for each cohort. The estimates are all highly statistically significant. Given that in Figure 1 we find that it takes time for the effects to fully manifest themselves, the ATE are substantially smaller than those measured at the end of the observation period.

All in all, we conclude that the divorce of a minority shareholder represents a valid shock to the concentration of the majority shareholder, both in terms of the exclusion restriction–there is no evidence of pre-trends– and of relevance–the effects on concentration are substantial.

4.2 Effects on mean performance

Next, we analyze the effects of concentration on firm performance in terms of average returns and returns variability. Figure 2 plots event study coefficients for the evolution of ROE pre-post-divorce. Panel (a) includes the standard controls (number of shareholders, the age of the majority shareholder, and the market value relative to the majority shareholder's wealth, all measured in the year before the divorce). First, there is no evidence of pre-trends: treated and control firms follow identical paths before the divorce. After the divorce, ROE drops immediately in treated firms, becoming significant after four years. Estimates

[8] One possibility is that the participation of the minority shareholder is directly liquidated by the firm through a buyback, reducing the value of the firm's equity. In this case, the majority shareholder would not increase their investment in the firm. We show below that this is not the case: the value of equity is unaffected by the divorce.

Table 3: First Stage ATE

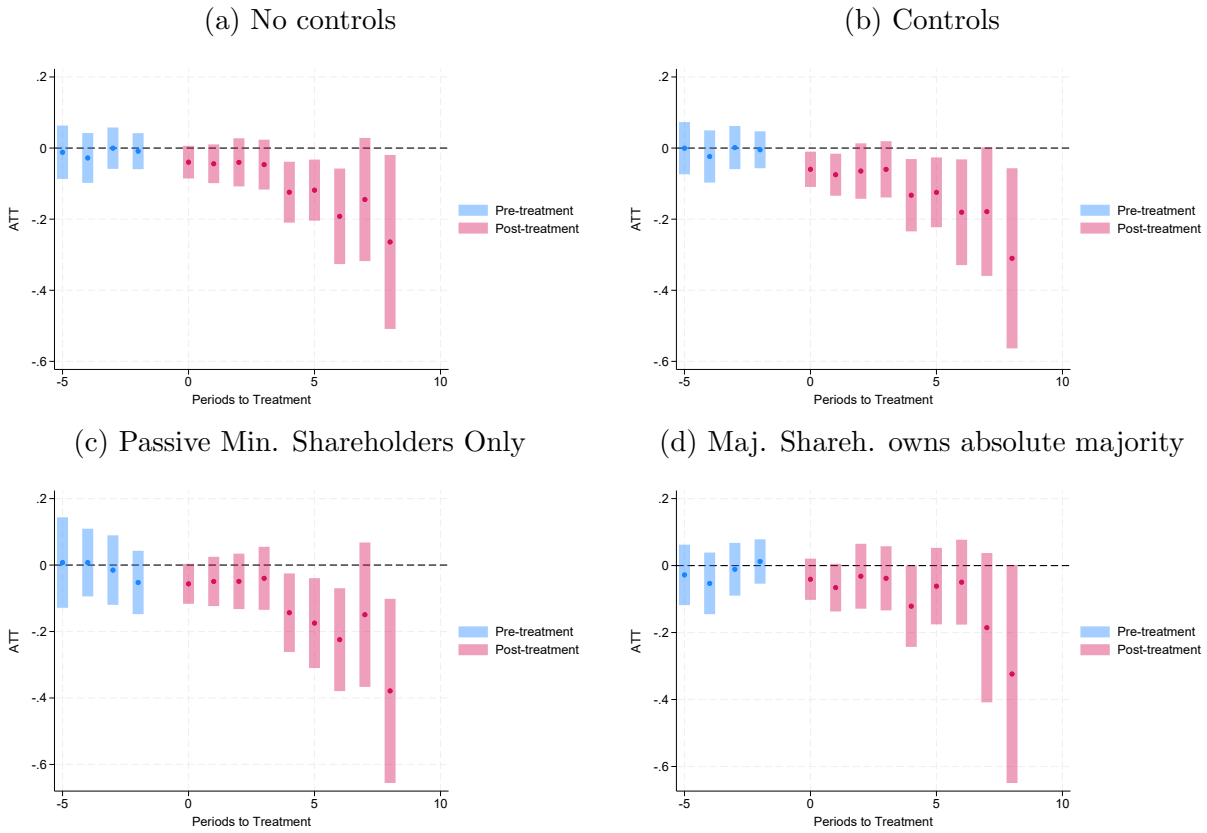
	[1] # of Shareholders	[2] Equity Shares	[3] Gross Wealth Conc	[4] Net Wealth Conc
ATT	-0.226***	0.038***	0.069***	0.039**
	(0.054)	(0.011)	(0.014)	(0.016)
N	7,096	7,096	7,051	5,636

Note: The table reports the ATT, using the Callaway and Sant'Anna (2021) estimator, of the divorce of a minority shareholder on firm ROE- controls include number of shareholders, the age of the majority shareholder, and the market value relative to the majority shareholder's wealth in the year prior to the divorce. Column [1] displays the results for the number of firm shareholders, Column [2] for the majority shareholder's equity share in the firm, Column [3] for the majority shareholder's wealth concentration in the firm, and Column [4] for the majority shareholder's wealth concentration in the firm, computed net of debt. Standard errors clustered at firm lvl. in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

are fairly stable thereafter, despite becoming less precise as we move further away from the divorce date, owing to the decreasing number of observations. Over this period, the value is around -15%. This is a very substantial drop, given that the average ROE over the sample period is 26% (see Table1). In panel (b), we add the following set of controls for majority shareholder and firm characteristics in the year prior to the divorce: majority shareholder wealth concentration, profit shares and wealth, firm equity, leverage, and employment. The results remain unchanged while slightly improving in precision.

Some minority shareholders may also work for the firm or serve on its board. In this case, the exclusion restriction is questionable. For example, the minority shareholder might stop working for the firm upon selling their shares. Or, even when keeping working for the firm, the divorce might negatively impact their ability to contribute to the firm operations. To check for this possibility, panel (c) repeats the exercise excluding all firms in which the minority shareholder has worked for the firm or has sat on its board at any time during the sample period. This reduces the number of observations from 6,879 to 3,053. We refer to this set of firms in the tables and figures as *Passive Min. Shareholders Only*. Despite this, we still get a significant reduction. The pattern is very similar; if anything, the magnitude is slightly larger in absolute value. This goes against the hypothesis that the decline in ROE is attributable to a reduced labor contribution by the minority shareholder to the firm's performance.

Figure 2: Event studies for ROE



Note: The figure plots event study coefficients using the Callaway and Sant'Anna (2021) estimator. We control for the number of shareholders, the age of the majority shareholder, and the market value relative to the majority shareholder's wealth in the year prior to the divorce. Panel (a) plots the results for the full sample. Panel (b) plots the results from the specification in Panel (a), augmented with controls for majority shareholder and firm characteristics in the year prior to the divorce. These controls include majority shareholder wealth concentration, profit shares and wealth, firm equity, leverage, and employment. Panel (c) plots the results for the specification in Panel (a) for the sample of firms in which the divorcing shareholder never worked for the firm and has never been in the firm board and Panel (d) for the sample of firms in which the majority shareholder was holding the absolute majority of firm shares prior to the divorce of the minority shareholder. Standard errors clustered at firm level.

Finally, our definition on majority shareholder is based on relative majority, that is, it includes also majority shareholders with less than 51% of shares pre-divorce of the minority shareholder. In this case, attributing the choice of the firm strategy to the majority shareholder only might also be questionable. In Panel (d), we show the results for the sample of firms in which the majority shareholder held the absolute majority of firm shares pre-divorce. This reduces the number of observations from 6,879 to 4,223. The results are robust to this modification, although with a slightly smaller precision.

We compute and report the ATE in Table 4. ROE is 7.9 percentage points lower on average

in the post-period in the basic specification (Column 1), and 11.9 percentage points lower when adding controls for firm and majority shareholder characteristics (Column 2). The drop is similar when restricting the analysis to the sample of firms in which the divorcing shareholder never worked for the firm and has never served on the firm's board (Column 3, Min. Shareholder Passive, 10.7 percentage points lower), and to the sample of firms in which the majority shareholder held the absolute majority of firm shares before the divorce of the minority shareholder (Column 4, 7.2 percentage points lower).

Table 4: Average treatment effect for ROE

	[1] No Controls	[2] Controls	[3] Min. Shareholder Passive	[4] Maj. Shareholders $> .50$
ATT	-0.079***	-0.119***	-0.107***	-0.072*
	(0.030)	(0.038)	(0.038)	(0.040)
N. Obs.	6,879	6,715	3,053	4,223

Note: The table reports the ATT, using the Callaway and Sant'Anna (2021) estimator, of the divorce of a minority shareholder on firm ROE- controls include number of shareholders, the age of the majority shareholder, and the market value relative to the majority shareholder's wealth in the year prior to the divorce. Column [1] displays the results for the full sample, Column [2] displays the results for the specification in Column [1], augmented with controls for majority shareholder and firm characteristics in the year prior to the divorce. These controls include majority shareholder wealth concentration, profit shares and wealth, firm equity, leverage, and employment. Column [3] displays the results for the specification in Column [1] for the sample of firms in which the divorcing shareholder never worked for the firm and has never been in the firm board and Column [4] for the sample of firms in which the majority shareholder was holding the absolute majority of firm shares prior to the divorce of the minority shareholder. Standard errors clustered at the firm level in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

4.3 Effects on performance dispersion

Having shown that firms settle on a lower growth profile after the shock to the main shareholder's concentration, we now study the effects on risk-taking. Our measure of risk-taking is the within-firm, over-time variability of ROE. We use the standard deviation, computed separately for each firm before and after the divorce according to Equations (1) and (2). We limit the sample to firms observed for at least three years before and at least three years after the divorce to obtain a meaningful measure of variability. As discussed in Section 2.2, a pre-post divorce variability measure is unsuitable for an event study design, so we use

the simple OLS estimator. Since we compare ROE variability measures before and after the divorce, a potential concern is that the results may capture changes in macroeconomic conditions between the earlier and later periods. Moreover, given the staggered event nature of our research design, the years over which we compute the pre-post variability change according to when the divorce occurred. To address this, in a second set of specifications, we use the residuals from a regression of ROE on year×sector fixed effects to compute the standard deviation, accounting therefore for any shock at year×sector level.

Column (1) of Panel A of Table 5 reports the result when using the standard deviation of ROE without controls. In column (2) we add controls, including an indicator variable for the year of the divorce, the age of the majority shareholder, the number of shareholders, and the firm value-to-majority-wealth ratio, all evaluated in the year prior to the divorce. In column (3), we add firm fixed effects. The divorce of a minority shareholder decreases the ROE standard deviation by around 0.07, which amounts to 0.33% of the median and 17% of the mean ROE standard deviation in the sample.

In columns [4], [5], and [6], we repeat specifications [1], [2], and [3] using the residuals of a regression of ROE on year-time-sector fixed effects as the measure of ROE when computing the standard deviation. This accounts for differences in macroeconomic conditions that could influence the firm's ROE standard deviation due to the different periods in which the standard deviation is computed, arising from variations in the year of the divorce. When ROE residuals are used to compute the standard deviation, the results are even stronger in magnitude, amounting to -0.11, 52% of the median and 38% of the mean of the ROE residuals standard deviation.

In Panel (B) of Table 5, we show the results replicating the specifications from Panel (A) while restricting the analysis to the sample of firms in which the divorcing shareholder never worked for the firm and has never served on its board. In Panel (C) we replicate the analysis by limiting the sample to firms in which the majority shareholder held the absolute majority of firm shares prior to the divorce of the minority shareholder. Results are qualitatively unchanged.

4.4 Effects at different quantiles of the performance distribution

One issue with the dispersion analysis is that lower variability does not necessarily mean lower risk, taking into account the drop in the mean returns. The leftward shift in the distribution that lowers the mean may outweigh the reduction in variance, resulting in the

Table 5: Difference in the ROE Variability pre-post divorce

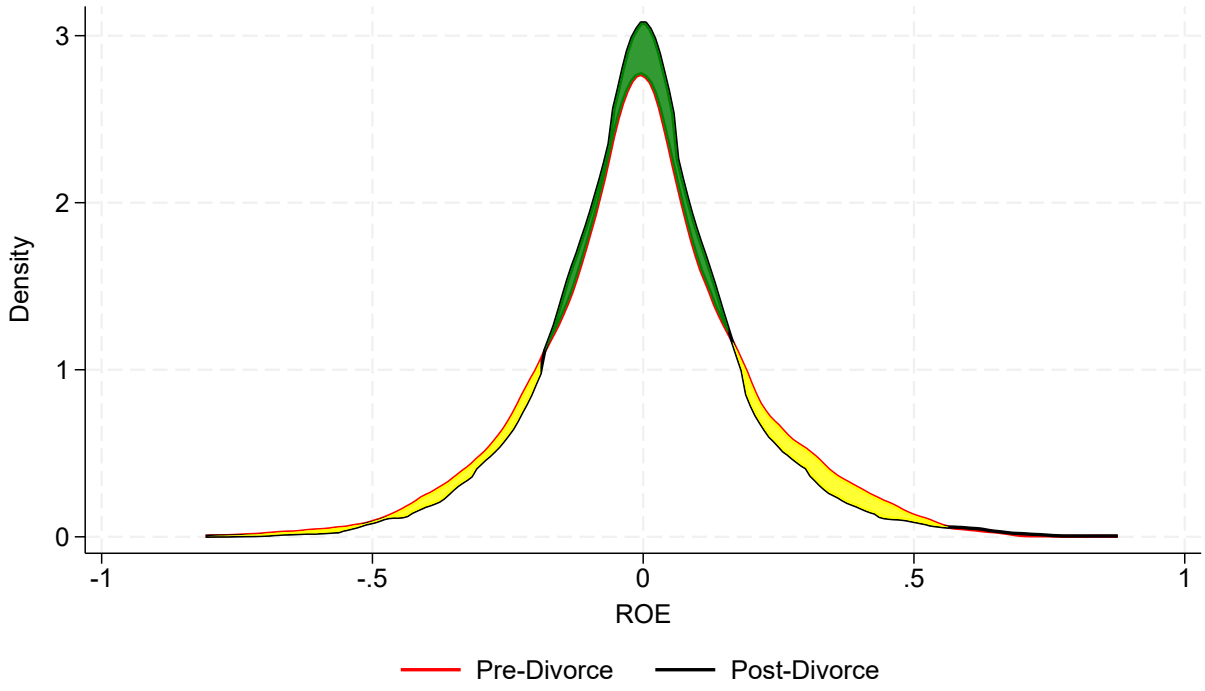
	[1]	[2]	[3]	[4]	[5]	[6]
	Panel A: All firms					
	SD(ROE)			SD(ROE Res)		
ATT	-0.061***	-0.068***	-0.068***	-0.111***	-0.111***	-0.111***
	(0.013)	(0.013)	(0.014)	(0.017)	(0.017)	(0.017)
N. Obs.	608	608	608	676	676	676
	Panel B: Passive Min. Shareholder Only					
	SD(ROE)			SD(ROE Res)		
ATT	-0.069**	-0.075***	-0.087***	-0.123***	-0.124***	-0.122***
	(0.028)	(0.028)	(0.028)	(0.026)	(0.026)	(0.026)
N. Obs.	289	289	289	322	322	322
	Panel C: Maj. shareholders own absolute majority					
	SD(ROE)			SD(ROE Res)		
ATT	-0.088***	-0.092***	-0.103***	-0.118***	-0.118***	-0.118***
	(0.025)	(0.025)	(0.023)	(0.023)	(0.024)	(0.024)
N. Obs.	370	370	370	412	412	412
Controls:						
Age Maj. Shareh.		Y			Y	
# Shareholders		Y			Y	
Year of the Divorce		Y			Y	
Firm Val to Wealth		Y			Y	
Firm f.e.			Y			Y

Note: The table reports the OLS coefficient of the effect of divorce of a minority shareholder on the firm ROE standard deviation. Column [1] reports the result for a pre-post specification without controls, in column [2] we add controls, including an indicator variable for the year of the divorce, the age of the majority shareholder, the number of shareholders, and the firm value-to-majority-wealth ratio, all evaluated in the year prior to the divorce. In column [3], we add firm fixed effects. In column [4], [5] and [6] we repeat specifications [1], [2], and [3] using the residuals of a regression of ROE on year-time-sector fixed effects as the measure of ROE. Panel A, displays the result for the full sample of firm, Panel B for the sample of firms in which the divorcing shareholder never worked for the firm and has never been in the firm board, and Panel C for the sample of firms in which the majority shareholder was holding the absolute majority of firm shares prior to the divorce of the minority shareholder. Standard errors clustered at firm lvl. in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

pre-divorce return distribution first-order stochastically dominating the post-divorce one. To rule this out, we analyze more in detail the shape of the two distributions of returns.

Figure 3 plots the distribution of ROE before and after the divorce. Consistently with our identification strategy, we plot the residualized version of ROE, after regressing it on year×sector fixed effects and firm fixed effects. The dotted red line represents the distribution of ROE prior to the divorce of a minority shareholder, while the dotted black line represents the distribution after the divorce. The green area displays the difference between the two distributions. Consistently with the regression results, the pre-divorce distribution is more dispersed. More importantly, the distribution exhibits greater mass in both the right and left tails. The increased right-tail mass suggests a higher likelihood of high returns, while the reduced left-tail mass supports the hypothesis that firms whose minority shareholders experienced a divorce become less risky, as they are less likely to generate extremely negative returns.

Figure 3: ROE Distribution Pre and Post Divorce



Note: The figure plots the univariate kernel density estimates, prior (red dashed line) and post (black dotted line) the divorce event, of the residuals of a regression of ROE. on year×sector fixed effects, and on firm fixed effects. The green area highlights the differences between the two densities.

While Figure 3 aligns with our hypothesis, it does not provide a means to quantify the magnitude or statistical significance of the effects. To address this, we conduct a quantile regression analysis. In recent years, research on the econometrics of Diff-in-Diff estimation has expanded significantly. However, the application of quantile regression within this frame-

work remains an evolving area, with no consensus on the optimal estimator. To ensure the robustness of our results, we estimate the quantiles using multiple estimation techniques.

We begin with a straightforward quantile estimator of the residualized ROE, obtained by regressing it, as before, on year × sector fixed effects and firm fixed effects. The resulting residuals are used as the dependent variable in a quantile regression with the dummy for post-divorce years as the explanatory variable. The coefficients from these quantile regressions correspond exactly to the difference in the densities displayed in Figure 3. We start with the 10^{th} percentile and estimate all ventiles up to the 90^{th} percentile.[9] The results of this estimation exercise are reported in Panel (a) of Figure 4. As expected, the quantile estimates confirm the patterns of Figure 3: the difference in ROE pre-post divorce is positive for lower quantiles and turns negative around the 60^{th} percentile. The estimated differences decrease smoothly and are statistically different from zero on both tails of the distribution. The size of the effect is 5% at the left tail and almost -15% at the right one. This compares with overall values of the 10^{th} and 90^{th} percentiles of ROE of -10% and 77% respectively (see Table 1). It indicates a significant reduction in negative outcomes and an even greater decline in positive ones, aligning with the idea that more exposed entrepreneurs adopt strategies with lower risk-return trade-offs.

To assess the robustness of these simple quantile regressions, we employ the method developed by Machado and Silva (2019) to directly incorporate fixed effects into quantile regressions. This approach allows firm fixed effects to influence the entire distribution of ROE, meaning that they can have a differential impact at each ventiles of the distribution. In particular, we first compute the residuals from a regression of ROE on the interaction of year and sector fixed effects, and then estimate on the residuals the following conditional quantile model:

$$Q_{roe}(\tau|X_{jt}) = (\alpha_j + \delta_j * q(\tau)) + \mathrm{X}_{jt} * (\beta + \gamma * q(\tau)) \tag{7}$$

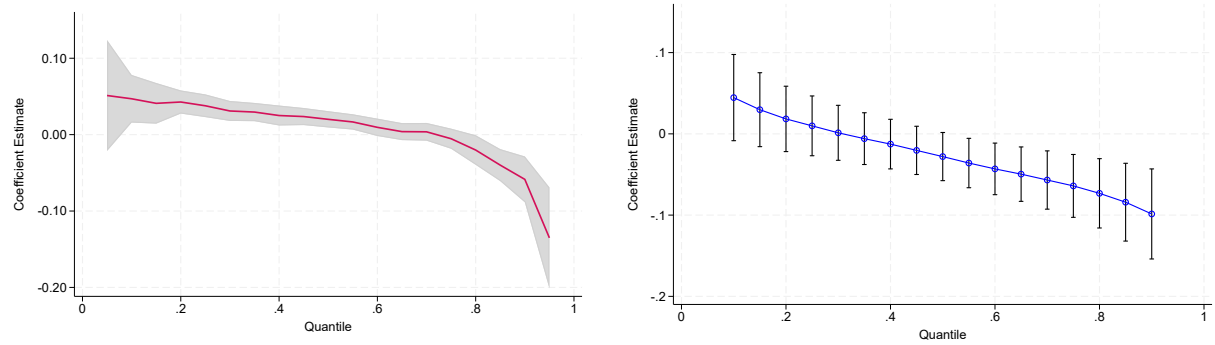
where τ is a quantile, $q(\tau) = F_u^{-1}(\tau)$, u an unobserved random variable with distribution F(u), $(\alpha_j + \delta_j * q(\tau))$ is the quantile-τ fixed effect for firm j, X_{jt} is a dummy variable for divorce of a minority shareholder. The results are reported in panel (b) of Figure 4, where we use a different graphical representation to distinguish this estimation technique from the previous one. The results are very similar both qualitative and quantitatively, with

[9] Quantile regression methods of the family of Koenker and Bassett Jr (1978) are not well suited for estimating extreme quartiles, as large sample theory does not hold in the tails of the distribution (Chernozhukov, Fernández-Val, and Kaji, 2017).

Figure 4: Quantile regressions for ROE

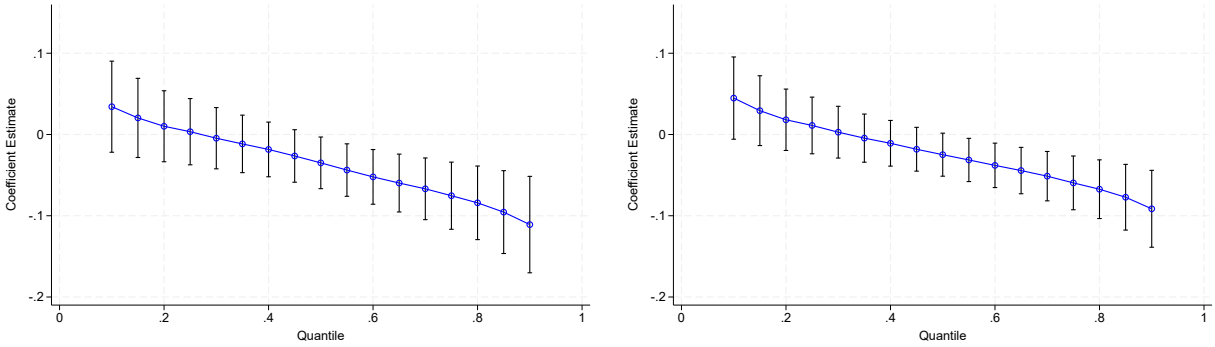
(a) Naive

(b) Machado-Silva, All observations



(c) Machado-Silva, Passive shareholders only

(d) Machado-Silva, Absolute majority only



Note: The figure plots coefficient estimates by quantiles from quantile regressions of R.O.E. on the divorce event. Panel (a) plots the coefficient estimates for the quantile regression of the residuals from the regression of R.O.E. on the interaction of year and sector fixed effects and firm fixed effects on divorce. Panel (b) plots the coefficient estimates for the quantile regression of the residuals from a regression of R.O.E. on the interaction of year and sector fixed effects on divorce and firm fixed effects, using the Machado and Silva (2019) method. Panel (c) plots the results for the specification in Panel (b) for the sample of firms in which the divorcing shareholder never worked for the firm and has never been on the firm's board, and Panel (d) for the sample of firms in which the majority shareholder held the absolute majority of firm shares prior to the divorce of the minority shareholder.

two slight differences. First, the effects at the lower quantiles are at the margin of statistical significance at 5%. Second, the decrease is more linear compare to the previous figure, where it accelerates substantially at the upper quantiles: at the 90^{th} percentile, ROE of firms which underwent treatment is 10% lower than that of firms not yet treated.

Finally, Panel (c) shows the results for the subset of firms with divorced minority passive shareholders and panel (d) for firms where the majority shareholders held at least 51% of the equity shares prior to the divorce. In both cases, results are virtually identical to those base on the whole sample.

As a final check, we implement the Quantile Treatment Effect on the Treated (QTT) developed by Callaway and Li (2019). This estimator is closely aligned with the Diff-in-Diff event study design proposed by Callaway and Sant'Anna (2021) used as our preferred empirical model. This estimator is designed for a three-period framework only: two pre-treatment periods, in which all firms are untreated, and one post-treatment period, in which some firms are treated. We therefore construct all possible triplets in our observation period that include two years with no treated firms and one year in which part of the sample is treated, and we estimate the corresponding QTT for each triplet. Appendix Figure D3 plots the point estimates from each triplet for each decile of the ROE distribution. The estimates follow exactly the same pattern, positive for the left quantiles and turning progressively negative moving towards the right of the distribution. The estimates tend to vary more at the extremes, likely because many triplets in these regions are based on a limited number of observations.

4.5 Effects on the default probability

The quantile regressions certify that, *conditional on surviving*, firms become safer in terms of the return distribution post-divorce of the minority shareholder. However, from the main shareholder's perspective, the most critical risk is firm failure. Adopting safer strategies should also lead to safer outcomes at the extensive margin, reducing the probability of default. In this subsection we test this hypothesis.

The default probability cannot be estimated using the not-yet-treated framework used thus far, as shareholders exist only in active firms. For this analysis, therefore, we use non-treated firms as the control group. Specifically, the control group consists of all Danish firms with at least one minority shareholder and which did not experience a minority shareholder's divorce between 2006 and 2017..[10] A firm is considered to have defaulted if it is recorded as bankrupt or undergoes either forced or voluntary liquidation during the observation period.[11] Firm default data are available through 2019.

The event study results show that the effects of a divorce emerge progressively over time. To assess changes in the default probability, we therefore need to observe firms for at least a few years after the divorce. This requires that a firm experiences a minority shareholder's

[10] For consistency, we censor the sample of non-treated firms at the same firm market value-to-wealth ratio thresholds used for treated firms, see section 3.4).

[11] Including voluntary liquidations in the default definition is debatable, as they do not necessarily represent a negative outcome. It turns out that they constitute a minority shares of all liquidations, and excluding them does not affect the results.

divorce sufficiently early in our time frame. This requirement generates a trade-off between the number of treated firms and the length of the observation period available for detecting defaults. We display different thresholds for the latest year in which a firm can experience the divorce of one of its minority shareholders in order to be included in the data. To ensure comparability between treated and controls, we only keep firms that were active in the year prior to the latest possible year of divorce, so as not to artificially inflate the survival rate of treated firms which, by construction, survive until the year of divorce. Then, we collapsed the data into one observation per firm, indicating whether the firm defaulted during the observation period, and run the following cross sectional OLS regression:

$$\text{Default}_j = \alpha + \beta \times \text{Divorce}_j + \theta_h \times \text{C}_j + \gamma_k \times \text{Z}_j + \epsilon_j \tag{8}$$

where Default$j$ is a dummy variable for a firm defaulting during the observation period, Divorce$j$ is a dummy variable for the divorce of a minority shareholder, and Cj is the vector of controls used in our identification strategy, namely the number of shareholders, the age of the majority shareholder, and the value-to-wealth ratio. Zj is a vector of firm characteristics, including firm sector, the year of establishment, and the number of employees. Controls are evaluated at the first year a firm appears in the dataset.[12] Standard errors are clustered at the firm level.

Table 6 presents the results of estimating equation (8) using 2009, 2013, and 2017 as the latest year of divorce thresholds. Odd-numbered columns report OLS estimates, while even-numbered columns present probit estimates, with marginal effects reported to ensure direct comparability between the two methods. First, OLS and probit estimates are virtually identical. Second, the effect of divorce on the probability of default is negative and significant across all three specifications. Third, its magnitude decreases when more recent years are chosen as the latest possible year of divorce. This is exactly what we expect, as it takes time to adjust firm strategy, meaning differences are smaller immediately after the divorce and grow larger over time. Specifically, when the latest year of divorce is set to 2009, we have a ten-year window for observing defaults, whereas with 2017 as the latest year, we have only two years. Finally, the magnitude is substantial: in the sample where 2009 is the latest year of divorce, we find a 4% drop in the probability of default, representing a reduction of nearly one-third in the overall default probability (14%)

[12] In our previous analysis, we evaluated controls in the year prior to the divorce because we only used firm that eventually experienced the divorce of a minority shareholder. Here, since we include non-treated firms in the control group—which lack a date of divorce—controls for all firms are evaluated in the first year a firm appears in the sample.

Table 6: Effect of a Minority Shareholder's Divorce on a Firm's Probability of Default

	Default					
	Latest Year of Divorce					
	2009	2009	2013	2013	2017	2017
	OLS	Probit	OLS	Probit	OLS	Probit
	(1)	(2)	(3)	(4)	(5)	(6)
Divorce	-0.042**	-0.040**	-0.018**	-0.018*	-0.009**	-0.010*
	(0.016)	(0.017)	(0.009)	(0.010)	(0.005)	(0.005)
N. Obs.	7,477	7,477	9,336	9,336	10,933	10,933

Note: The table reports the effect of a minority shareholder's divorce on the firm's probability of default. Years 2009, 2013, and 2017 represent the latest year in which a firm can experience the divorce of one of its minority shareholders in order to be included in the data. We only keep firms were active in the year prior to the latest possible year of divorce. Specifications (1), (3), and (5) are estimated using OLS, while specifications (2), (4), and (6) are estimated using a Probit estimator. The divorce coefficients shown in (2), (4), and (6) are average marginal effects. Controls common to all specifications include: the age of the majority shareholder, the number of shareholders, market value relative to the majority shareholder's wealth, firm sector, firm age, and the number of employees. These controls are measured in the first year that a firm appears in the dataset. Standard errors, shown in parentheses, are clustered at the firm level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

We have experimented with different definitions of liquidation. One concern is that the legal registration of firm default may occur long after a firm has actually ceased economic activities. To address this issue, we define firm default as a firm being observed with zero employees in a given year up to the end of the observation period. Additionally, we consider defining default as the disappearance of a firm from the Danish Central Business Register (CVR). With this definition, default data are available until 2021, with the caveat that some of these exits could result from mergers and acquisitions. In both cases, the default measure is highly correlated with our preferred one. Appendix Table D3 and D4 reports the results with these alternative definitions, confirming their robustness.

Taking stock, the evidence presented in this section can be summarized as follows. The divorce of a minority shareholder forces the majority shareholder to increase their wealth concentration in the firm. This induces them to adopt safer strategies, positioning the firm on a lower risk-return combination: the average ROE and its dispersion decrease, the lower percentiles of the ROE distribution increase and the upper ones decrease, and the firm's default probability decreases.

That is the increased concentration following the divorce of a minority shareholder induces the majority shareholder to choose a lower risk-lower return combination for firm's performance.

5 How does the entrepreneur move to a lower risk-return combination?

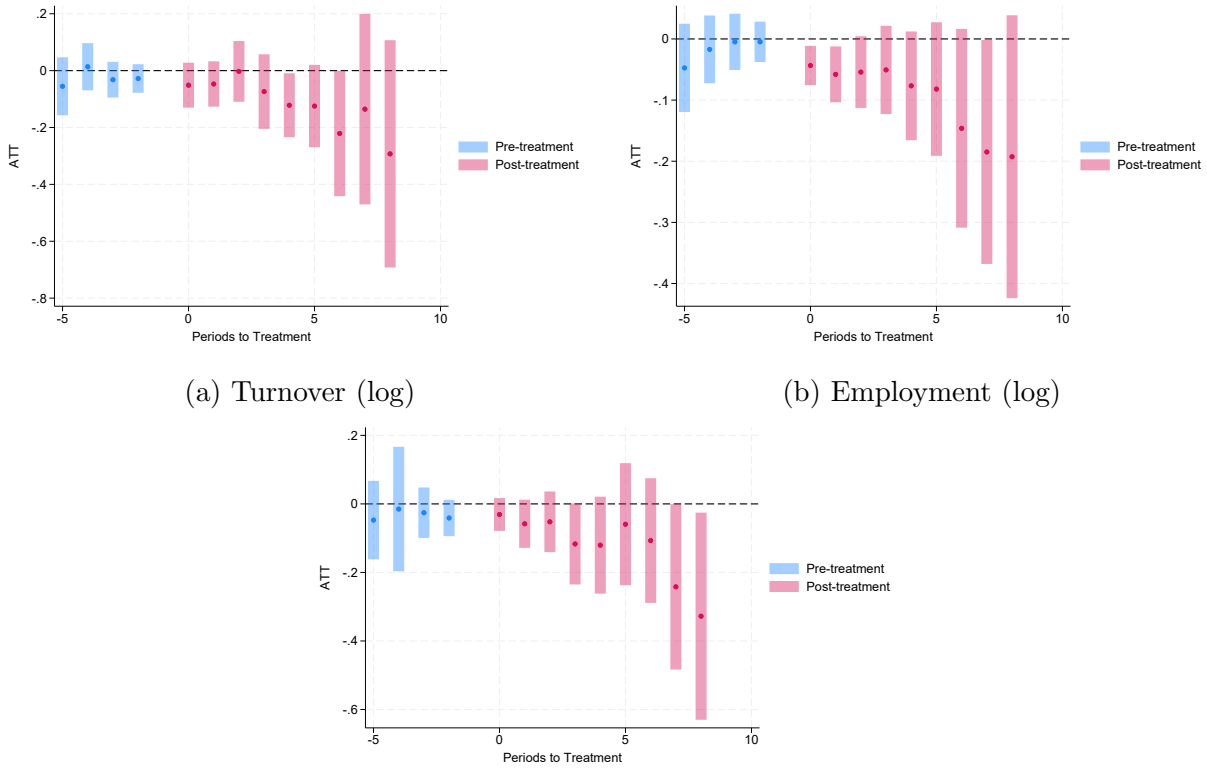
Our model in Appendix Section A assumes that entrepreneurs can freely choose any feasible risk-return combination. In practice, this requires changes in the firm's strategy, which we cannot directly observe. We conjecture that strategies that imply lower risk and lower returns are generally related to a reduction in the firm's growth prospects. Entrepreneurs will cut risky investment projects, which on average generate higher growth, but which also have a higher chance of failure. For example, exporting firms might downsize their plans to expand to new foreign markets or exit from the more difficult ones, and firms in technological sectors might cut their R&D expenditures. This implies that firms hit by the divorce of a minority shareholder should exhibit lower and less variable growth. This is what we test in this section.

We repeat the analysis carried out for ROE using turnover, employment, and assets as outcome variables. First, we replicate the event study of Figure 2 using the log of these three variables. We use the specification with the expanded set of controls (number of shareholders, age of the majority shareholder, market value relative to the majority shareholder's wealth, majority shareholder wealth concentration, profit shares and wealth, firm equity, leverage, and employment, all measured the year before the divorce). The results, reported in Figure 5, support the reduced growth hypothesis. First, no evidence of any pre-trend emerges: for all three variables, differences between treated and controls are never significant before the divorce. After that, firms are hit by the divorce of a minority shareholder record substantially lower level in all outcome variables, compared to not yet treated firms. The effects are large, particularly in the years further away from the divorce. However, the estimates become less precise due to a lower sample size, making point inference less reliable.[13] The strong effects that we measure are consistent with the fact that most of our firms are SMEs, for which growth choices might have a discontinuous component. This is particularly true for employment: for example, for a firm with 5 employees and only using full time contracts,

[13]If fact, in some cases the standard deviation in period 9 is so large to make the graphs less readable. We therefore only report estimates up to period 8.

the smallest feasible workforce reduction is 20%.

Figure 5: Event studies for Turnover, Employment, and Assets



(a) Turnover (log)

(b) Employment (log)

(c) Assets (log)

Note: The figure plots event study coefficients using the Callaway and Sant'Anna (2021) estimator. We control for the number of shareholders, age of the majority shareholder, market value relative to the majority shareholder's wealth, majority shareholder wealth concentration, profit shares and wealth, firm equity, leverage, and employment. All controls are evaluated the year prior to the divorce. Panel (a) plots the results for the effect on firm log(Turnover), Panel (b) for firm log(Employment), and Panel (c) for firm log(Assets). Standard errors are clustered at the firm level.

We compute and report the average treatment effects in Table 7. On average, firms hit by the divorce of a minority shareholder record lower turnover and asset of about 8%, and lower employment of almost 7%. The effects are significant and confirm a substantial change in firm growth after the divorce.

Next, we check if the lower growth goes together with a lower variability of the outcome variables, which, as before, we use as a proxy for risk. We compute the standard deviation of log turnover, employment, and asset for each firm pre- and post-divorce of the minority shareholder. We apply the same filters as we did for ROE. Specifically, only firms that are observed for at least three years both before and after the divorce. We residualize the

Table 7: Other Performance Measures: Average Treatment Effects

	[1] log(Turnover)	[2] log(Employment)	[3] log(Assets)
ATT	-0.082**	-0.070**	-0.087**
	(0.041)	(0.030)	(0.041)
N. Obs.	6,510	6,824	6,760

Note: The table reports the ATT, using the Callaway and Sant'Anna (2021) estimator, of the divorce of a minority shareholder on firm [1] log(Turnover), [2] log(Employment), [3] log(Assets), controls include the number of shareholders, age of the majority shareholder, market value relative to the majority shareholder's wealth, majority shareholder wealth concentration, profit shares and wealth, firm equity, leverage, and employment. All controls are evaluated the year prior to the divorce. Standard errors in parentheses are clustered at firm lvl.. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

outcome variables using year×sector fixed effects. Regressions are simple OLS.

Table 8, Panel A reports the results for turnover variability. Column 1 shows that the standard deviation decreases by 0.06 in the post-divorce period. Results are almost identical when we add the usual set of firm controls (Column 2) and firm fixed effects (Column 3). The estimates are always highly significant.

Panel B of Table 8 reports the results for employment and Panel C for Assets. For both variables, the standard deviation drops significantly in the post-divorce period for all specifications, although they are not statistically different from zero for assets. This supports the hypothesis that entrepreneurs opt for lower-risk, lower-return strategies that are less conducive to growth but help stabilize growth variability, thereby mitigating risk.

Entrepreneurs who choose to mitigate risk by scaling down their operations are likely to forego investment opportunities, thereby lowering their investment requirements. In line with this, we have demonstrated above that assets tend to decline following divorce. We now investigate whether a firm's financial structure changes following a divorce, analyzing the extent to which the reduction in assets is attributable to declines in debt and equity. Building on the seminal work of Myers (1977), a large theoretical and empirical literature shows that the financial structure is a major determinant of corporate risk. In particular, highly levered firms are more at risk of financial distress and display a high sensitivity of equity returns to changes in operating performance. Reducing debt therefore reduces

Table 8: Diff-in-Diff estimates: Standard Deviation of Turnover, Employment, and Assets

	[1]	[2]	[3]
	Panel A: log(Turnover)		
Divorce	-0.063***	-0.064***	-0.059**
	(0.019)	(0.019)	(0.018)
N. obs.	652	652	652
	Panel B: log(Employment)		
Divorce	-0.048***	-0.048***	-0.048***
	(0.012)	(0.012)	(0.012)
N. obs.	673	673	673
	Panel C: log(Assets)		
Divorce	-0.015	-0.016	-0.019
	(0.020)	(0.020)	(0.020)
N. obs.	669	669	669
Controls:			
Age Maj. Shareh.		Y	
# Shareholders		Y	
Year of the Divorce		Y	
Firm Val to Wealth		Y	
Firm f.e.			Y

Note: The table reports the OLS coefficient of the effect of divorce of a minority shareholder on the firm log(turnover) (Panel A), log(Employment) (Panel B), log(Assets) (Panel C), standard deviation. Column [1] reports the result for a pre-post specification without controls, in column [2] we add controls, including an indicator variable for the year of the divorce, the age of the majority shareholder, the number of shareholders, and the firm value-to-majority-wealth ratio, all evaluated in the year prior to the divorce. In column [3], we add firm fixed effects.All the outcome variables of interest are first regressed on year-time-sector fixed effects, and the residuals from these regressions are used to compute the standard deviations. Standard errors in parentheses are clustered at firm lvl. . * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

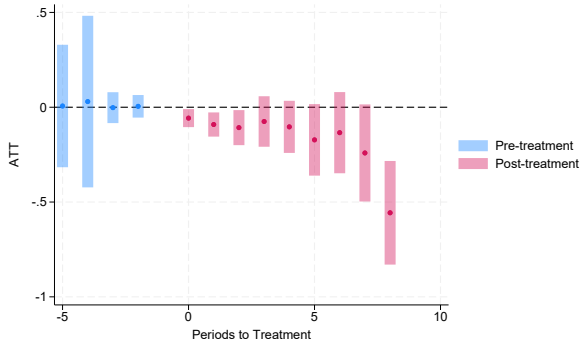
entrepreneurial risk.

Panel (a) of Figure 6 plots the event study for the log of debt. We find that debt decreases

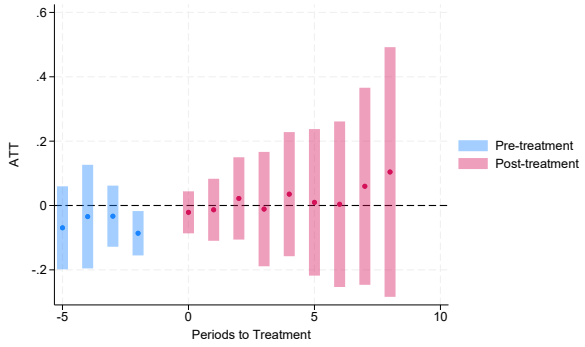
progressively after the divorce. The reduction reaches a maximum of almost 20 log points by the end of the period and experience a drop to 50 p.p. the last observation year. There is no evidence of any pre-trend: the debt trajectory diverges from that of controls only after the divorce.

Figure 6: Firm debt, equity and leverage

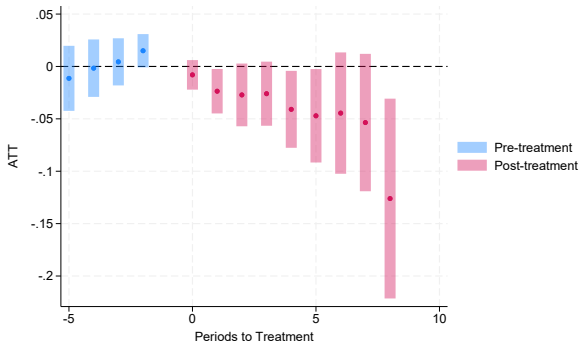
(a) Debt (log)



(b) Equity (log)



(c) Leverage



Note: The figure plots event study coefficients using the Callaway and Sant'Anna (2021) estimator. We control for the number of shareholders, age of the majority shareholder, market value relative to the majority shareholder's wealth, majority shareholder wealth concentration, profit shares and wealth, firm equity, leverage, and employment. All controls are evaluated the year prior to the divorce. Panel (a) plots the results for the effect on firm log(Debt), Panel (b) for firm log(Equity), and Panel (c) for firm leverage. Standard errors are clustered at the firm level.

Panel (b) of Figure 6 shows the evolution of equity. We find no evidence of any significant change in equity. This indicates that, after the minority shareholder's divorce, overall shareholders' financial involvement in the firm does not change: rather, as shown in Panel (b) of Figure 1, the main shareholder increases their equity participation. Given that debt decreases and equity remains stable, leverage, defined as debt over total assets goes down by approximately 5%, as shown in Panel (c) (by 10% in the last observation year). Results are confirmed by the estimates of the average treatment effect, reported in Table 9.

Table 9: Average treatment effect for debt, equity and leverage

	[1] log(Firm Debt)	[2] Leverage	[3] log(Equity)
ATT	-0.124***	-0.032 ***	0.0073
	(0.043)	(0.011)	(0.057)
N. obs.	6,725	6,722	6,780

Note: The table reports the ATT, using the Callaway and Sant'Anna (2021) estimator, of the divorce of a minority shareholder on firm [1] log(Debt), [2] leverage, [3] log(Equity), controls include number of shareholders, age of the majority shareholder, market value relative to the majority shareholder's wealth. All controls are evaluated the year prior to the divorce. Standard errors in parentheses are clustered at firm lvl.. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Overall, the evidence indicates that entrepreneurs reduce their risk exposure by decreasing the firm's growth prospects. This goes together with a reduction in debt and leverage, which contributes to mitigating the risk of financial distress and reduces the variability of equity returns.

6 How important is the lack of diversification for aggregate outcomes?

We now use the estimates obtained above to quantify the aggregate effects of the lack of diversification. To obtain the effect of a change in concentration on ROE we compute the ratio of the reduced form coefficient to the first stage coefficient, that is, the unit effect of the divorce on performance divided by the unit effect of the divorce on concentration. We then run the following counterfactual. We consider all firms that have more than one shareholder at any point in time and adjust the majority shareholder's stake to 51% in case it is higher than 51%. We change the majority shareholder's wealth concentration accordingly. Compared to those with a single shareholder, these firms already exhibit an open ownership and may be more responsive to policies that encourage broader shareholding. Additionally, this adjustment ensures that the majority shareholder retains control, thereby minimizing any fundamental change to the firm's governance structure. For these firms, we compute the counterfactual ROE as:

$$\text{ROE counterfactual}_{jt} = \text{ROE}_{jt} + \frac{\beta_{roe}}{\beta_{conc}} * (\text{Counterfactual Conc}_{ijt} - \text{Conc}_{ijt})$$

where β_{roe} is the estimated effect of divorce on ROE in Table 4 Column (1), β_{conc} is the estimated effect of divorce on the majority shareholder wealth concentration in Table 3 Column (3), Conc_{ijt} is actual concentration as defined in equation (5) and

$$\text{Counterfactual Conc}_{ijt} = \text{Conc}_{ijt} * \mathbb{1}(\text{Share}_{ijt} \leq 0.51) + \frac{0.51 * \text{Value}_{jt}}{\text{Total Wealth}_{it}} * \mathbb{1}(\text{Share}_{ijt} > 0.51).$$

We then calculate the average across firms actual and counterfactual ROE. We find that average ROE increases by 5 percentage points, from 21% to 26%. We repeat the same calculations for turnover and employment, finding that employment increases by 5.5 log points (from 2.11 to 2.17) and sales by 6 log points (from 15.72 to 15.78).

These average values weight all observations equally. To obtain the overall increase in ROE, employment and sales, we also compute weighted means, where ROE is weighted by firm equity in total equity, and employment (sales) by firm employment (sales) in total employment (sales). This amounts to computing the change in the overall ROE, employment and sales. In this case, ROE increases by 8.4 percentage points, employment by 8.5 log points and sales by 10 log points. If we only consider firms in which the majority shareholder is above 51%, that is, those "treated" by the experiment, the increase in average ROE is 15%. The effect is also larger if we include firms with only one shareholder. Overall, we conclude that the effects of reducing the majority shareholder's concentration are substantial.

Of course, this exercise must be interpreted with care, as it does not consider the potential general equilibrium effects of the aggregate change in the ownership structure. For example, stronger firm growth affects the allocation of capital between firms with different productivity and affects firm entry and exit. These effects can only be accounted for with a fully specified structural model. If anything, stronger firm growth is expected to translate into greater competition, which reinforces selection effects and amplifies the partial equilibrium effects we compute.

7 Conclusions

Our study provides causal evidence on the impact of entrepreneurs' wealth concentration on firm outcomes. Using the divorce of a minority shareholder as an exogenous shock, we show that an increase in the majority shareholder's exposure leads to a shift toward lower risk-return strategies. Average return on equity and its variability decline markedly, the lower tail of the return on equity distribution loses probability mass and default probability decreases.

These findings suggest that when more exposed to firm idiosyncratic risk entrepreneurs react adopting more conservative business strategies, prioritizing stability over growth. Consistently with this, firms whose controlling shareholder becomes more concentrated experience slower and less volatile growth in sales, employment, and assets, and a significant reduction in leverage.

Our results highlight the social inefficiencies of entrepreneurial under-diversification, as risk-averse behavior discourages high-growth, high-risk investments. In fact, the lower risk-return profile choice of more exposed entrepreneurs is socially inefficient as the idiosyncratic business risk that triggers it could be potentially diversified. Our findings imply that policies aimed at mitigating the negative effects of entrepreneurial under-diversification could enhance firm performance and economic growth. One approach is to expand access to financial instruments that allow entrepreneurs to mitigate their exposure to firm-specific risk, such as private equity secondary markets or insurance products tailored to business owners. Policymakers could also consider fostering venture capital and private equity markets, which provide alternative funding sources and reduce reliance on personal wealth. Finally, improving financial literacy programs for business owners may help them better manage risk while making growth-oriented investment decisions.

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Appendixes

A A simple model

An entrepreneur has a stock of personal wealth w . He can access a private business which yields a random return per dollar invested $\widetilde{R}_p \sim (R_p, \sigma_p^2)$ where $R_p = R_{min} + \delta(\sigma_p - \sigma_{p,min})$, defines the risk-return combinations that the entrepreneur can choose from. R_p is the sum of the return when investing in the least risky alternative R_{min} and a premium increasing in the risk profile of the firm, where $\sigma_p \in [\sigma_{p,min}, \sigma_{p,max}]$ and $\delta = (R_p - R_{min})/(\sigma_p - \sigma_{p,min})$ is the private firm Sharpe ratio. The entrepreneur can choose to invest in the risky business provided he/she has enough assets to finance it. This requires a minimum stock of wealth w_p. Hence only those with wealth $w > w_p$ can invest in a private business. Assume $w > w_p$. The entrepreneur (like all other investors) can invest in a risk-free asset with return R_f and in a diversified stock index with return $\widetilde{R}_s \sim (R_s, \sigma_s^2)$. We assume $R_p \gg R_s \gg R_f$ and $\sigma_p^2 \gg \sigma_s^2$, that is the expected return on the private business exceeds that on the stock index for all values of the risk-return combinations and the variance of the private business exceeds that of the index even if the entrepreneur chooses the most conservative strategy. This is consistent with the idea that the stocks market index provides diversification benefits and non-diversified risk in a private business carries a premium (see Kartashova (2014), and Fagereng, Guiso and Pistaferri (2020)). .

If the entrepreneur invests in the private business w_p he can invest the "domestic" wealth $w - w_p$ in a portfolio that combines the stock index and the safe asset. The value of final wealth is then:

$$\widetilde{w} = w_p \widetilde{R}_p + (w - w_p)(\alpha \widetilde{R}_s + (1 - \alpha) R_f) \tag{A.1}$$

where α is the share of domestic wealth invested in the stock index. Assuming utility is mean-variance in final wealth, the investors solves:

$$\max_{\{\sigma_p, \alpha\}} E\widetilde{w} - \frac{\theta}{2} Var(\widetilde{w}) \tag{A.2}$$

where θ is an absolute risk aversion parameter. Noticing that

$$E\widetilde{w} = w_p(R_{min} + \delta(\sigma_p - \sigma_{p,min})) + (w - w_p)(\alpha R_s + (1 - \alpha) R_f) \tag{A.3}$$

and

$$Var(\widetilde{w}) = w_p^2 \sigma_p^2 + (w - w_p)^2 \alpha^2 \sigma_s^2 + 2\rho\alpha w_p (w - w_p)\sigma_p \sigma_s \tag{A.4}$$

where ρ is the correlation between the private business and the stock market index, the first order conditions for the entrepreneur problem are:

FOC1: $\delta w_p - \theta[w_p^2\sigma_p + \rho\alpha w_p(w - w_p)\sigma_s] = 0$

FOC2: $(w - w_p)(R_s - R_f) - \theta\alpha(w - w_p)^2\sigma_s^2 - \theta\rho w_p(w - w_p)\sigma_p\sigma_s = 0$

From which

$\sigma_p = \frac{\delta}{\theta w_p} - \frac{[\rho\alpha(w - w_p)\sigma_s]}{w_p}$

$\alpha = \frac{(R_s - R_f)}{\theta(w - w_p)\sigma_s^2} - \frac{\rho w_p\sigma_p}{(w - w_p)\sigma_s}$

Let $k = w_p/w$ denote the concentration of family wealth in the firm. Consider first the case of no correlation between the retrun on the private business and the stock market., i.e. when $\rho = 0$. The optimal solution for σ_p and α is:

$\sigma_p^* = \frac{\delta}{\theta w k}$

$\alpha^* = \frac{(R_s - R_f)}{\theta w(1-k)\sigma_s^2}$

An increase in concentration, all else equal, lowers the risk and the return in the firm and increases the share in the diversified stock index. Holding concentration constant, an increase in relative risk aversion, θw , induces a more conservative risk-return profile and lowers the share in the diversified index.

An increase in public diversification opportunities - which we can proxy by a lower σ_s^2 - increases the share in the index but leaves the risk-return profile in the firm unchanged. Suppose now that the private returns is correlated with the stock market, so that $0 < \rho \leq 1$. In this case the choice of the risk profile and the domestic portfolio allocation are interdependent: a higher share in index stocks in the family portfolio induces a more prudent risk-return profile in the firm; vice versa: a riskier profile in the private firm lowers exposure to the stock market in the domestic portfolio as the (re-written) FOCs below show:

$\sigma_p = \frac{\delta}{\theta w k} - \frac{[\rho(1-k)\sigma_s]}{k}\alpha$

$\alpha = \frac{(R_s - R_f)}{\theta w(1-k)\sigma_s^2} - \frac{\rho k}{(1-k)\sigma_s}\sigma_p$

Solving for σ_p and α yields the optimal values:

$\sigma_p^* = \frac{\delta}{\theta w k(1-\rho^2)} - \frac{\rho}{1-\rho^2}\frac{R_s - R_f}{\theta w k\sigma_s} = \frac{1}{\theta w k(1-\rho^2)}(\delta - \rho\frac{R_s - R_f}{\sigma_s})$

$\alpha^* = \frac{1}{\theta w(1-k)(1-\rho^2)\sigma_s}[\frac{(R_s - R_f)}{\sigma_s} - \rho\delta]$

Consider first the risk strategy choice in the firm. If the optimal risk exposure falls short of the minimum attainable level, i.e., $\sigma_p^* < \sigma_{p,min}$ the individual will not invest in the private firm. For investing w_p in the firm it is necessary that $\delta \geq u_m = \rho\frac{R_s-R_f}{\sigma_s} + \theta wk(1-\rho^2)\sigma_{p,min}$, which requires a sufficiently high Sharpe ratio in the private business, δ, compared to the market, the more so the higher the correlation between private business and market returns. When $\rho = 1$,the risk adjusted return in the private business must exceed that in the diversified index for the individual to invest in the firm.

Consider next the optimal share in the diversified stock market index. For $\alpha^* > 0$ it is required that $\delta < u_M = \frac{1}{\rho}\frac{(R_s-R_f)}{\sigma_s}$. If $\delta \geq u_M$ the individual will only invest in the private stock of the company and temper the risk exposure to the private business investing w-w_p in the risk-free asset.

The table below summarizes the optimal solution corresponding to different values of δ.

	σ_p^*		α^*	
$\delta < u_m$	no private investment		$\frac{(R_s-R_f)}{\theta w\sigma_s^2}$	
$\delta = u_m$	$\sigma_{p,min}$		$\frac{1}{\theta w(1-k)(1-\rho^2)\sigma_s}[\frac{(R_s-R_f)}{\sigma_s} - \rho u_m]$	
$u_m < \delta < u_M$	$\frac{1}{\theta wk(1-\rho^2)}(\delta - \rho\frac{R_s-R_f}{\sigma_s})$		$\frac{1}{\theta w(1-k)(1-\rho^2)\sigma_s}[\frac{(R_s-R_f)}{\sigma_s} - \rho\delta]$	
$\delta \geq u_M$	$\frac{1}{\theta wk(1-\rho^2)}(\delta - \rho\frac{R_s-R_f}{\sigma_s})$		0	

We focus on the case relevant to us assuming $\delta > u_m$ so that it is optimal for the individual to invest w_p in the firm and choose the corresponding risk return combination (R_p^*,σ_p^*).

It can be easily checked that an increase in concentration k lowers the risk exposure in the private business and increases the share of the domestic wealth $w - w_p$, invested in the stock market except when $\delta \geq u_M$. In this case all the domestic wealth is invested in the risk free asset.

Thus, faced with higher exposure to non-diversifiable risk, the entrepreneur chooses a safer strategy for the firm. Furthermore, if the private firm Sharpe ratio is larger than the market (i.e. $\delta > \frac{R_s-R_f}{\sigma_s}$) the effect of an increase in concentration on the firm risk profile is stronger in firms that correlate more strongly with the market (high ρ compared with firms with low correlation). The opposite if $\delta < \frac{R_s-R_f}{\sigma_s}$. These predictions can be tested.

In addition, in this mean-variance set up, in response to an increase in concentration the entrepreneurs raises the exposure to the (well diversified) market portfolio. And the size of the response varies across firms depending on the correlation with the market. If $\delta < \frac{R_s-R_f}{\sigma_s}$ response is stronger for weakly correlated companies, the opposite if $\delta < \frac{R_s-R_f}{\sigma_s}$.

Second, better market diversification, again proxied by a lower index volatility σ_s^2, increases the optimal domestic share in the index *and* also the risk-return profile in the private company, particularly for private businesses that covary more strongly with the market (higher ρ). This is because more diversification at home allows to take more risk in the company is return in the private business and in the market are correlated.

In sum, for our exercise, we can compute the correlation of the company returns with a stock market index in Denmark and split the sample between high and low correlation. We should find a stronger response of private return and risk to an increase in concentration in the firm in firms whose return covary more strongly with the market assuming the risk adjusted return in the private company exceeds that in the market - **an assumption that is backed by our empirical estimates** (**Check**).

When we look at the private portfolio response to an increase in concentration in the firm, we should find a positive effect. Its size is stronger when correlation is relatively low and weaker if private business returns and stock market returns are strongly correlated.

B Instrument Formally

Formally: Call Divorce_{jt} a dummy variable that is 1 if the event death of minority shareholder happened in year prior time t. That is call τ the year of divorce of a minority shareholder, then $\text{Divorce}_{jt} = 1$ if $t > \tau$ and 0 otherwise. Clearly, for a firm for which no minority shareholder divorced than $\text{Divorce}_{jt} = 0$ for every period. Call, numbershare_j the number of shareholder observed during the year prior the divorce, and age_j the majority shareholder age the year prior the divorce.

Call y_{jt} a firm outcome variable that is alternatively ROE_{jt} or $sdROE_{j\tau}$. Given the following relationships:

$$y_{jt} = \alpha + \beta_y \times \text{Conc}_{ijt} + \gamma_1 \times \text{numbershare}_j + \gamma_2 \times \text{age}_j + \epsilon_{3jt} \tag{B.1}$$

$$\text{Conc}_{ijt} = \alpha + \beta_3 \times \text{Divorce}_{jt} + \gamma_1 \times \text{numbershare}_j + \gamma_2 \times \text{age}_j + \epsilon_{4it} \tag{B.2}$$

We assume that:

First Stage : the divorce of a minority shareholder given the number of shareholders and

the highest age of the minority shareholder increases the share of household i's wealth due to the ownership of firm j:

$$E[\text{Divorce}_{jt} \times \text{Conc}_{ijt} | \text{numbershare}_j, \text{age}_j] \neq 0 \tag{B.3}$$

Exclusion Restriction:

1) We assume that there is no direct effect of the divorce of a minority shareholder on the firm outcome variables of interest:

$$E[\text{Divorce}_{jt} \times \epsilon_{3it} | \text{numbershare}_j, \text{age}_j] = 0 \tag{B.4}$$

2) And that given the number of minority shareholders and the highest age observed among minority shareholders, the divorce of a minority shareholder is as good as random.

$$E[\text{Divorce}_{jt} \times \epsilon_{4it} | \text{numbershare}_j, \text{age}_j] = 0 \tag{B.5}$$

For what concern B.3 it is a testable assumption that we test in the data, having in mind the mechanism described in the paragraph The mechanism.

For what concern B.4, namely that the divorce of minority shareholder does not have a direct effect on the firm outcome variables of interested we think is supported in our empirical setting by :

1. As we are concerned in minority shareholder they do not directly influence firm decision making.
2. The divorce of a minority shareholder can not have any disruptive impact in firm management.

For what concern B.5, we claim that conditional on the majority shareholder age and the number of shareholders the first year prior the divorce, the probability that the firm experience the divorce of a minority shareholder is as good as random. This is equivalent to assume that the probability that a firm experience the divorce of a minority shareholder depends structurally on: a function of the minority shareholders age- proxy by the age of the minority shareholder- and the number of shareholder, and on a random term. Controlling for number and age of shareholders, we exploit the random variation that cause divorce among firm minority shareholders. Formally:

$$\text{Divorce}_{jt} = \alpha_3 + \theta_1 \times \text{numbershare}_j + \theta_2 \times \text{age}_j + \epsilon_{5jt} \tag{B.6}$$

So controlling for numbershare$_j$ and age$_j$ in B.1 is equivalent to exploit the random component ϵ_{5jt} for the probability of divorce of a minority shareholder in a firm in B.6.

C Valuation using multiples

The valuation of unlisted firms using market multiples requires the definition of an appropriate set of comparable public companies for which a market price is available, and the aggregation of the firm-level multiples in the comparable set. We define comparability based on the sector of activity, and choose as aggregation rule the average multiple of listed companies in the sector. The market multiple we choose is the price-to-book value multiple (P/B) defined as:

$$PB_{s,t} = \frac{\sum_{i \in s} P_{i,t}}{\sum_{i \in s} SE_{i,t}} \tag{C.1}$$

where $PB_{s,t}$ is the multiple for sector s in period t, $P_{i,t}$ is the market capitalization of firm i belonging to sector s in period t, and $SE_{i,t}$ is the shareholders' equity of firm i belonging to sector s in period t. This procedure is equivalent to taking a weighted average within sectors of the firm-level PB ratios using the shareholders' equity as a weight. After the PB multiples are computed for each sector, the value of a private company in sector s and period t is obtained as:

$$Value_{i,s,t} = PB_{s,t} SE_{i,s,t} \tag{C.2}$$

To estimate the multiples in Equation C.1, we use DataStream information for listed companies in Denmark, excluding firms whose end of fiscal year is not in December, and those with negative equity. The market prices are taken at the day in which the financial information is made available in DataStream. The data are trimmed yearly at the 95th percentile of the ratios distribution. DataStream classifies companies using the 4-digit U.S. Standard Industrial Classification (SIC) code system. The private companies in Danish archives are classified using the EU Nomenclature of Economic Activities (NACE) Rev. 2 system. We, therefore, map the two systems into a common 27-sector classification (Figure C1) to which we assign average price-to-earnings ratios as computed by Aswath Damodaran in 2019 for a sample of European firms[14]. Then, we restrict the number of industries to 10 by aggregating

[14]File downloaded in December 2020 from

sectors with similar PE value, ending up with the classification shown in Figure C1. These 10 sectors are then used to compute PB ratios as in Equation C.1 and the value of private companies as in Equation C.2.

Figure C1: Classification of sectors of activity

Industry (27-sector classification)	Industry (10-sector class.)	PE Ratio (Europe)
Wholesale Trade	1	9.06
Real Estate		11.24
Agriculture, Forestry and Fishing		12.03
Petroleum Refining and Related Industries		12.12
Mining		12.37
Construction		12.58
Metal Industries		12.68
Finance and Insurance	2	12.91
Lumber and Wood Products, Except Furniture	3	13.03
Stone, Clay, Glass, and Concrete Products		14.18
Trade and Repair of Motor Vehicles		14.54
Hotels and Restaurant		14.94
Educational Services		17.39
Transportation, Communications	4	17.67
Paper, Printing and Publishing	5	17.74
Chemicals and Plastic Products	6	18.56
Electric, Gas and Sanitary Services	7	21.6
Transportation Equipment		22.2
Machinery, Electronic and Computer Equipment, Mesr/Anlyz/Cntrl Instrmnts and Repair Services		22.46
Private Household and Other Services	8	23.68
Health Services and Social Services		24.21
Food, Beverages and Tobacco		25.87
Retail Trade		25.91
Furniture and Fixtures and Miscellaneous Manufacturing Industries	9	30.29
Textile and Leather Products		32.48
Business Services	10	35.07

Note: The table shows the mapping from a 27-sector classification to a 10-sector one based on Aswath Damodaran's company ranking.

https : *//pages.stern.nyu.edu/ adamodar/New*$_{H}$*ome*$_{P}$*age/datacurrent.html*, at the section "Multiples", "PE Ratios, PEG Ratios and Expected Growth Rates by Industry Sector" – "Europe", file 1/20.

D Additional tables and figures

Table D1: Descriptive Statistics: Firms with more than one shareholder, 2006-2017

	Emp.	Age	Equi.	Ass.	Net Profit	Turnover
10p	2	1	27,226	106,341	-33,611	145,610
25p	3.5	3	75,022	257,340	4,143	403,216
50p	8.5	8	221,414	665,704	38,517	1,026,429
75p	19.5	16.5	590,481	1,721,068	133,120	2,626,112
90p	40	26.5	1,624,441	4,391,691	356,383	6,261,127
Mean	19	11	1,587,537	3,056,379	218,466	2,640,949

Values are in Dollars. They were originally computed in 2015 Danish Crown. Average 2015 Dollar to DKK exchange rate: 1 dollar for 6.74 Danish Krone. Emp. reads employees, Age reads firm age, Equi. reads equity, Ass. reads Assets, # Shareholders reads number of shareholders. All percentiles are computed as averages around the percentile, in compliance with Statistics Denmark's confidentiality regulations.

Table D2: Descriptive Statistics: Majority Shareholder Characteristics

	Conc.	Net Conc.	Shares
10p	0.02	0.03	0.25
25p	0.08	0.1	0.33
50p	0.22	0.33	0.5
75p	0.49	0.66	0.68
90p	0.79	0.92	1
Mean	.31	.38	.59

Value are in 2015 Danish Crown . Average 2015 Dollar to DKK exchange rate: 1 dollar for 6.74 Danish Krone. Conc. reads wealth concentration, Conc. reads wealth concentration net of mortgages, Shares reads Profit Shares, Mkt. V. to Wealth reads Firm Market value to majority shareholder wealth ratio . All percentiles are computed as averages around the percentile, in compliance with Statistics Denmark's confidentiality regulations.

Table D3: Effect of a Minority Shareholder's Divorce on a Firm's Probability of Default: Default as Disappearence from Danish Business register

	Default					
	Latest Year of Divorce					
	2009	2009	2013	2013	2017	2017
	OLS	Probit	OLS	Probit	OLS	Probit
	(1)	(2)	(3)	(4)	(5)	(6)
Divorce	-0.0643***	-0.0594**	-0.0227**	-0.0217**	-0.00990	-0.0101
	(0.0179)	(0.0189)	(0.0104)	(0.0108)	(0.00636)	(0.00678)
N	6096	6096	8452	8452	10889	10889

Note: The table reports the effect of a minority shareholder's divorce on the firm's probability of default. Years 2009, 2013, and 2017 represent the latest year in which a firm can experience the divorce of one of its minority shareholders in order to be included in the data. We only keep firms were active in the year prior to the latest possible year of divorce. Specifications (1), (3), and (5) are estimated using OLS, while specifications (2), (4), and (6) are estimated using a Probit estimator. The divorce coefficients shown in (2), (4), and (6) are average marginal effects. Controls common to all specifications include: the age of the majority shareholder, the number of shareholders, market value relative to the majority shareholder's wealth, firm sector, firm age, and the number of employees. These controls are measured in the first year that a firm appears in the dataset. Standard errors, shown in parentheses, are clustered at the firm level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

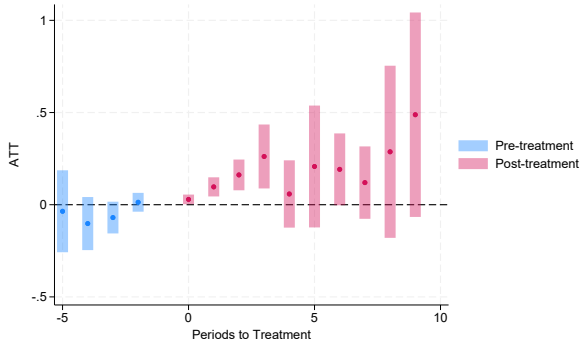
Table D4: Effect of a Minority Shareholder's Divorce on a Firm's Probability of Default: 0 Employees

	Default			
	Latest Year of Divorce			
	2009	2009	2013	2013
	OLS	Probit	OLS	Probit
	(1)	(2)	(3)	(4)
Divorce	-0.0653***	-0.0637***	-0.0478***	-0.0464***
	(0.0219)	(0.0219)	(0.0140)	(0.0143)
N	6096	6096	8452	8452

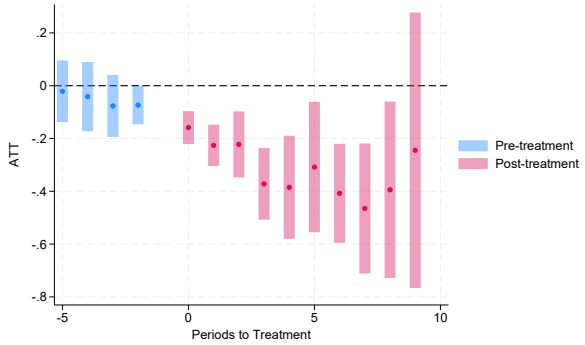
Note: The table reports the effect of a minority shareholder's divorce on the firm's probability of default. Years 2009, 2013, and 2017 represent the latest year in which a firm can experience the divorce of one of its minority shareholders in order to be included in the data. We only keep firms were active in the year prior to the latest possible year of divorce. Specifications (1), (3), and (5) are estimated using OLS, while specifications (2), (4), and (6) are estimated using a .Probit estimator. The divorce coefficients shown in (2), (4), and (6) are average marginal effects. Controls common to all specifications include: the age of the majority shareholder, the number of shareholders, market value relative to the majority shareholder's wealth, firm sector, firm age, and the number of employees. These controls are measured in the first year that a firm appears in the dataset. Standard errors, shown in parentheses, are clustered at the firm level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Figure D1: Effect of Divorce on majority shareholder equity shares and wealth concentration for firm with VTW ratio higher 90th/10th percentile

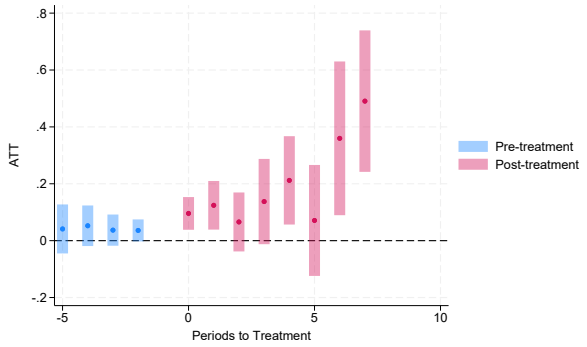
(a) Higher 90th Percentile: Equity Shares



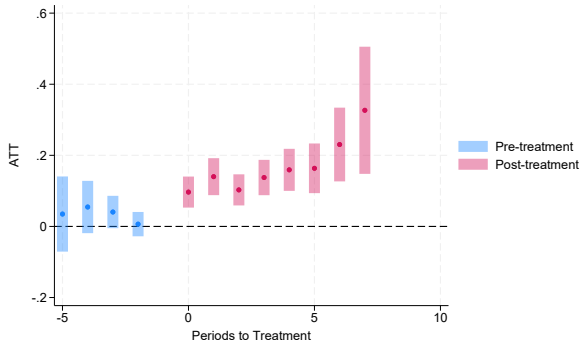
(b) Higher 90th Percentile: Wealth Shares



(c) Lower 10th Percentile: Equity Shares



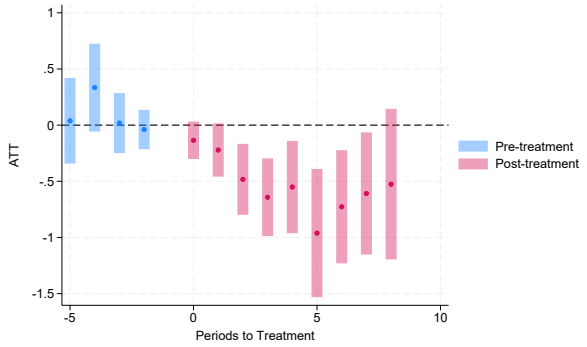
(d) Lower 10th Percentile: Wealth Shares



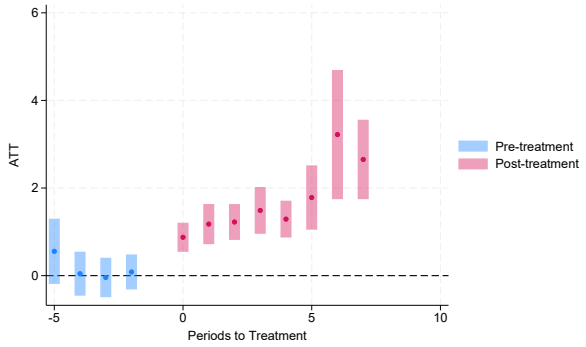
Note: The figure plots event study coefficients using the Callaway and Sant'Anna (2021) estimator. We control for the number of shareholders, age of the majority shareholder, market value relative to the majority shareholder's wealth. All controls are evaluated the year prior to the divorce. Panel (a) plots the results for the effect on the firm's majority shareholder equity shares, while Panel (b) shows the effect on her wealth concentration. Panels (a) and (b) display the results for firms where the VTW is above the 90th percentile. Panel (c) plots the results for the effect on the firm's majority shareholder equity shares, while Panel (d) shows the effect on her wealth concentration. Panels (c) and (d) display the results for firms where the VTW is below the 10th percentile.

Figure D2: Effect of Divorce on Firm Equity for firms with VTW ratio lower/higher 10th/90th percentile

(a) Higher 90th Percentile: Firm Equity

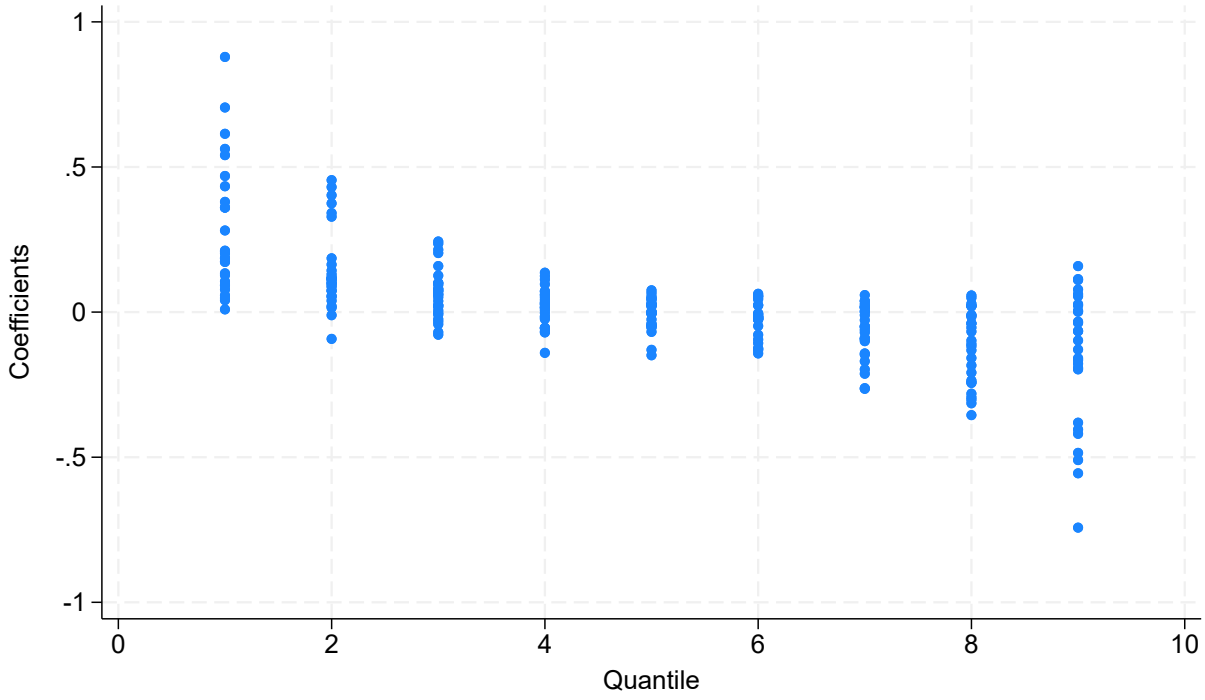


(b) Lower 10th Percentile: Firm Equity



Note: The figure plots event study coefficients using the Callaway and Sant'Anna (2021) estimator. We control for the number of shareholders, age of the majority shareholder, market value relative to the majority shareholder's wealth. All controls are evaluated the year prior to the divorce. Panels (a) and (b) plot the results for the effect on the firm's equity. Panel (a) displays the results for firms where the VTW is above the 90th percentile, while Panel (b) shows the results for firms where the VTW is below the 10th percentile.

Figure D3: Quantile regressions for ROE: QTT Callaway et al.



Note: The figure plots all the event study coefficients by quantiles (from 1^{st} decile to the tenth), using the Callaway and Li (2019) quantile regression estimator, of all the possible triplets of two non treated period and one pontentially treated period available across the 2006-2017 time window. Controls include the number of shareholders, age of the majority shareholder, market value relative to the majority shareholder's wealth.