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The next steps after BEPS: Analysing the effects of interest deduction limitation rules on capital misallocation

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Abstract: This paper explores the impact of the Swedish implementation of tighter limits to interest deductibility in 2019, following the recommendations of the OECD's Base Erosion and Profit Shifting (BEPS), on financially constrained firms and sectors. Utilising a panel dataset from 2014 to 2021, we analyse the effects at both the sector and firm level, employing the Rajan Zingales index to study sector-level financial constraints and various measurements such as the marginal revenue product of capital for firm-level constraints. We also consider the effect on capital misallocation. Our findings indicate that the implementation of the reform resulted in higher tax payments by about SEK 80 thousand, reduced debt levels by an average of SEK 20 million, and lower productivity, as measured by TFPR, which reflects the increase in revenue per unit, by 0.028 for financially constrained firms, in contrast to their less constrained counterparts. Notably, no significant effects were discerned at the sector level. Our findings show that the reform did not affect capital misallocation in financially constrained sectors. This study contributes to the misallocation literature by highlighting the implications of interest deduction rules on investment, financing structures, and productivity.

Keywords: BEPS, Financial Constraints, Misallocation, Productivity, Investment, Tax Policy, Thin Capitalisation Rules

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1 Introduction

A growing field of economic research concerns how the misallocation of resources between and within countries can affect aggregate economic outcomes, such as investments and productivity (Buera et al., 2011; Hall & Jones, 1999; Hsieh & Klenow, 2008). Capital misallocation, the allocation of capital to firms with lower rather than higher returns to capital, and financial constraints significantly influence firm productivity, and by extension, economic growth.

In this paper, we study the effects of a tax reform on firm behaviour and capital misallocation in Sweden. More specifically, we study a reform that increased debt capital costs for firms with high levels of debt, and we explore how that affected financially constrained firms and sectors. We examine the effects on firms' financing decisions, investments, and productivity as well as the reform's effect on capital misallocation. We hypothesise that financially constrained firms and sectors would have been affected the most. Firms' access to capital may not only be dictated by their returns to capital, but by other firm characteristics such as age, size, tangibility, or by firm level policy distortions. As a result, firms may face financial constraints and have high returns to capital. Simultaneously, other firms may have too much capital in relation to their other production inputs. This unbalance results in an inefficient distribution of capital, a misallocation of capital.

In recent years, the global landscape of fiscal taxation policy has undergone significant changes following initiatives aimed at curbing tax avoidance and ensuring fair taxation. One such initiative is the Base Erosion and Profit Shifting (BEPS) project led by the OECD. A part of the BEPS recommendation, Action 4, addresses interest deductions and their impact on tax revenues and economic efficiency. In 2019, the BEPS recommendation on interest deductions was implemented in Sweden, and set new limits on the levels of interest deductions for all firms. In Sweden, taxation rules have historically been favourable for debt financing, allowing firms to lower their tax base by deducting their interest expenses. The reform aimed to reduce tax avoidance but also to increase the neutrality between equity and debt financing.

The interest deductibility of debt generates a tax shield that increases the company value. By limiting the levels of permitted interest deductions, the reform brought about higher tax payments for highly leveraged firms, making debt capital costlier. Therefore, highly leveraged firms with a high dependence on debt capital would have been mostly affected. Several studies have shown how financial constraints affect firms' financial development and productivity (Fazzari et al., 1988; Hadlock & Pierce, 2010; Kaplan & Zingales, 1997; Lamont et al., 2001; O. Levine & Warusawitharana, 2021; Rajan & Zingales, 1998; Whited & Wu, 2006). Additionally, research has shown that financial constraints can hinder companies from making productive investments and adopting new technologies (Hsu et al., 2014; Moreno-Badia & Slootmaekers, 2009). Generally, financial frictions distort the allocation of capital, limiting some firms' access to capital. Previous research has shown that financial constraints may be worsened by policy, leading to increased capital misallocation (Buera et al., 2011; Restuccia & Rogerson, 2008).

We study how the Swedish implementation of BEPS on interest deductions affected Swedish firms with financial constraints. More specifically, we ask how limits to interest deductions affected the financing decisions of firms in the short term and their productivity and investments in the short-to-medium term, by the degree of financial constraint. The new rules meant that, for example, an interest expense of SEK 5 million, that prior to the reform could be deducted now brought about an additional tax burden of over SEK 2 million (Melz et al., 2018).

We anticipate that firms with high debt levels and reliance on external capital would face tighter financial constraints post-reform and be forced to adjust their financing decisions, leading to lower investments and productivity. As firms adjust their financial structure by, for example, lowering their liabilities, the direct effect of the reform should be visible in firms' net interest expenses and tax payments. Our rationale is that the reform mainly affected firms with high levels of debt, who were not able to exchange their debt with other capital. As a result, these firms, now facing even tighter financial constraints, would be forced to scale back operations or investments, which should increase their marginal product of capital. At an aggregate level, this should increase capital misallocation. Therefore, it is an appropriate policy to use to study the prevalence of financial constraints, and if the reform led to a reallocation of resources. There are certainly other effects at play too, suggesting different outcomes than we anticipate. For example, the reform did not necessarily only affect productive firms with high levels of debt, but also targeted firms who financed unproductive investments with debt. Thereby, the reform potentially deterred companies from making low yielding debt-financed investments. Such effects could potentially have contributed to reducing capital misallocation. However, we focus on the effects on our outcome variables and capital misallocation through the channel of financial constraints.

We use a panel data set from the Swedish House of Finance's Serrano database comprised of comprehensive financial history of Swedish companies. Our study adopts a dynamic panel analysis and we employ a difference-in-differences approach as our empirical strategy on both firm and sector levels. We use the Rajan Zingales index (hereinafter RZ-index) by Rajan and Zingales (1998) to identify financially constrained sectors. In our firm analysis, we study the differential effects by firms' MRPK following similar work by Bau and Matray (2023).

Our results show that the financially constrained, in average, lowered their debt levels by approximately SEK 20 million (in comparison the treatment group average in the whole period was around SEK 60 million), increased their tax payments by about SEK 80 thousand (in comparison the treatment group average in the whole period was around SEK 1 255 thousand), and saw productivity losses by a magnitude of 0.028 after the reform. However, we cannot conclude that the decrease in firm productivity is an effect of capital misallocation since we find no results that capital misallocation in financially constrained sectors increased nor do we find any indication that it increased in the economy at large. This suggests that the productivity decrease is not driven by changes in capital allocation between firms or sectors. We find no robust results

showing that investments were affected.

There has been some research on the effects of rules that limit interest deductions, in the literature called Thin Capitalisation Rules (TCRs). Our study resembles a number of studies in Germany. Buslei and Simmler (2012) found that firms facing TCRs significantly adjusted their financial strategies, by reducing debt ratios or restructuring assets, to stay below the set interest expense threshold, effectively broadening the tax base without harming short-term investment. Buettner et al. (2012) and Wamser (2013) found similar results when studying TCRs that specifically targeted multinational corporations and intra-group loans. Firms started to depend less on internal loans and more on borrowing from outside lenders, showing the efficiency of TCRs. Overall, several studies show that TCRs have direct effect on firm outcomes such as tax payments and debt levels. However, the literature is inconclusive in regard to the effects of TCRs. Research from the IMF, by de Mooij and Liu (2021), shows that while TCRs help reduce tax avoidance, they might also make companies less likely to invest. We expand on this literature by studying the impact on productivity and capital misallocation.

Misallocation of capital, resulting from inefficiencies in capital markets, plays a crucial role in the disparities in productivity observed among different countries (Hsieh & Klenow, 2008). Pre-dating the broader model by Hsieh and Klenow (2008), Restuccia and Rogerson (2008) show that the misallocation of resources among firms, stemming from different firm-level distortions induced by for example tax policy or firm-level variation in debt costs, could significantly impact aggregate Total Factor Productivity (TFP). Recent work by Bau and Matray (2023) has shed light on how policy-making can affect capital misallocation and thereby improve aggregate productivity. They find that foreign capital liberalisation reduces capital misallocation and increases aggregate productivity for affected industries. Employing a difference-in-differences approach, they estimate the effects of a foreign capital liberalisation reform on both total capital and the distribution of capital across firms, depending on firms' ex-ante marginal revenue products of capital (MRPK). Their paper relates to literature considering financial frictions and misallocation and literature quantifying the importance of misallocation for aggregate outcomes.

Buera et al. (2011) show that reduced financial constraints can result in substantial improvements in aggregate productivity and economic growth. In the literature on TFP, most research has been conducted comparatively across countries, however, some papers also look at TFP growth across firms. For example, R. Levine et al. (1999) show that financial development primarily boosts economic growth by increasing firm productivity. Studying the relationship between financial development and economic growth, Bakke (2009) finds that a well-developed financial system plays a crucial role in facilitating economic growth by efficiently allocating resources and reducing transaction costs, which, in turn, enhances productivity.

In conclusion, there exists a substantial body of literature on the prevalence of financial constraints and its impact on constrained firms' economic outcomes. In addition, it is clear from the literature that an easing of financial constraints may improve productivity, and consequently that financial constraints can help in

explaining capital misallocation. Moreover, in the literature on TCRs, it is evident that such policies directly impact firms' financing decisions and investments, which in turn could affect firms' MRPK and productivity. Thus, we have a strong theoretical foundation in studying the effect of the reform on firms with financial constraints and the effect on capital misallocation. In doing so, we contribute to the misallocation literature, the literature on financial constraints and on TCRs, as well as the BEPS implementation in a Swedish context.

The paper is organised as follows. In Section 2 we provide a background of interest deduction rules policy in Sweden, financial constraints, capital misallocation and productivity. Section 3 describes our sample and variables. In Section 4 we present our empirical approach. In Section 5 we comment on the results, which we discuss in Section 6. Section 7 concludes.

2 Background

2.1 Interest Deduction Policy

The issue of interest deduction limitations has been a longstanding topic of debate in Sweden. In 2008, the Swedish Tax Agency released a memorandum that highlighted substantial incentives for companies to establish intra-group debt (Ministry of Finance, 2008a). Specifically, interest expenses on intra-group loans were exploited as a cross-border strategy for intra-group tax planning. The Swedish Tax Agency identified that this resulted in a significant reduction of the Swedish tax base. Consequently, the memorandum proposed a legal amendment that, under specific conditions, would curtail targeted companies' ability to deduct interest expenses on debt to legal entities within the same group (Ministry of Finance, 2008b). The proposal translated into changes in the 2009 Income Tax Act, placing limitations on the deduction of interest related to debts arising from co-ownership rights of a company within a company group or community of interest.[1] Aside from striking down on tax planning, the policy aimed to increase neutrality between equity and debt financing as financing forms. The Swedish legislation was part of a broader international trend towards more stringent regulation of inter-company financing and profit shifting (Buettner et al., 2012).

After the reform, the Swedish tax authority was tasked with examining if further limitations were necessary (The Swedish Tax Agency, 2011). Their review concluded that the 2009 reform had not succeeded in limiting tax avoidance to a satisfactory degree and that a significant share of interest deductions were still not economically motivated, but rather used to reduce tax bases. Therefore, in 2013 the Government implemented more restrictions on interest deduction (Ministry of finance, 2012). Around this time, the Ministry of Finance also appointed a committee, the Committee on Corporate Taxation, tasked with reviewing the entire corporate taxation system and proposing further changes (Committee on Corporate Taxation, 2014).

2.1.1 The OECD's BEPS Program

In 2016, the OECD launched BEPS, its Base Erosion and Profit Shifting initiative, to tackle tax avoidance (OECD, 2020). Following the BEPS initiative, the European Union passed a directive called the Anti-Tax Avoidance Directive (ATAD) in 2016 to implement OECD's recommendations. The legislation aimed to prevent aggressive tax planning within Europe. More specifically, Action 4 of BEPS encompassed limitations on deductible net interest as one such tool. This legislation was at the time, and still is, part of Europe's larger effort to strengthen tax governance and protect tax revenues (Council of the European Union, 2016).

[1] The Swedish Tax Authority's definition of a community of interest is: companies are in a community of interest with each other if any of the following conditions are met: one of the companies has, directly or indirectly, through an ownership stake or otherwise, a significant influence in the other company, or the companies are mainly under joint management. The relevant definitions are included in Chapter 1, § 4 of the Annual Accounts Act (1995:1554) (Ministry of Justice L1., 1995).

2.1.2 The Swedish Reform

Following the EU directive and the Corporate Tax Committee's report initiated in 2014, new rules limiting interest deductions were drawn up in 2017 and 2018. The motivation for the policy on interest deductions was three-fold; (i) the Government's inquiry asserted that the financial crisis had highlighted the severe repercussions of excessive corporate sector indebtedness; (ii) the Government's inquiry emphasised that overly favourable tax regulations concerning interest deductions could result in erosion of the tax base and profit shifting; (iii) it pointed out an imbalance in the current corporate taxation, that at the time favoured debt-financed investments over equity-financed ones (Committee on Corporate Taxation, 2014). Therefore, the Government's inquiry advocated for the implementation of more broadly defined regulations limiting interest deductions. The 2019 tax reform can be viewed as a continuation and expansion of the principles underlying the 2009 and 2013 reforms combined with the OECD's BEPS and the EU's ATAD initiatives.

The reform expanded the scope of interest deduction limitations beyond intra-group loans and the new limits applied to all firms with interest deductions. More specifically, the new rules, which are still active as of 2024, concerned the deductions of negative net interest expenses. The reform also further reduced the corporate tax rate to 21.4% in 2019 and 20.6% in 2021. The rules are found in Chapter 24 of the Income Tax Act (The Swedish Tax Agency, 2024). There are two main rules to consider: the principal rule and the simplification rule.[2]

The principal rule stipulates a general limitation based on Earnings before Interest, Taxes, Depreciation, and Amortization (EBITDA). More specifically, negative net interest expenses can be deducted to an amount of 30 per cent of EBITDA.[3] The EBITDA rule can be applied in the case of a profit or a deficit in business operations because the calculation results in either a surplus or deficit in business operations. Thus, the result of business operations is the basis for the deduction base. To calculate the size of the interest deduction in relation to EBITDA, the negative net interest is considered, which is the difference between the company's interest expenses and interest income, if interest expenses exceed interest income. A company may deduct negative net interest up to 30 per cent of the deduction base, which is called the deduction space.

The simplification rule allows an independent company or company group/community of interest to deduct negative net interest up to a maximum of SEK 5 million. If a company within a company group/community of interest claims a deduction for negative net interest under the simplification rule, the remaining companies in the company group/community of interest are excluded from applying the same rule.

The Government's inquiry (the "Inquiry"), pre-dating the reform, drafted by the Ministry of Finance,

[2]If the entire negative net interest according to Chapter 24, Section 24 of the Income Tax Act cannot be deducted in one year, it can be carried forward and deducted within a six-year period (The Swedish Tax Agency, 2024). This applies to both rules. Unfortunately, we cannot consider this in our analysis as we cannot distinguish this in the data.

[3]The deduction base, EBITDA, is calculated in accordance with Chapter 24, Section 25 of the Income Tax Act and consists of the following breakdown: income from business operations increased by deductible interest expenses, annual depreciation deductions, deductions for certain acquisition costs, deductions for allocation to a provision fund reduced by interest income, surplus from shares in a Swedish trading partnership or a foreign legal entity and annual reversal of deductions for allocation to an accruals fund (Ministry of Finance S1., 1999)

discussed the potential effects of the reform in great detail (Ministry of finance, 2017). Focusing on stock companies the Inquiry found that the effects would vary widely. Most companies at the time were relatively small, but a small group of large and very large companies contributed significantly to the state's corporate tax revenue. The Ministry's analysis, considering only the principal rule, found that the reform would limit interest deductions for 35 000 corporations but that, due to the weak correlation between EBITDA and tax results, not all of these companies would necessarily pay more taxes. Considering also the simplification rule, the number of affected companies was found to be only 2 050 (Ministry of finance, 2017).[4]

2.2 Misallocation of Capital

Financial frictions has been shown to lead to decreased productivity growth (O. Levine & Warusawitharana, 2021). For example, firm-level policy distortions, like adjustment frictions from quasi-fixed capital, affect aggregate economic efficiency. These distortions result in resource misallocation across firms, causing significant productivity differences within industries across countries. In this regard, such distortions influence both the distribution of resources among current firms and the market entry or exit of businesses (Bartelsman et al., 2013). Financial frictions and capital misallocation can also explain differences in TFP across countries, which in turn is important in understanding the variation in output across countries. (Buera et al., 2011; Hall & Jones, 1999; Hsieh & Klenow, 2008). It is, however, not evident in the literature that capital misallocation can be solved only by a generally higher access to capital, as it relates to the distribution of capital between unproductive and productive firms (Gopinath et al., 2017).

At the firm level, access to capital is naturally important. For example, access to credits has a strong and positive correlation to firm productivity (Gatti & Love, 2008). For firms that are financially constrained, this is especially important (Krishnan et al., 2014). Firms' financial constraints may affect firms' investments, such as R&D investments, which could impact productivity (Bai et al., 2023; Brown et al., 2009; Fazzari et al., 1988). Financial constraints also relate to the different costs related to internal or external capital (Fazzari et al., 1988). For example, tax policy which eased internal financial constraints has been shown to increase productivity (Liu et al., 2024). Moreover, tighter credit conditions may lead to decreased productivity for firms with external financing constraints (Duval et al., 2018).

2.3 Financial Constraints

Financial constraints refer to restrictions faced by firms in accessing capital for investment or operational needs. Financial constraints have been a central topic in the finance and economic literature, influencing firms' investment, financing decisions, and response to policy changes. As financial constraints are not an observable variable, several different studies have been conducted to measure it (Fazzari et al., 1988; Hadlock & Pierce,

[4]Their analysis did not consider previous year deficits, the possibility of using group contributions within a company group and companies with a negative EBITDA.

2010; Kaplan & Zingales, 1997; Rajan & Zingales, 1998; Whited & Wu, 2006). A common approach is to use pre-determined indices. In the literature, the four most used and established indices are the Rajan Zingales index by Rajan and Zingales (1998), the Kaplan Zingales index by Lamont et al. (2001), the Whited Wu index by Whited and Wu (2006) and the Hadlock Pierce index, also known as the SA-index, by Hadlock and Pierce (2010). The indices have been scrutinised over time. In a review of the indices, Schauer et al. (2019) identify the main issue as parameter stability, which has to be assumed when indices estimated on one sample are used on another. The use of the indices has also been criticised as it is not always consistent with what the indices actually measure (Schauer et al., 2019). While the indices are still being used in contemporary research, measurements such as cash-holdings and MRPK, have as a result of the potential weaknesses of the indices started to grow in relevance.

2.3.1 Rajan Zingales Index

The RZ-index was introduced by Rajan and Zingales (1998), serving as a foundational tool for assessing sectors' dependence on external financing. The RZ-index measures sectors' external financial dependence by looking at how much capital industries require from external sources for growth. It is commonly used to examine the impact of financial development on economic growth across countries. The index highlights the differential benefits that sectors derive from financial development based on their reliance on external capital, emphasising the critical role of financial constraints in industry growth and strategic decision-making.

The RZ-index relies on the assumption that the index is constant within sectors, also known as constant external finance dependency (EFD). Villani (2021) challenged the idea that the EFD remains uniform across different times and places, and shows that the opposite holds true. However, Villani (2021) finds that the RZ-index is closely related to the measures of corporate borrowing or lending and thus is still reflective of firms' financing needs. Sectors showing a negative RZ-index value demonstrate a low dependency on external finance, relying instead on their own cash reserves for funding investments. This finding emphasizes the fluid character of financial dependence and points to the importance of factors such as the age of a company and its stage in the business life cycle.

2.3.2 Marginal Revenue Product of Capital

Firms with high MRPK have high marginal returns to capital meaning that their productivity would have been higher if they had access to more capital. Bau and Matray (2023) apply MRPK as a treatment variable to classify industries depending on their degree of financial constraints. They also consider the variance of MRPK dispersion as an indicator of capital misallocation. If the variance of MRPK is high, this reflects an uneven distribution of capital where high MRPK firms who can increase their productivity with more capital fail to access it. In a frictionless world with perfect capital markets, we would see an even distribution of capital, where these firms would have access to capital and thus lower MRPK. Several studies have used

MRPK as a measure to study financial constraints and misallocation. Fakos (2024) explores the consequences of sub-optimal capital structure on MRPK and finds that it leads to a misallocation of resources and lowers productivity. Ye and Kong (2023) find that bank deregulation leads to a significant growth in physical capital and a reduction in MRPK for firms with initially high MRPK experience, highlighting the importance of MRPK in understanding financial frictions. Following the work from Hsieh and Klenow (2008), Kamutando and Edwards (2023) investigate the issue of resource misallocation in Zimbabwe and its impact on TFP by calculating the MRPK to assess the effect of misallocation.

3 Data

We use a panel data set from the Swedish House of Finance's *Serrano* database covering all incorporated Swedish firms (Weidenman, 2024). The data set contains year-level financial history from both public and private Swedish companies from 1997 to 2021. The database is constructed to ensure that the underlying register data is compiled as comparable calendar year values and that the data for each company and each year reflects the situation as of December 31st. The Serrano Database collects its financial information mainly from the Swedish Companies Registration Office, along with historical data about companies from Statistics Sweden, bankruptcy information, and group data from Dun & Bradstreet's registers.

3.1 Sample

We restrict our sample in several ways. Firstly, we only include firms that are likely to have been impacted by the reform. As per the reform, companies are permitted to deduct negative net interest expenses up to 30% of their EBITDA or up to SEK 5 million for a company or company group/community of interest. Applying the thresholds exactly set by the new rules to restrict our sample would exclude firms that at some point during our research period transitioned from low debt levels to debt levels so high they were hit by the reform. Likewise, it might result in the exclusion of firms with initially high debt levels affected by the reform, but who proactively reduced their debt levels in anticipation of the new rules. Instead, we identify potentially affected firms by using several conditions based on the rules that ensure we include firms who could potentially be impacted. We include firms with negative net interest to EBITDA ratios exceeding 20 per cent, firms with net interest exceeding SEK 3 million and all group companies since the identification of company group affiliations is not available in our dataset. We also include firms with total liabilities exceeding SEK 120 million, as this would correspond to interest expenses of about SEK 3 million kronor with the interest rates of 2019 (Melz et al., 2018). We include all firms that satisfied these criteria during the period 2014 to 2016 to ensure that firms that lowered their debt in the face of the policy remain in the sample. Our restrictions rely on the assumption that firms do not suddenly substantially increase their debts.[5] We further discuss this sample restriction in our robustness section.

Moreover, we only consider firms that were active during the period we study, between 2014 and 2021. This ensures we have as many years in the pre-treatment period as the post-treatment period. We exclude firms that in any year have cash holdings and liquid assets equal to zero.[6] Following accounting standards, we exclude firms with negative balance sheets, negative sales and negative costs (Bau & Matray, 2023). We also exclude firms that have liquid assets that are larger than total assets as this is inconsistent with the

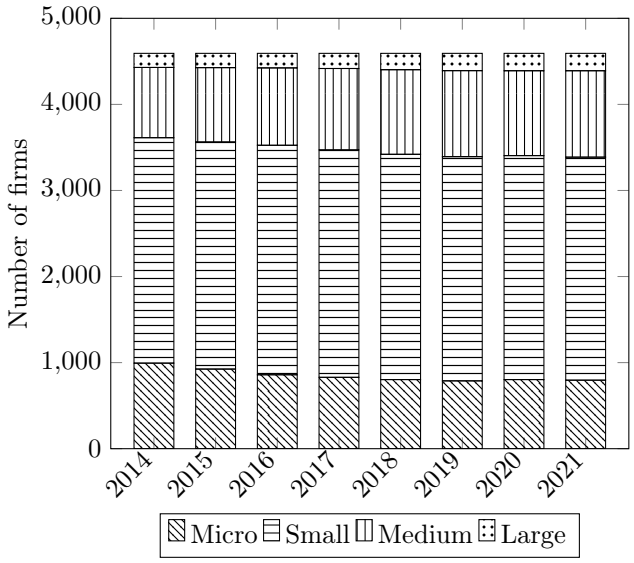
[5] A firm with SEK 3 million in interest deductions would need to increase their debt with SEK 80 million kronor to reach SEK 5 million in interest deductions

[6] The reason for this is that we find firms with non-zero sales and zero assets in the data and interpret this as that the Serrano database has coded missing values as zeros.

definition of total assets (liquid assets are a part of total assets). We exclude all firms with negative equity values following Buslei and Simmler (2012). We drop non-stock companies as several firm types face other tax and accounting regulation than stock companies. In addition, we exclude very small firms (less than three employees), as this is a common practice in studies using firm-level data due to concerns about the reliability of the data and the consistency of variables over time (Buslei & Simmler, 2012). We winsorise the data at the 1st and 99th percentiles for all variables to exclude the impact of extreme outliers following Becker et al. (2012). Our sample therefore consists of a balanced panel data set of stock companies active between 2014 and 2021 with positive sales, assets, equity values, and more than 3 employees. Out of all firms in the database that were active during the entire period between 2014 and 2021, we have excluded 99% following our restrictions, ending up with a sample size of 36,744 observations.

As seen in Figure 3.1, after our restrictions, our sample mainly consists of firms with 11 - 49 employees, so-called small firms. The second largest category is micro firms, with between 3 and 9 employees and medium-sized companies, with between 50 and 249 employees. Large companies, with more or equal to 250 employees, are significantly fewer.

Figure 3.1: Firm Size Composition



We categorise firms into 99 sectors based on the two-digit SNI classification (Statistics Sweden, 2007). We exclude several sectors.[7] Firstly, we exclude the finance, insurance, and real estate sectors, a common

[7]We drop the following sectors: Activities at international organizations, foreign embassies, etc.; activities auxiliary to financial services and insurance activities; air transport; artistic and cultural activities; entertainment activities; care activities with accommodation; coal mining; education; extraction of crude petroleum and natural gas; financial service activities, except insurance and pension funding; health activities; hotel and accommodation activities; insurance, reinsurance, and pension funding, except compulsory social security; interest advocacy; religious activities; library, archive, and museum activities, etc.; manufacture of coke and refined petroleum products; manufacturing of clothing; materials recovery; mining of metal ores; open social care activities; public administration and defence; compulsory social security; real estate activities; remediation activities and other waste management services; repair of computers, household articles, and personal articles; restaurant, catering, and bar activities; scientific research and development; sewerage; support activities for extraction; tobacco product manufacturing;

exclusion in the literature (Buslei & Simmler, 2012). Secondly, we omit sectors identified as significantly impacted by COVID-19 according to the *Background report for the Corona Commission* (Ekholm, Skans et al., 2022), as well as sectors characterised by more lenient budget constraints, such as education, extraterritorial organizations, and public administration & defence. Additionally, sectors with less than 3 firms are excluded. After our restrictions, our sample is comprised of 56 sectors. An overview of the sectors is presented in Table A.11 in the appendix.

3.2 Measures of Financial Constraints

Below, we account for how we calculate our two main measures of financial constraints. We use the Rajan Zingales index when studying the effects on the sector level and MRPK on the firm level. We provide summary statistics in Table 3.1.

3.2.1 Rajan Zingales Index

To calculate the RZ-index, we use the following equation.

$$RZ = \frac{CapEx - CashFlow}{CapEx} \tag{3.1}$$

To calculate CapEx, we take the difference in total fixed tangible assets, adding back depreciation and amortization.[8] We calculate cash flow following the procedure in Ahmed et al. (2009) and the adjustments as stated in Hellman et al. (2022). Cash flow is calculated as:

$$CashFlow = NetProfits - Accrurals \tag{3.2}$$

where[9]

$$\begin{aligned} Accrurals = \Delta TotalAssets - \Delta LiquidAssets - (\Delta CurrentLiabilities \\ - \Delta CurrentLiabilitiesToCreditInstitutions - \Delta Taxes) \end{aligned} \tag{3.3}$$

Following Rajan and Zingales (1998), we calculate the RZ-index in rolling 10-year windows for each firm to minimise the impact of fluctuations.[10] We then take the median of the RZ-index for each sector for each year. Since we are using the RZ-index as our measurement of financial constraint, we exclude all firms with

travel agency, tour operator, and other reservation services and related activities; waste collection, treatment and disposal activities; water collection, treatment, and supply.

[8] The depreciation and amortization variable is negative in the Serrano database, hence we first make the variable positive.

[9] *Total Assets* is the sum of fixed assets and current assets. *Liquid Assets* is calculated as the sum of the recognised items cash and bank balances, and investments in securities. *Current liabilities* are all recognised liabilities. *Current Liabilities to Credit Intuitions* are recognised liabilities to credit institution item. *Taxes* is tax recognized. All variables are defined and calculated in the dataset.

[10] We do this before excluding the years prior to 2014.

missing values for CapEx, cash flow and RZ-index. In the original paper by Rajan and Zingales (1998), the estimations of the index varies between -0.45 to 1.49, with the majority of sectors having below zero values. Our RZ-index has a minimal value of -5.34 and a maximal value of 1.97, with a mean of -0.54. The RZ-index rests upon two assumptions, namely that the level of sector RZ-index is steady in time and across countries. As we only study within-country effects, we only validate the first assumption. Our RZ-index values do not vary substantially across years.[11] Therefore, we create our treatment variable by averaging the RZ-index for each sector over the years and splitting the sample relative to the sample median. More specifically, we take the average in the years 2012–2016 as we do not want our treatment and control group composition to change post treatment year.[12] We then divide sectors into treated and untreated sectors depending on whether their average RZ-index value over the period is above or below the median of the average RZ-index of all sectors.

3.2.2 MRPK

We calculate MRPK following Bau and Matray (2023). We use a Cobb-Douglas production function and estimate MRPK as $MRPK = \frac{\delta Revenue_{it}}{\delta K_{it}} = \alpha_j^k \frac{Revenue_{it}}{K_{it}}$. Thus $\frac{Revenue_{it}}{K_{it}}$ provides a within-sector measure of MRPK, under the assumption that all firms in a sector share the same output elasticity of capital, α_j^k. To then estimate and determine whether firms had a high or low MRPK prior to our reform, we average each firm's MRPK from the years 2012-2016 to fix the value which identifies treatment and control groups. We then classify the treated and untreated as having high or low MRPK prior to the reform depending on if their average is above or below the median value of the averages within each sector. We classify firms with high MRPK as being financially constrained.

Table 3.1: Summary Statistics of Financial Constraints.

	Mean	Median	Std. Dev.	Observations
Total sample				
RZ-index	-0.414	-0.304	0.634	36 744
MRPK	2.118	1.933	1.216	36 744
Treatment				
RZ-index	0.126	0.078	0.318	16 053
MRPK	2.901	2.659	1.201	18 328
Control				
RZ-index	-0.833	-0.696	0.483	20 691
MRPK	1.338	1.337	0.546	18 416

[11] We drop the sector Clothing manufacturing as its RZ-index value is not constant. This adjustment is included in the exclusions described in Section 3.1 and the total number of sectors in our sample is 56.

[12] We do this before excluding the years prior to 2014.

3.3 Outcome Variables

The outcome variables are liabilities, tax payments, net interest, capital investments, labour investments, productivity, and MRPK dispersion. Liabilities and tax payments are variables that are already defined in our data set. Net interest is calculated as the difference between interest income and expenses.[13] We describe how we construct our measures for MRPK dispersion, productivity and investments below. We present summary statistics for our outcome variables across sectors-years and firms-year in Table 3.2.

3.3.1 MRPK Dispersion

Following Bau and Matray (2023), we consider MRPK dispersion as a measure of capital misallocation and compute it as the logarithm of the variance of MPRK within sectors. Thereby, our measure of MRPK dispersion will only capture if MRPK dispersion within financially constrained sectors has increased relative to unconstrained sectors after the reform. In this sense, our measure does not account for whether capital misallocation has increased as a whole between firms in the entire economy.

3.3.2 Productivity

We calculate productivity as TFPR using the cost shares approach outlined in Foster et al. (2008). TFPR is a revenue measure of productivity that can be calculated using readily available data on inputs and outputs, making it practical in many empirical studies.[14] TFPR has its weaknesses as it confounds idiosyncratic demand and factor price effects with efficiency differences. However, TFPR is positively correlated with true productivity.

We are assuming that our production function $Y_{ft} = e^{z_{ft}} f(K_{ft}, L_{ft})$ is a simple Cobb-Douglas production function:

$$Y_{ft} = e^{z_{ft}} K_{ft}^{\alpha} * L_{ft}^{1-\alpha}$$

Y_{ft}^{i} is value added, which we use since we don't include materials in our production function, and is calculated as operating profit/loss (adjusted for items affecting comparability) plus labour costs, depreciation and amortisation. K_{ft}^{i} is capital defined as total tangible fixed assets. L_{ft}^{i} is labour costs calculated as the sum of the salaries and social security contributions. α, is defined as $\alpha = med\left\{\frac{r_t k_{ft}}{w_{ft} l_{ft} + r_t k_{ft}}\right\}$ where r_t^k = rental cost of capital. r_t^k is defined as $r_t^k = r_t^n - \gamma_t + \delta_t$, where δ_t is the sum of actual depreciation of 7% and a risk premium of 5% following Chiavari and Goraya (2024), r_t^n is the nominal interest rate which we approximate

[13] The interest income variable is calculated as the sum of interest income from group companies, external interest income and other financial income. Interest expenses are calculated as the sum of interest expenses to group companies, external interest expenses and other financial expenses multiplied by -1.

[14] TFPQ, on the other hand, requires detailed data on quantities of inputs and outputs, which may not always be readily accessible or reliable.

by using the 10-year Swedish Government Bond yield (The Riksbank, 2024), and inflation, γ_t, is actual Swedish inflation data (Statistics Sweden, 2024).

We then take the logarithm of both sides to get a linear structure:

$$y_{ft} = \alpha k_{ft} + (1-\alpha) l_{ft} + Z_{ft}$$

Z_{ft} is TFPR and can therefore be calculated as:

$$TFPR = \alpha k_{ft} + (1-\alpha) l_{ft} - y_{ft}$$

3.3.3 Investments

We use two measures for investments. Firstly, we use CapEx as a measure of investment in physical capital (Doshi et al., 2018). We scale CapEx, as defined in section 3.3.1., by total assets, $I_t^C = \frac{CapEx_t - K_{t-1}}{K_{t-1}}$. Secondly, as a measurement of labour investments, we use the difference in wage expenses between two consecutive years in relation to the year prior's wage expenses, $I_t^L = \frac{l_t - l_{t-1}}{l_{t-1}}$.

3.3.4 Descriptive Statistics

In Table 3.2, we present descriptive statistics for the variables. Some statistics stand out. For instance, the treatment group in our firm analysis has higher productivity than our control group which, stated differently, says that firms with financial constraints are more productive than unconstrained firms. Overall, the treatment group in our firm analysis has higher productivity, holds less debt, pays less in net interest expenses, pays less in taxes, and invests more in labour, and capital in relation to their assets. When looking at our treatment group for the sector analysis, financially constrained sectors have lower productivity, hold more debt, pay less in net interest expenses, pay less in taxes, and invest less in labour but more in capital in relation to their assets. Looking at MRPK dispersion, treated sectors has a higher MRPK dispersion than untreated sectors. The sectors we classify as financially constrained, which make up our treatment group, are stated in Table A.12. In Table 3.3, we describe what industries the sectors we study are part of based on the 1-digit SNI classification (Statistics Sweden, 2007). As can be seen, several of the sectors included in the treatment group belong to traditionally capital heavy industries such as agriculture, forestry, and fishing as well as manufacturing and transport and storage. Meanwhile, the largest part of the untreated sectors also belong to the manufacturing industry. The differences between the firm and sector treatment group characteristics can be explained by the fact that we use different treatment variables for the two levels. For sectors, we use RZ-index which depends on CapEx and cash flow. For firms, we use MRPK which reflects firms' return to capital.

Table 3.2: Variable Descriptive Statistics

	Sector			Firm		
	Total sample	Treatment	Control	Total sample	Treatment	Control
Productivity	1.316	1.087	1.494	1.316	1.511	1.123
	(0.405)	(0.394)	(0.313)	(0.770)	(0.710)	(0.778)
Taxes	1365.513	1230.641	1470.153	1365.513	1255.266	1475.233
	(534.872)	(510.525)	(592.891)	(1928.24)	(1807.474)	(2035.489)
Liabilities	90101.67	118872.6	67779.88	90101.670	60329.31	119731.800
	(128012.7)	(168524.8)	(76988.1)	(544589.700)	(255692.6)	(724519.300)
Net interest	494.767	647.445	376.313	494.767	325.075	663.649
	(1434.479)	(1888.805)	(924.292)	(11247.960)	(6108.016)	(14671.360)
Capital investments	0.372	0.309	0.420	0.372	0.381	0.363
	(0.235)	(0.287)	(0.169)	(4.890)	(4.152)	(5.522)
Labour investments	0.321	0.127	0.472	0.321	0.525	0.118
	(1.475)	(1.414)	(1.503)	(40.470)	(56.807)	(7.496)
MRPK Dispersion	0.037	0.302	-0.169	-	-	-
	(0.634)	(0.727)	(0.455)	-	-	-
Control variables						
Firm age	25.409	25.574	25.281	25.409	24.439	26.374
	(2.436)	(2.554)	(2.334)	(9.563)	(9.868)	(9.148)
Firm size	71.544	90.767	56.629	71.544	75.151	67.953
	138.754	(204.797)	(33.782)	(371.412)	(327.837)	(410.187)
Sales growth	0.078	0.075	0.080	0.078	0.075	0.081
	(0.032)	(0.040)	(0.0241)	(0.402)	(0.489)	(0.317)
Observations	56	33	23	36 744	16 053	20 691

Table 3.3: Sector Descriptive Statistics

Category Name	**Treated**	**Untreated**	**Total**
Agriculture, forestry and fishing	3	0	3
Mineral extraction	1	0	1
Manufacturing	8	12	20
Supply of electricity, gas, heat, and cooling	1	0	1
Construction activities	2	1	3
Trade; repair of motor vehicles and motorcycles	3	0	3
Transport and storage	4	0	4
Information and communication activities	4	2	6
Activities in law, economics, science, and technology	5	3	8
Rental, property services, travel services, and other support services	4	0	4
Culture, entertainment, and recreation	2	0	2
Other service activities	1	0	1
Total	33	23	56

Notes: The table shows the number of treated and untreated sectors in each "head sector".

4 Methodology

To analyse the impact of the interest deduction limit reform on firms and sectors with financial constraints, we employ a difference-in-differences (DiD) approach. A DiD, that examines changes pre and post-reform while addressing parallel trends between financially constrained and unconstrained firms or sectors, offers a clear causal interpretation of the reform's impact. A simpler approach to study the effects of the reform in general or to study the effects of being financially constrained in general would be to run an ordinary Least Squares (OLS). However, this would not allow us to identify the causal effect of the reform for financially constrained firms. The OLS would also provide biased estimates as it fails to account for unobserved, time-invariant variables such as differences between the treatment and control group. In our analysis of the reform's impact, we compare the differences in the level of our outcome variables, before and after the policy intervention, for financially constrained versus unconstrained firms or sectors. In this sense, we are capturing the effect that the reform had on our treatment group as our control group represents the counterfactual scenario where the reform did not take place. But for this to be true, both groups should have, in the absence of the intervention, experienced similar temporal changes. In order for the DiD model to provide unbiased estimates, it is crucial that firms/sectors with financial constraints would have followed the same trends over time in the absence of the treatment.

In order to examine the policy effect we conduct two levels of analysis, sector and firm level.

Our sector-level analysis entails studying the differential effect that the reform had on financially constrained sectors in comparison to unconstrained sectors. Our motivation to study this effect is a solid theoretical foundation, initiated by Rajan and Zingales (1998), that posits that different sectors have different access to internal and external capital due to sector-specific characteristics such as technological constraints. A large portion of the literature on financial constraints studies sector-level differences. Our treatment variable is the RZ-index. We apply it by splitting the sample of sectors into two groups depending on whether their RZ-index value is above or below the sample median of all sectors.

Our firm-level analysis entails studying the differential effect that the reform had on firms that are financially constrained in comparison to non-financially constrained firms within different sectors. As described in Section 2, there is a large literature that shows the prevalence of firm-level financial constraints and their effects on economic outcomes. Our main treatment variable is the MRPK following similar work by Bau and Matray (2023). To identify financially constrained firms, we split the sample into two groups within each sector depending on whether their MRPK value is above or below the sector median. Treating the firms within sectors allows us to exclude the impact of sector-specific properties on our treatment variable. In studying the effects within sectors we also control for the impact of Covid-19, assuming that the pandemic had similar effects on firms within a sector. We then pool all treated firms from all sectors into one treatment group and run difference-in-differences regressions. As a robustness check on our firm-level results, we will

also apply the KZ, WW, and SA indices as the treatment variable. We do this in order to provide more robust results and to relate our findings to previous literature in the financial constraint field.

The exogenous variation is the interest deduction reform that took effect on the first of January 2019. The EU ATAD directive came in 2016 and the Swedish Government's inquiry into the Swedish transposition of the directive was subsequently presented in 2017. The proposals were circulated in a public consultation during 2017, and in 2018 the Government presented final law proposals. The new rules were in force from the first of January 2019. We reason that firms were aware of the impending reform already in 2018 and that firms that would be affected would begin to alter their financing structure to avoid higher tax expenses. We therefore choose 2018 as our treatment year. We also run an alternative test using the actual year of the implementation, 2019, as the treatment year. These results are presented in the Appendix.

Equation 4.1 is our main specification:

$$Y_{ijt} = \alpha + \beta_1 Post2018 + \beta_2 Treat_{ij} + \beta_3 Post2018_{ijt} \times Treat_{ij} + X_{ijt} + \theta_t + \mu_j + \epsilon_{it} \tag{4.1}$$

where i denotes a firm, j denotes sectors and t denotes years, and Y_{ijt} is either of the outcome variables of interest described in the data section. $Post2018$ is a dummy variable equal to one for the years 2018 and onward, and zero otherwise, $Treat_i$ is a dummy equal to one if the firm or sector is financially constrained and zero otherwise. X_{it} is a vector of control variables that in this specification includes firm age[15], defined as years since incorporation, firm size, measured as number of employees, year-on-year sales growth. For the sector analysis, we take the averages of the controls. We include these controls as it is common in the literature (Buettner et al., 2012; O. Levine & Warusawitharana, 2021). Standard errors are clustered at the firm level and sector level respectively. θ_t is year-fixed effects and is applied in both of our analyses. Including year-fixed effects allows us to control for linear time trends common for all firms or sectors, such as macroeconomic fluctuations. μ_j is sector fixed effects which is applied in our firm-level analysis. Including sector-fixed effects allows us to exclude the variation that stems from sector-specific differences. The remaining variation in our firm-level analysis is characterised by variation across time and among firms, while in our sector-level analysis, it fluctuates across time and sectors. This serves our purpose as we are examining the effect of the reform on a subset of all firms or sectors in one period compared to another. The coefficient of interest is β_3, which captures the differential effect of the reform on firms that are financially constrained relative to the firms that are not. The main specification allows us to study reform's indirect effect on investments, productivity and MRPK dispersion, as it considers the entire post-treatment period.

We also run a dynamic specification regression, Equation 4.2, when studying the pre-reform trends and immediate effects. We are primarily interested in the immediate effects on net interest expenses, tax payments

[15]Moreno-Badia and Slootmaekers (2009) find that financial constraints mainly affect young firms' productivity. We partly consider this nuance in the relationship between financial constraints and productivity by considering firms' age. However, this is not a particular focus of this thesis.

and liabilities.

$$Y_{ijt} = \alpha + \beta Treat_{ij} + \sum_{t=2014, t\neq 2017}^{2021} \delta_t Year_t + \sum_{t=2014, t\neq 2017}^{2021} \gamma_t (Year_t \times Treat_{ij}) + X_{ijt} + \mu_j + \epsilon_{it} \quad (4.2)$$

4.1 Hypothesis

H1: The reform affects financially constrained firms more negatively than unconstrained firms.

As outlined in our introduction, all firms with high levels of debt faced the risk of higher debt costs following the reform. Firms that were not financially constrained should have been able to exchange debt capital for internal capital when faced with higher costs. This is not an option for financially constrained firms that would only have had two options: keep their liabilities unchanged and pay higher tax expenses or lower their liabilities. For firms that kept their financing structure unchanged, we anticipate higher tax payments. For the other constrained firms, we expect lower liabilities and net interests. We also anticipate that some firms might both lower liabilities but not to the degree that their tax payments remain unchanged. Thus, we expect some firms will pay more in taxes and lower their liabilities following the reform. Independent of their decision, constrained firms would face tighter financial constraints due to the reform, either by lower loans or higher tax payments, or both, and as a result, we expect them to scale back investments. In consequence, their productivity should decrease. If the decrease in productivity is due to tighter financial constraints, we expect the firms' MRPK to increase which should increase capital misallocation. We anticipate these effects on both the sector and firm level.

5 Results

In this section, we present the main results from the sector and firm regressions. In the subsequent section, we run several robustness checks on the results and comment on how they relate our main results.

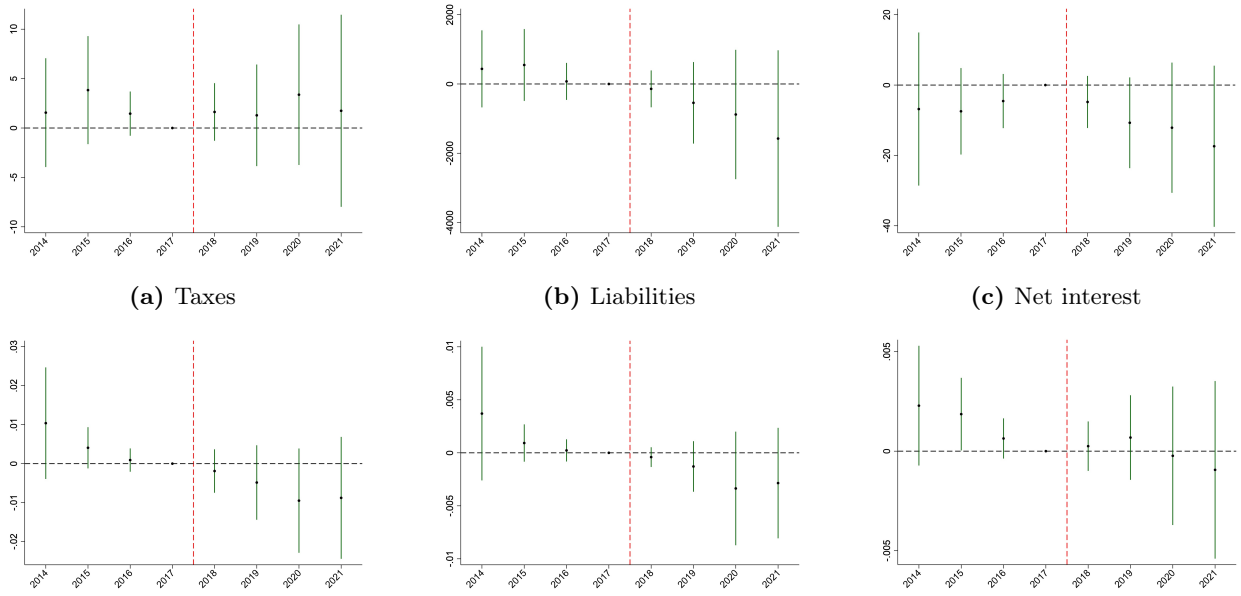
5.1 Main Results

Figure 5.1 shows the sector results from the dynamic specification (Eq. 4.2) run with control variables. Table 5.1 presents the sector results from the main specification (Eq. 4.1) run both with and without controls. In the dynamic specification, we plot the coefficient for the interaction between each year and our treatment group dummy, $Year_t * Treat$, setting the year before the reform took effect, 2017, as the baseline year. As seen in Figure 5.1, all outcome variables display parallel trends prior to the treatment year, 2018. However, no significant results are found in the treatment year or afterwards. This is not in line with our hypothesis. We expected treated sectors to lower their debt levels, pay more in taxes as direct effects of the reform, and to invest less and see productivity losses as later effects.

When running the main sector specification, we find no significant results for our coefficient of interest, the interaction term $Post2018 * Treat$, which measures the effect of the reform on sectors with financial constraints. The non-significant results hold both with and without controls.[16] Our results show that the reform had no significant impact on financially constrained sectors overall in the post-reform period. This result is inconsistent with our hypothesis. We expected that the reform would affect financially constrained sectors' productivity more negatively than unconstrained sectors. One potential explanation for our results could be that financial constraints vary within sectors and that the reform mainly had differential effects on firms within sectors. To address the potential issue that the RZ-index does not correctly identify financially constrained sectors, we also run the sector analysis regression applying MRPK as the treatment variable instead of the RZ-index. When doing this our results do not change. This supports our non-significant results in the sector analysis. Another explanation for our null results is that the reform did not have an impact at all. We comment on this further in our firm level analysis and discussion.

[16]When running the regressions using an unbalanced data set of 130 782 observations we only find a negative impact on labour investments, significant at the 5% level.

Figure 5.1: Dynamic DiD Sector Level Results



(a) Taxes **(b)** Liabilities **(c)** Net interest

(d) Labour investments **(e)** Capital investments **(f)** Productivity

Notes: The figures show the estimates of the interaction between post-treatment year and our treatment variable $Post2018 * Treat$, from the regression in Equation 4.2.

Figure 5.2 presents the firm-level results from the dynamic specification (Eq. 4.2) run with the set of controls described in Section 4. As seen in Figure 5.2, all outcome variables display parallel trends before the treatment year. Table 5.2 presents the results from the main specification (Eq. 4.1) run both with and without the set of controls.

The main coefficient of interest is the interaction term $Post2018 * Treat$, which measures the effects of the reform on firms with financial constraints. As seen in Table 5.2, we find some direct effects of the reform. We find a negative effect on the liabilities coefficient of SEK -20377.248 thousand significant at the 5% level. This can be interpreted as that a financially constrained firm decreased their liabilities with in average about SEK 20 million (in comparison the treatment group average in the whole period was around SEK 60 million) in the post-treatment period in comparison to unconstrained firms. Moreover, for tax payments, we find a positive coefficient of SEK 83.655 thousand, significant at the 1% level, which suggests that financially constrained firms paid on average SEK 83 thousand (in comparison the treatment group average in the whole period was around SEK 1 255 thousand) more in taxes as a result of the reform. These results can also be seen in our dynamic specification in Figure 5.2. For liabilities, we see a downward-sloping trend in firms' debt levels starting after the reform. In 2020, firms had decreased their liabilities significantly in comparison to 2017 levels. For taxes, we see an increase in tax payments with tax payments being significantly higher in 2020 compared to 2017 base levels.

Considering second-stage effects, we see a negative $Post2018 * Treat$ coefficient on productivity of -0.028,

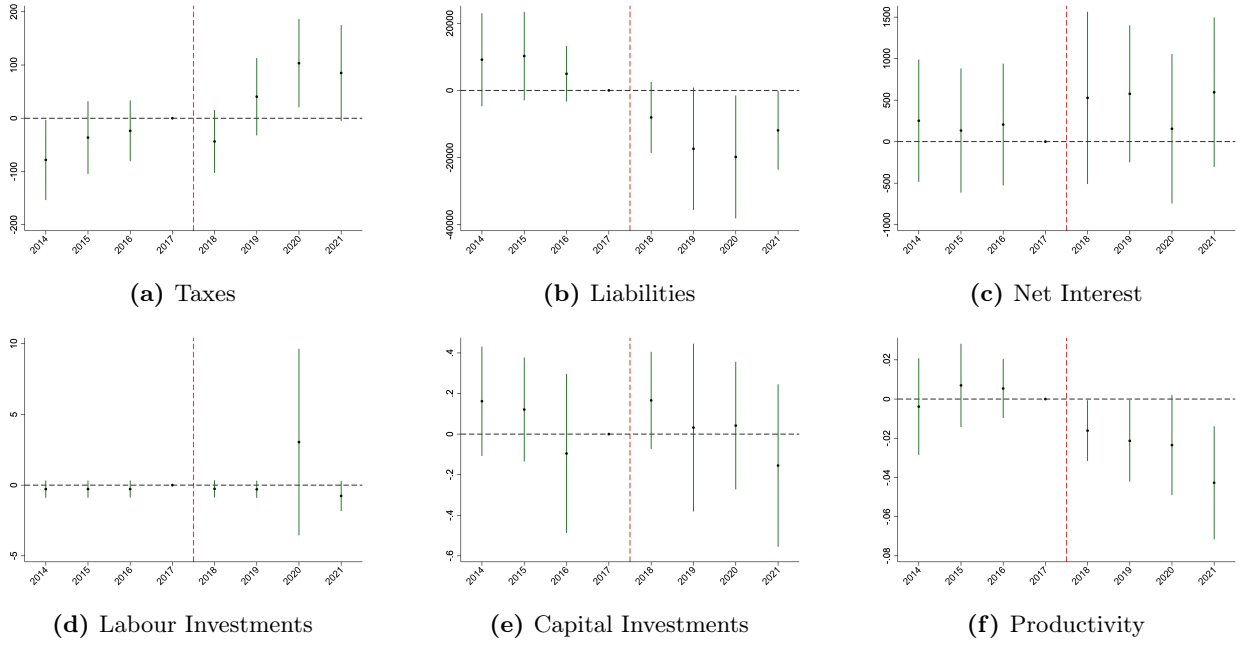
Table 5.1: Main Specification Sector Level Results

	Productivity		Taxes		Liabilities		Net Interest		Labour investments		Capital investments	
	(Revenue per unit)		(SEK thousand)		(SEK thousand)		(SEK thousand)		(Per cent)		(Per cent)	
Treat	-0.373***	-0.407***	-249.252	-239.773	41291.684	51626.346	206.264	274.326	-0.534	-0.338	-0.099	-0.109
	(0.109)	(0.131)	(202.744)	(226.451)	(27706.864)	(33461.318)	(276.531)	(312.331)	(0.306)	(0.390)	(0.058)	(0.064)
Post2018*Treat	-0.001	-0.001	0.295	0.524	-1050.454	-1067.331	-6.556	-6.395	-0.010	-0.012	-0.003	-0.003
	(0.002)	(0.002)	(3.249)	(3.463)	(916.045)	(942.604)	(7.759)	(7.711)	(0.007)	(0.009)	(0.002)	(0.002)
Firm size	0.000		0.871*		373.219***		2.145**		0.007***		0.000	
	(0.000)		(0.334)		(99.767)		(0.780)		(0.000)		(0.000)	
Firm age	-0.093***		9.465		2981.173		75.311		-0.128		-0.022	
	(0.014)		(32.348)		(6566.811)		(77.555)		(0.121)		(0.013)	
Sales growth	2.171***		4822.054*		692420.008		5719.380		1.041		1.130	
	(0.686)		(1905.870)		(532504.089)		(3524.780)		(3.599)		(0.706)	
Fixed effects	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year
Observations	56	56	56	56	56	56	56	56	56	56	56	56
Controls	✓		✓		✓		✓		✓		✓	

Notes: All columns show difference-in-differences estimates following Equation 4.1 and display the average effect of being a financially constrained sector ($Treat$), and the interaction between post-treatment year and our treatment variable $Post2018 * Treat$. Each column represents our outcome variables, both with or without controls. ***: p-value < 0.005, **: p-value < 0.01, *: p-value < 0.05

significant at the 1%.[17] This can be interpreted as that financially constrained firms that have a pre-treatment average productivity of 1.489, became less productive with a productivity decrease of 0.028 as a result of the reform. This is a relatively small decrease compared to their pre-treatment average level. By looking at Figure 5.2 we can conclude that productivity steadily decreases the years after the treatment year. These results are in line with our hypotheses. We find a positive non-significant estimate on *Net Interest*, *Labour Investments*, and a negative non-significant estimate on *Capital Investments*.

Figure 5.2: Dynamic DiD Firm Level Results



(a) Taxes **(b)** Liabilities **(c)** Net Interest

(d) Labour Investments **(e)** Capital Investments **(f)** Productivity

Notes: The figures show the estimates of the interaction between post-treatment year and our treatment variable $Post2018 * Treat$, from the regression in Equation 4.2.

Next, we consider the effects on MRPK dispersion which is our measurement of capital misallocation. We hypothesised that the reform would increase capital misallocation. We study the effect on capital misallocation by comparing the variance of MRPK levels within sectors. More specifically, we compare the MRPK dispersion between financially constrained sectors and their unconstrained counterparts.

Figure 5.3 presents the sector level results from the dynamic specification on MRPK dispersion run with the controls. Table 5.3 presents the sector level results from the main specification run both with and without controls. As seen in Figure 5.3, MRPK dispersion displays parallel trends prior to the treatment year but no significant results in the treatment year or afterwards. The coefficient of interest on the interaction between the treatment year and our dummy for financial constraints, $Post2018 * Treat$, estimates the average effect on MRPK dispersion in financially constrained sectors increased in the post treatment period in comparison to

[17] When running the regressions using an unbalanced data set of 130 782 observations we also find a negative impact on productivity, significant at the 0.5% level. We find no other significant results.

Table 5.2: Main Specification Firm Level Results

	Productivity		Taxes		Liabilities		Net Interest		Labour investments		Capital investments	
	(Revenue per unit)		(SEK thousand)		(SEK thousand)		(SEK thousand)		(Per cent)		(Per cent)	
Treat	0.389***	0.400***	-234.568***	-258.575***	-50506.483***	-49690.458***	-534.187**	-486.489*	0.036	0.074	0.019	0.034
	(0.017)	(0.017)	(46.384)	(47.152)	(8171.111)	(11427.080)	(198.230)	(189.491)	(0.098)	(0.089)	(0.064)	(0.064)
Post2018*Treat	-0.028**	-0.029**	83.655**	-0.718	-20377.248*	-17951.244	315.424	325.724	0.641	0.647	-0.026	-0.033
	(0.011)	(0.011)	(30.916)	(35.403)	(10268.936)	(10291.580)	(270.259)	(271.291)	(0.851)	(0.847)	(0.102)	(0.101)
Firm size	-0.000		1.176***		536.885***		2.765***		0.003*		-0.000***	
	(0.000)		(0.342)		(109.747)		(0.946)		(0.001)		(0.000)	
Firm age	-0.005***		16.563***		1049.549		-16.547		-0.009		-0.06*	
	(0.001)		(2.583)		(821.866)		(11.301)		(0.007)		(0.003)	
Sales growth	0.057		251.639*		-2412.727		47.785		0.524		0.527	
	(0.031)		(115.505)		(4432.511)		(154.041)		(0.422)		(0.293)	
Fixed effects	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year
	Sector	Sector	Sector	Sector	Sector	Sector	Sector	Sector	Sector	Sector	Sector	Sector
Observations	36 744	36 744	36 744	36 744	36 744	36 744	36 744	36 744	36 744	36 744	36 744	36 744
Controls	✓		✓		✓		✓		✓		✓	

Notes: All columns show difference-in-differences estimates following Equation 4.1 and display the average effect of being a financially constrained firm ($Treat$), and the interaction between post-treatment year and our treatment variable $Post2018 * Treat$. Each column represents our outcome variables, both with or without controls. ***: p-value < 0.005, **: p-value < 0.01, *: p-value < 0.05

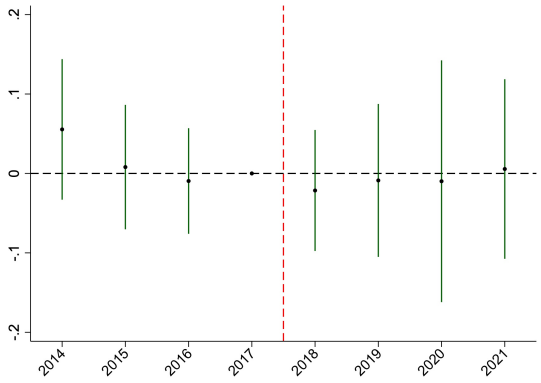
the unconstrained sectors. As seen in Table 5.3, we do not find any significant results. The MRPK dispersion point estimate is -0.002 with a standard error of 0.043. The standard errors are large in relation to our point estimate, suggesting that our estimate is affected by noise. The point estimate is small compared to the treatment group mean of 0.302. However, in relation to the average MRPK dispersion across all sectors in the economy of 0.037, the estimate taken together with its standard error is rather large. Thus, it is not certain if the null result we find is a true null. As seen in Figure 5.4, where we plot estimates of the year variables regressed on MRPK dispersion for both the treatment group and the control group, we see that MRPK dispersion seems to decrease in the whole economy, suggesting that capital misallocation decreased as a whole. While this is a non-causal representation of the development of capital misallocation, it is not in line with our hypothesis.

Table 5.3: Main specification Log Variance MRPK results

36 744 obs.	**Log Variance MRPK**	
Treat	0.520	0.482
	(0.266)	(0.270)
Post2018*Treat	-0.002	-0.022
	(0.043)	(0.043)
Firm Size	-0.000	
	(0.000)	
Firm age	-0.083*	
	(0.037)	
Sales Growth	1.461	
	(1.184)	
Fixed effects	Year	Year
Controls	✓	

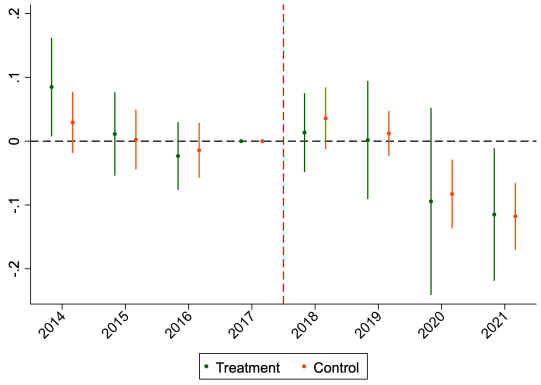
Notes: Both columns show difference-in-differences estimates following Equation 4.1 and display the average effect of being a financially constrained sector ($Treat$), and the interaction between post-treatment year and our treatment variable $Post2018 * Treat$. Each column represents our outcome variables, both with or without controls. ***: p-value < 0.005, **: p-value < 0.01, *: p-value < 0.05

Figure 5.3: Dynamic DiD MRPK Dispersion



Notes: The figure show the estimates of the interaction between post-treatment year and our treatment variable $Post2018 * Treat$, from the regression in equation 4.2.

Figure 5.4: MRPK Dispersion Yearly Estimates



Notes: The figure shows estimates for OLS regressions with MRPK dispersion as the outcome variable and the yearly dummies and controls as independent variables. The estimates are run separately for the treatment and control group.

5.2 Robustness

Below we describe several robustness checks we perform and discuss if and how they may change the interpretation of our results.

5.2.1 Indicies

As mentioned in Section 3 we use, in addition to MRPK, three indices as our treatment variable for our firm-level analysis as a robustness check. We rerun the same regression specifications. Below follows a short description of each index, how they are constructed and the results from each regression. Table 5.4 shows descriptive statistics of each index.

5.2.1.1 Kaplan Zingales Index

The Kaplan Zingales index, KZ-index, developed by Lamont et al. (2001), is derived from a predictive model for financial constraints introduced by Kaplan and Zingales (1997). This index quantifies the level of financial constraints faced by a firm inferred from observable characteristics such as cash flow, market-to-book ratio, and debt level, with higher scores indicating more significant constraints. Lamont et al. (2001) and Kaplan and Zingales (1997) focused on publicly listed firms. Baker et al. (2003) extended the index to unlisted firms. The KZ-index mainly considers firms' internal financial constraints and does not control for external financing constraints. For example, it does not consider firms' size or age. As our sample consists of unlisted firms, we adopt the Baker et al. (2003) version of the KZ-index. This approach has also been applied to a European sample by Asdrubali et al. (2022). We calculate the KZ-index following Asdrubali et al. (2022) and Baker et al. (2003) where all variables (except *Financial leverage*) are scaled with respect to beginning-of-the-year total assets and winsorised at 1% and 99 %. *Cash flow* is calculated as described in Section 3; *Financial leverage* is calculated by taking the sum of current and non-current liabilities and dividing with the sum of liabilities and total equity and *Dividend-ratio* is a variable in our data set for distributed dividends.

$$KZ_{it} = -1.002 CashFlow_{it} + 3.139 Financialleverage_{it} - 39.368 DividendRatio_{it} - 1.313 CashHoldings_{it} \tag{5.1}$$

5.2.1.2 Whited Wu Index

The Whited and Wu (WW) index, developed by Whited and Wu (2006), represents an alternative approach to the KZ-index. The WW-index considers both internal and external financial constraints, taking into account firm size, which reflects firms' degree of external financial constraints, as well as firms' leverage, profitability, and growth prospects, which encompass firms' internal constraints. We calculate the WW-index following Whited and Wu (2006) and Asdrubali et al. (2022) where all variables are scaled with respect to beginning-of-the-year total assets. $Cashflow_{it}$ is calculated as described in the Data section; *Dividend* is a

dummy if the firm has paid out dividends in the current period; $TLTD_{it}$ is total long-term debt; LTA_{it} is the natural logarithm of total assets, SSG_{jt} is the corresponding sector's growth and SSG_{it} is firm sales growth. All values have been adjusted and expressed in terms of 1997 US million dollars to match the parameters in Whited and Wu (2006), following the approach of Asdrubali et al. (2022).

$$WW_{it} = -0.091CashFlow_{it} - 0.062Dividend_{it} + 0.021TLTD_{it} - 0.044LTA_{it} + 0.102SSG_{jt} - 0.035SG_{it} \quad (5.2)$$

5.2.1.3 Hadlock Pierce Index

The Hadlock and Pierce index, often referred to as the SA-index, is another development of KZ-index. Hadlock and Pierce (2010) evaluated the KZ and WW-index and concluded that financial constraints correlated with firm size and firm age. The SA-index therefore only focuses on the size and age of a firm as the primary indicators of financial constraints. The rationale is that smaller and younger firms are generally more likely to face difficulties in accessing external capital due to their higher risk profiles and lower collateral values. Given this, the SA index only identifies firms facing external financing constraints. We calculate the SA-index as stated below where $Size$ is measured as the natural logarithm of total assets (Hadlock & Pierce, 2010) and firm age is defined as the number of years between the company started its business and today, following Asdrubali et al. (2022). Asset values have been adjusted and expressed in terms of 2004 US dollars to match parameters. As Hadlock and Pierce (2010) we have capped Size at the logarithm of 4.5 billion US dollars and age at 37 years. This is done as Hadlock and Pierce (2010) find that the relationship between financial constraints and the firm characteristics size and age is flat above these cutoffs.

$$SA_{it} = -0.737Size_{it} + 0.043Size_{it}^2 - 0.04Age_{it} \quad (5.3)$$

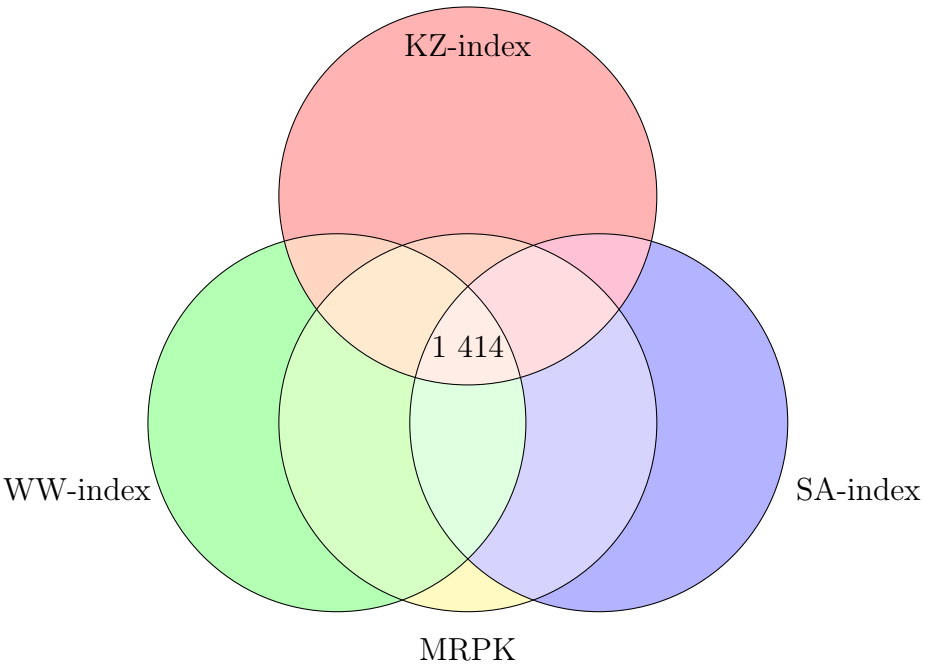
5.2.1.4 Descriptive Statistics

Table 5.4: Descriptive Statistics for MRPK, KZ, WW and SA variables.

	Mean	Median	Std. Dev.	Observations
Total sample				
MRPK	2.118	1.933	1.216	36 744
KZ	-0.837	0.199	3.578	36 744
WW	-0.005	0.001	0.049	36 744
SA	-2.970	-2.912	0.642	36 744
Treatment				
MRPK	2.901	2.659	1.201	18 328
KZ	1.525	1.632	0.937	18 211
WW	0.030	0.030	0.027	18 306
SA	-2.478	-2.514	0.333	17 458
Control				
MRPK	1.338	1.337	0.546	18 416
KZ	-3.159	-2.203	3.693	18 533
WW	-0.04	-0.033	0.041	18 438
SA	-3.414	-3.282	0.519	19 286

Figure 5.5 shows the number of firms in treatment groups that overlap when using the indices and our main measure of financial constraints, MRPK. As seen in the figure, the treated firms vary substantially between the measurements and only 1 414 firms are classified as financially constrained by all. This could be reflective of the different types of financial constraints that the indices measure, as discussed above. We apply the indices as robustness as they are well-established in the literature. As seen in the figure, the MRPK measurement interacts relatively well with the indices, primarily the WW and SA-index. This strengthens our usage of the indices as robustness checks. However, given that the indices classify different firms as treated, the results are difficult to compare to each other. All in all, the four measurements classify 35 109 firms out of our entire sample of 36 774 firms as treated. This makes it difficult to synthesise the different results when using the different measurements of financial constraints. We discuss this further below, in section 5.2.1.5.

Figure 5.5: Interaction of Measurements of Financial Constraints



Notes: The figure highlights the overlap between the different treatment groups as identified by our different measurements of financial constraints in our firm-level analysis. The number of firms that interact with all four measurements is 1 414.

5.2.1.5 Results

We first consider the parallel trends of the outcome variables using the indices by running our dynamic specification with controls. The results are shown in Table 5.5. In Table 5.6, we present the results from Equation 4.1. The coefficient presented from each regression is the coefficient of interest, $Post2018 * Treat$, as described in our main results section.

Looking at the results for the regressions on productivity the indices yield different coefficient estimates than our MRPK measure. The $Post2018 * Treat$ coefficient is small and similar in magnitude for all measurements of financial constraints, however, applying the indices yields a positive effect on productivity. As stated above, when applying MRPK we find an effect of productivity loss of 0.028, significant at the 1% level. In contrast, with the KZ-index, we find an effect of 0.031, significant at the 0.05% level, with standard errors of similar relative magnitude as our estimates. This suggests that firms, that in general face tight internal financial constraints, see an increase in productivity in the post-reform period. The WW-index and SA-index both provide positive non-significant results. As concluded in Figure 5.5, the indices include partly different firms in their treatment groups, and thus the results for the $Post2018 * Treat$ coefficient when using different indices are difficult to compare. When only including firms that are identified as financially constrained by both MRPK and all three indices (1 414 observations) in the treatment group, we find no significant results. While this result is not consistent with our hypothesis, it is partially consistent with our main results as we

find that the reform did not increase capital misallocation. It should, however, be noted that the sample size of the treatment group is very small in relation to the control group.

Looking at taxes, our main result suggested that financially constrained firms paid in average SEK 83 thousand more in taxes in the post-reform period compared to unconstrained firms. Applying the KZ-index also yields a positive $Post2018 * Treat$ coefficient of SEK 157.802 thousand, significant at the 0.5 % level. Meaning an average effect of SEK 158 thousand more in tax payments as a result of the reform. This suggests that firms facing tight internal financial constraints, which often implies higher leverage, pay more in taxes during the post-treatment period due to diminished opportunities for interest deductions. The SA-index provides a non-significant negative value and when applying the WW-index the parallel trends assumption does not hold for taxes.

Examining the effects on liabilities, the indices show similar results as our MRPK measure. The MRPK measure yields a significant negative result of SEK -20377.248 thousand, significant at the 5% level. For both the KZ and WW-index, the $Post2018 * Treat$ coefficient is negative and significant. The KZ-index yields a negative estimate of SEK -21553.878 thousand, significant at the 5% level, and the WW-index estimate stands at SEK -36038.274 thousand, significant at the 0.5% level. As previously discussed, firms with elevated KZ-index and WW-index levels may be heavily leveraged, thus compelled to reduce their loans in response to the reform. Meanwhile, the SA-index exhibits a positive value of SEK 22903.505 thousand, significant at the 5% level. One plausible explanation is that firms with high SA-index values are typically young and small enterprises, which might not be highly leveraged and hence less affected by the reform. Consequently, they may be able to continue increasing their liabilities in the post-treatment period.

None of the indices exhibit significant effects on net interest expenses or labour investments. The SA-index displays a negative coefficient when looking at capital investment of -0.244, significant at the 5 % level, while the other indices and MRPK all yield non-significant values.

Overall, there is no outcome variable where all four measurements yield the same direction in terms of positive or negative results. However, as discussed above, the indices measure different types of financial constraints and when applying them we consider partly different firms as treated. When using our other measurements of financial constraints we find that our estimates on liabilities and taxes are robust with significant results. This shows that the reform did have a direct impact on firms with financial constrains.

Table 5.5: Parallel Trends Assumption

Dependent Variable	KZ-index	WW-index	SA-index
Productivity	✓	✓	✓
Taxes	✓		✓
Liabilities	✓	✓	✓
Net Interest	✓	✓	✓
Labour Investment	✓	✓	✓
Capital Investment	✓	✓	✓
Sector fixed effects	✓	✓	✓
Year fixed effects	✓	✓	✓
Controls			
Firm Age	✓	✓	N/A
Firm Size (Employees)	✓	✓	N/A
Sales Growth Control	✓	✓	✓

Notes: The table shows whether each outcome variables follow a parallel trend for each index.

Table 5.6: Main Specification Indices Results

	Coefficient Post2018*Treat (Std. Err.)			
Dependent Variable	MRPK	KZ-index	WW-index	SA index
Productivity	-0.028^{**}	0.031^{***}	0.015	0.008
(Revenue per unit)	(0.011)	(0.011)	(0.011)	(0.011)
Taxes	83.655^{**}	157.802^{***}	-110.622^{***}	-30.517
(SEK thousand)	(30.916)	(30.225)	(31.001)	(31.217)
Liabilities	$-20377.248*$	-21553.878^{*}	-36038.274^{***}	22903.505^{*}
(SEK thousand)	(10268.936)	(9698.826)	(10217.581)	(10319.765)
Net Interest	315.424	-102.792	36.468	-108.256
(SEK thousand)	(270.259)	(275.001)	(282.324)	(282.417)
Labour Investment	0.641	-0.799	-0.830	1.050
(Per cent)	(0.851)	(0.837)	(0.827)	(0.890)
Capital Investment	0.026	-0.099	-0.052	-0.244^{*}
(Per cent)	(0.102)	(0.101)	(0.101)	(0.101)
Fixed effects	Year Sector	Year Sector	Year Sector	Year Sector
Observations	36 744	36 744	36 744	36 744
Controls				
Firm age	✓	✓	✓	-
Firm size	✓	✓	✓	-
Sales growth	✓	✓	✓	✓

Notes: All columns show difference-in-differences estimates following Equation 4.1 and display the interaction between post-treatment year and our treatment variable $Post2018 * Treat$. ***: p-value < 0.005, **: p-value < 0.01, *: p-value < 0.05

5.2.2 All Firms Analysis

In our main firm analysis, we consider within-sector variation in the level of MRPK. But our own classification may result in an imprecise identification as firms that we identify as financially constrained might in fact not be financially constrained relative to other firms in general, but only relatively financially constrained in their sector. By comparing firms' financial constraints to all other firms in our sample, this analysis will help us discover the effects of the reform on the entire economy. In this analysis, we therefore split the entire sample into two groups based on the median values of MRPK and the KZ, WW and SA indices. We run the main regression as stated in Equation 4.1. These results are presented in Table A.1 (parallel trend assumptions), Table A.2 (main specification MRPK) and Table A.3 (main specification indices).

When running the main regressions, the coefficient of interest is $Post2018 * Treat$. We find a positive and significant effect on tax payments of SEK 104.404 thousand, significant at the 0.5% level. This is true both with and without controls. This can be interpreted as that financially constrained firms faced higher tax payments as a result of the reform, in comparison to unconstrained firms. However, this result should be interpreted with caution as it does not meet the parallel trends assumption. We find no other significant results in the main specification.

When running the main regression using the indices as our treatment variable instead of MRPK, we find partially different results. Looking at tax payments, the KZ-index elicits a coefficient of SEK 151.517 thousand and the WW-index a coefficient of SEK -131.514 thousand, both significant at the 0.5% level. The SA-index yields a positive non-significant result. For liabilities, the indices also yield different but significant results. Similar to the estimates when we apply MRPK, the KZ-index yields a negative coefficient of SEK -163.757 thousand, significant at the 0.5% level. The WW-index yields a positive coefficient of SEK 123.437 thousand, significant at the 5% level. However, the WW-result should be interpreted with caution as it does not meet the parallel trends assumption. The different results suggest that our results when applying the treatment variable MRPK to all firms, may not be very robust. Other than these contradicting results, there are no significant results.

The significant positive effect on tax payments is in line with our hypothesis that financially constrained firms increased their tax payments as a direct effect of the reform compared to unconstrained firms. However, since taxes does not follow parallel trends before the reform for the all firms analysis, this result needs to be interpret with caution. In this analysis, we find no significant results on productivity or liabilities. In other words, we can conclude that the reform most likely did not affect firms that, relative to all other firms in the economy, are financially constrained. However, firms operate in very different sectors with different average levels of MRPK. Therefore, our main firm analysis results can still be accurate, given that they elicit the within sector relative effects.

5.2.3 Other Robustness Checks

5.2.3.1 Outliers

In this section, we examine if our main results change when we exclude the impact of outliers in treatment assignments. In our analyses, there is a risk of bias stemming from the fact that we identify treatment as having a RZ-index or MRPK value above the sample or sector median. For instance, sectors with extremely high RZ-index values or firms with extremely high MRPK values could skew the results. We handle this bias by also running our regressions comparing percentiles to reduce the impact of outliers. More specifically, we restrict the sample to comparing the 70th-90th percentile to the 15th-25th for the main firm analysis and the 65th-95th percentile to the 10th-30th for the sector analysis. Since our sample consists of 61 sectors, we allow our robustness check, excluding outliers, to be less restrictive in our sector analysis. These results are presented in our appendix in Table A.4 (sectors), Table A.5 (firms) and Table A.6 (MRPK dispersion). When running the sector regressions for the sample restricted to the percentiles, we find no significant results that challenge our main results for our coefficient of interest, $Post2018 * Treat$. When running the firm regressions for the sample restricted to the percentiles we find no significant results for our coefficient of interest $Post2018 * Treat$. This suggests that it is the firms in the 90th percentile and above that are driving the results in the firm regressions. To more closely study where the effects are coming from we also run the main specification regression for our firm analysis with firms with MRPK values in the 75th percentile and above as the treatment group. We find similar positive significant results for tax payments. Otherwise, we find no results that challenge our main results. This further indicates that the observed effects in the firm regressions are primarily driven by firms in the 90th percentile and above. When running the regression studying MRPK dispersion for the sample restricted to the percentiles we find no significant results for our coefficient of interest, $Post2018 * Treat$, that challenge our main results.

5.2.3.2 Treatment Year Test

In this section, we examine if our results change when we set 2019 as the treatment year. In our main regressions, we set the treatment year to 2018. However, the actual limitations to interest expense deductions were in 2019. In selecting 2018 we assume that firms already started to adjust their financing structure in response to the impending threat of higher tax payments. However, this might not be a valid assumption for all firms in our sample. We control for this by running the same regressions using the treatment year 2019. These results are presented in Table A.7 (sector level), Table A.8 (firm level), and Table A.9 (MRPK dispersion). When running the sector regressions with 2019 as the treatment year we find no significant results on our coefficient of interest $Post2019 * Treat$. This could show that our reasoning that firm started to adjust in anticipation of the reform already in 2018 is sound. Another interpretation of this is that the reform did not impact firms at all, and that our results are driven by other events in 2018.

5.2.3.3 Sample Composition

In this section, we examine if our results change when we run our regressions using different sample compositions. First, we include all stock companies in Sweden. However, all other adjustments to the data as described in Sector 3, e.g., the exclusion of sectors severely affected by COVID-19, are still applied. We do this in order to see if the results change when we use less conservative sample restrictions and consider the effects of firms that for example hold no or small debt. As the new rules that the reform brought about applied to all firms, one could argue that they posed a potential effect on all Swedish companies. If the results are similar, this could be indicative that our results are driven by something else than the reform. Second, we narrow our main sample more conservatively, excluding group companies that do not have high limits of debt. The reason we include these firms in our main sample, is that we cannot identify what groups belong to the same company group or community of interest. As the simplification rule applies to all companies in the same group, we include these firms in our main sample as they may be affected. However, in this section, we exclude them to see if our results differ as we remove some of the noise. This can thus be seen as a test of the precision of our results. The results from these regressions are found in Table A.10. The results are overall consistent with our main results. The only significant result is on productivity and taxes in the firm-level analysis run on the whole sample, where the coefficient of interest for productivity shows a value of -0.027, significant at the 0.5% level, compared to our main result at -0.028, significant at the 1% level. The coefficient of interest for taxes shows a positive, but smaller, value. However, when we restrict our sample more and exclude companies this significant effect disappears. One potential explanation could be that group companies with lower debt levels than our original sample restriction conditions (SEK 3 million in net interest expenses or SEK 120 million in debt) drive the effect in our main sample. Another explanation could be the substantially smaller sample size. The fact that the standard errors increase substantially indicates a loss of precision when restricting the sample.

6 Discussion

The main finding of this paper is that the implementation of BEPS in Sweden led to that financially constrained firms payed more in taxes, decreased their debt and saw lower productivity, compared to unconstrained firms.

When looking at the firm-level dynamic specification, where the yearly results helps us to decompose the immediate and later effects, we find a downward sloping trend in liabilities. In 2020, firms had decreased their liabilities significantly compared to 2017. This result is in line with Buslei and Simmler (2012), who found that firms in Germany adjusted their debt to stay below the set interest expense threshold in response to TCRs. Such behaviour could also be what is driving our main results as we find a decrease in debt levels for financially constrained firms. When looking at the indices the result stands when using the KZ-index and the WW-index, which suggests our results are robust. In addition, the fact that we find that financially constrained firms increased their tax payments in the post-reform period partially tells a different story. If constrained firms decreased their liabilities to avoid increased tax payments, we should not find a significant result that they pay more in tax. We find that tax payments increased in average with SEK 83 thousand for financially constrained firms, which compared to the mean of the treatment group at SEK 1 225 thousand is a rather small increase. However, there might be several forces at play that are difficult to distinguish. For example, even though firms tried to lower their liabilities to avoid increased tax payments, they could still have been impacted by the reform. We hypothesised that this would be the case. The fact that the change to average pre-reform debt levels is substantially larger than the change to average pre-reform tax payments is also consistent with our hypothesis. In addition, by looking at the dynamic specification we can see a small yearly increase of tax payments, with a significant increase at 2020, the year after the policy implementation, which supports our hypothesis. It should be noted that the lowering of the corporate tax rate in 2019 would have reduced the impact of the increased tax payments firms faced after the new limitations to interest deductions.

We hypothesised that the impact on firms' financing and tax payments would impact their investments and productivity. For example, as financially constrained firms decrease their liabilities, which our results indicate, or if constrained firms pay more in taxes, which our results suggest, they may face tighter financial constraints and have to scale back operations in ways which would reduce their productivity.

We find that the reform led to significant productivity losses for firms with financial constraints compared to unconstrained firms. The effect on productivity is negative and significant for our main sample in both the dynamic and main specification. This holds true both with and without controls. When only considering the percentiles, the negative significance disappears. The decrease in productivity for financially constrained firms is in line with our hypothesis. As the reform affected firms' costs of capital, the reform should have affected firms' productivity. If productivity decreases due to tightened financial constraints, MRPK should also increase for these firms, which should increase capital misallocation, that we measure by MRPK dispersion.

We find no significant effect for the investment variables, in contrast to de Mooij and Liu (2021) who found that TCRs can affect investments negatively.

In the sector analysis, we find no significant results when studying the effects of the reform on our outcome variables. This holds true both with and without controls, and in our robustness checks where we first control for the impact of very high and low RZ-index values as well as different sample compositions. One explanation for this could be that the RZ-index is not constant across sectors and that it therefore fails to account for the differential effects of the reform on firms. As discussed by Villani (2021), the RZ-index might not be constant across sectors, which questions the foundation of the index, namely that the financial constraints are a direct result of sectors' technological constraints. Another suggestive indicator of the weakness of RZ-index is that the sectors in our treatment group vary a lot in their characteristics. On the one hand, we see that industries such as agriculture, forestry, fishing, and aquaculture have high RZ-index values. One could imagine that these sectors generally face, for example, seasonal cash flows and substantial upfront investments in equipment and land. Similarly, sectors like civil engineering, construction, and manufacturing may have significant capital needs due to infrastructure, technology, and labour costs. On the other hand, we see that sectors like management consultancy, employment services, information, and professional, scientific, and technical activities also show high RZ-values. It is not as clear why these sectors would be relatively financially constrained as they overall have lower physical capital needs. To address the potential issue that the RZ-index does not correctly identify financially constrained firms, we run the sector analysis regression applying MRPK as the treatment variable instead of the RZ-index. When doing this our results do not change. This supports our non-significant results in the sector analysis. Another explanation for our non-significant results is that the reform simply did not affect more financially constrained sectors as a whole in comparison to unconstrained sectors, which highlights the importance of our firm level analysis.

In our *all* firms analysis, where we study the effects of the reform on firms who are financially constrained relative to the entire economy median we find no significant results either. This holds true both with and without controls, and when applying the indices. This can be interpreted as that the reform most likely did not affect firms that relative to all other firms in the economy are financially constrained. However, firms operate in very different sectors with different average levels of MRPK. One explanation to the null results could therefore be that the difference in average MRPK levels is substantially larger than the magnitude of the reform's effect.

We find no significant results when studying the effects of the reform on capital misallocation which we measure using MRPK dispersion. This holds true both with and without controls and when controlling for the impact of very high and low RZ-index values. On the one hand, our non-significant result on MRPK dispersion is inconsistent with our result that productivity decreased, as the decrease in productivity should be driven by an increase in MRPK for treated firms. Our measurement of MRPK dispersion only captures the effect of capital misallocation within treated sectors. However, as seen in Figure 5.4 MRPK dispersion seems to

decrease across overall during this time. Nevertheless, the total effects of capital misallocation within sectors are ambiguous as the reform affected productive and unproductive firms in very different ways. For example, Melz et al. (2018) predicted that the reform could lead to a lower number of highly leveraged companies with low returns on their assets. After the reform, highly leveraged companies with low-yielding investments would have experienced higher corporate tax payments compared to pre-reform levels, while highly leveraged firms with high-yielding investments would have been less affected, as the increased EBITDA from these investments expands their potential deductions space. Conversely, low-leveraged companies with high-yielding investments would have seen reduced corporate tax expenses. This redistribution of the tax burden could also have affected capital misallocation, with highly leveraged firms with unproductive investments being targeted. In this sense, the redistributed tax burden would have contributed to potentially improving the misallocation of capital within sectors. The reform should have affected the financing decisions of investments. Prior to the reform, the deductibility of interest expenses was of greater significance. The reform effectively reduced this significance and thus discouraged low-yielding investments financed with debt. We have not captured this effect directly. However, our non-significant results on labour and capital investments suggests that this effect either not large or not visible given our short post-reform research period.

One important factor that impact our results, is the low interest rates during our research period. At the time of the reform, loans of SEK 200 million were needed to meet the limit of the simplification rule. Considering today's substantially higher interest rates[18], a loan of SEK 50 million would be enough to hit the interest deduction limit.[19] The difference is thus significant. In our sample of firms, just over 260 firms met our requirements set to reflect firms who potentially were affected by the reform (liabilities exceeding SEK 120 million, net interest to EBITDA ratio exceeding 20%, net interest exceeding SEK 3 million). Given the significantly higher interest rates today, all else being equal, the number of affected firms would likely have been considerably higher. Despite that firms would have adapted their financing structure in the face of rising interest rates, it is not unlikely that the number of firms that have become affected by the reform since its implementation is very high given the increase in interest rate.

[18]Following the development of the Swedish Central Bank's interest rate and assuming an average corporate loan rate of 10 %.
[19]In regards to the simplification rule.

7 Conclusion

In this paper, we examine the effect of the Swedish implementation of limitations to interest deductions (BEPS Action 4) on financially constrained firms. We use a balanced panel data set of Swedish stock companies active between 2014 and 2021. We consider the effect of the reform on both sectors and firms. We study the comparative effects on firms and sectors by their relative level of financial constraints. For the sector-level analysis, the Rajan-Zingales index is used to measure financial constraints. For the firm-level analysis we use firms' relative marginal returns to capital and the most well-established indices for financial constraints.

The main findings of this paper are that the implementation of BEPS Action 4 led financially constrained firms to pay more in taxes and decrease their debt, compared to unconstrained firms. We also find that financially constrained firms saw productivity losses following the reform. However, given that we find no indication that capital misallocation, as seen by MRPK dispersion, increased, this suggests that other events or conditions may have affected productivity development, apart from tightened financial constraints.

Our results show that the implementation of BEPS Action 4 had significant effects on financially constrained firms. These findings are in line with Buettner et al. (2012), Buslei and Simmler (2012) and Wamser (2013), as we show that firms reduce their debt levels as a response to these specific thin-capitalisation rules. We contribute to the literature on thin-capitalization rules by showing that the Swedish reform was successful in reducing average debt levels while not hurting firms' investments and without increasing capital misallocation.

This paper suffers from some limitations. For example, the broad effects of the COVID-19 pandemic on firms' financing decisions and performance. While we succeed in controlling for some of the impact of the pandemic, it is difficult to isolate the impact of the policy in 2020 or 2021. For example, the public grants paid out by the Government affect our results. As these grants were direct cash transfers they may have mitigated increased financing costs caused by the interest deductions reform. This source of bias remains despite the exclusion of severely affected industries since the support was so broadly distributed. The report by Ekholm, Nordström Skans et al. (2022) shows that two-thirds of all firms with significant falls in revenue during the pandemic year 2020 would have experienced a similar drop during normal times. Consequently, cash transfers to these firms, based on a mistaken attribution of their negative turnover trends to the pandemic, may have skewed our results. Another limitation relates to the fact that in the same year as the policy of study was implemented, the corporate taxation rate decreased. This reduces the potential effect of the implementation of the recommendation, BEPS Action 4, which can explain our ambiguous results.

For further research, exploring the reform's effects with more recent data could provide valuable insights, particularly considering its close correlation with prevailing interest rates. BEPS is a EU-wide and OECD-wide policy, and therefore, extending the analysis and considering the effects in other countries as well as cross-country effects would be of interest. Moreover, it would be interesting to continue to study the effects

of thin capitalisation rules on investments, productivity, and capital misallocation.

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A Appendix

A.0.1 All Firms Analysis

In this section, we run our regressions on the firm level, but do not run the analysis within sectors. Rather, we treat firms that are above the sample median (by MRPK or indices values) as financially constrained. We run the same regressions with the same sample.

In Table A.1 we present for which outcome variables the parallel trend assumption holds for each index.

Table A.1: Dynamic DiD Specification All Firms

Dependent Variable	MRPK	KZ-index	WW-index	SA-index
Productivity	✓	✓		
Taxes		✓		
Liabilities	✓	✓	✓	✓
Net Interest	✓	✓	✓	✓
Labour Investment	✓	✓	✓	✓
Capital Investment	✓	✓		✓
Sector fixed effects	✓	✓	✓	✓
Year fixed effects	✓	✓	✓	✓
Firm Age	✓	✓	✓	N/A
Firm Size (Employees)	✓	✓	✓	N/A
Sales Growth	✓	✓	✓	✓

Notes: The table shows whether each outcome variables follow a parallel trend for each index.

A.0.1.1 Results

Table A.2: Main Specification All Firms

	Productivity		Taxes		Liabilities		Net Interest		Labour investments		Capital investments	
	(Revenue per unit)		(SEK thousand)		(SEK thousand)		(SEK thousand)		(Per cent)		(Per cent)	
Treat	0.367***	0.376***	-279.074***	-273.827***	-363.974***	-386.933***	-622.872***	-498.104***	-0.136	-0.012	0.074	0.091
	(0.018)	(0.018)	(48.662)	(50.389)	(82.687)	(82.518)	(193.609)	(170.565)	(0.116)	(0.101)	(0.069)	(0.069)
Post2018Treat	0.003	0.000	104.404***	107.108***	-83.139	-79.291	224.509	231.096	1.005	1.003	-0.126	-0.139
	(0.010)	(0.009)	(30.515)	(30.248)	(52.992)	(52.908)	(274.646)	(275.721)	(0.847)	(0.839)	(0.102)	(0.101)
Firm age	-0.005***		16.459***		17.330***		-17.128		-0.009		-0.006*	
	(0.001)		(2.575)		(3.916)		(11.536)		(0.006)		(0.003)	
Firm Size	-0.000*		1.186***		0.423**		2.791***		0.003*		-0.000***	
	(0.000)		(0.342)		(0.153)		(0.950)		(0.001)		(0.000)	
Sales Growth	0.057		252.295*		74.088		48.333		0.529		0.519	
	(0.030)		(115.640)		(53.506)		(153.444)		(0.425)		(0.293)	
Fixed effects	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year
	Sector	Sector	Sector	Sector	Sector	Sector	Sector	Sector	Sector	Sector	Sector	Sector
Observations	36 744	36 744	36 744	36 744	36 744	36 744	36 744	36 744	36 744	36 744	36 744	36 744
Controls	✓		✓		✓		✓		✓		✓	

Notes: All columns show difference-in-differences estimates following Equation 4.1 and display the average effect of being a financially constrained firm ($Treat$), and the interaction between post-treatment year and our treatment variable $Post2018 * Treat$. Each column represents our outcome variables, both with or without controls. ***: p-value < 0.005, **: p-value < 0.01, *: p-value < 0.05

Table A.3: Indices All Firms

	Coefficient Post2018*Treat (Std. Err.)			
Dependent Variable	MRPK	KZ-index	WW-index	SA-index
Productivity	−0.003	0.020*	0.020*	−0.015
(Revenue per unit)	(0.010)	(0.010)	(0.010)	(0.010)
Taxes	104.404***	151.517***	−131.514***	16.468
(SEK thousand)	(30.515)	(30.257)	(30.666)	(30.712)
Liabilities	−83.139	−163.757***	123.437*	−4.076
(SEK thousand)	(52.992)	(52.815)	(53.054)	(53.677)
Net Interest	224.509	−311.542	29.977	−98.545
(SEK thousand)	(274.646)	(272.737)	(281.494)	(281.483)
Labour Investment	1.005	−0.814	−0.831	0.900
(Per cent)	(0.847)	(0.846)	(0.831)	(0.883)
Capital Investment	−0.126	−0.094	0.053	−0.143
(Per cent)	(0.102)	(0.101)	(0.101)	(0.101)
Fixed effects	Year	Year	Year	Year
	Sector	Sector	Sector	Sector
Observations	36 744	36 744	36 744	36 744
Controls				
Firm Age	✓	✓	✓	-
Firm Size (Employees)	✓	✓	✓	-
Sales Growth Control	✓	✓	✓	✓

Notes: All columns show difference-in-differences estimates following Equation 4.1 and display the interaction between post-treatment year and our treatment variable $Post2018 * Treat$. ***: p-value < 0.005, **: p-value < 0.01, *: p-value < 0.05

A.0.2 Outliers

In this section, we limit our sample and only consider the 15th-25th and 70th-90th percentile for the firm-level analysis and the 10th-30th and 65-95th for our sector analysis. We run the same regressions. We do this in order to see if the results differ from our results due to extreme values. Since the sector analysis consists of 61 sectors we cannot restrict our sample as much as for the firm analysis.

A.0.2.1 Sector

The parallel trends assumption holds for all outcome variables except productivity and labour investments.

Table A.4: Percentiles Sector Analysis

	Productivity		Taxes		Liabilities		Net Interest		Labour investments		Capital investments	
	(Revenue per unit)		(SEK thousand)		(SEK thousand)		(SEK thousand)		(Per cent)		(Per cent)	
Treat	-0.401	-0.460*	-347.092	-537.421	-19975.692	11048.198	-510.895***	37.653	-0.181***	-0.002	-0.097	-0.133
	(0.156)	(0.201)	(158.219)	(244.112)	(29729.088)	(19076.842)	(116.381)	(192.849)	(0.003)	(0.008)	(0.076)	(0.108)
Post2018Treat	0.002	0.001	2.875	5.190	70.448	161.225	-0.267	-4.015	0.000	-0.000	0.000	-0.002
	(0.005)	(0.003)	(2.131)	(3.843)	(119.557)	(276.251)	(0.974)	(3.047)	(0.000)	(0.000)	(0.000)	(0.003)
Firm age	-0.067		-73.290		-5934.583		382.114***		-0.003		-0.064	
	(0.037)		(45.070)		(21013.438)		(56.680)		(0.002)		(0.032)	
Firm Size	0.000		0.483***		719.363		1.610		0.000		0.001	
	(0.000)		(0.137)		(471.145)		(1.574)		(0.000)		(0.001)	
Sales Growth	13.438*		29890.586***		394818.896		-11124.313*		0.619***		4.736*	
	(4.748)		(7093.409)		(4303.326)		(0.103)		(1.740)		(2.097)	
Year fixed effects	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year
Controls	✓		✓		✓		✓		✓		✓	
Observations	29	29	29	29	29	29	29	29	29	29	29	29

Notes: All columns show difference-in-differences estimates following Equation 4.1 and display the average effect of being a financially constrained sector ($Treat$), and the interaction between post-treatment year and our treatment variable $Post2018 * Treat$. Each column represents our outcome variables, both with or without controls. ***: p-value < 0.005, **: p-value < 0.01, *: p-value < 0.05

A.0.2.2 Firm

The parallel trend assumption holds for all but capital investments.

Table A.5: Percentiles Firm Analysis

	Productivity		Taxes		Liabilities		Net interest		Labour investments		Capital investments	
	(Revenue per unit)		(SEK thousand)		(SEK thousand)		(SEK thousand)		(Per cent)		(Per cent)	
Treat	0.395***	0.405***	-274.118***	-259.634***	-37218.417***	-14915.917	-533.205*	-439.578*	0.013**	0.019***	0.180*	0.196*
	(0.028)	(0.028)	(80.471)	(85.855)	(7768.374)	(12433.642)	(211.558)	(197.261)	(0.005)	(0.005)	(0.079)	(0.080)
Post2018*Treat	-0.013	-0.015	158.762***	158.807***	-2664.085	-1363.182	261.987	263.386	-0.012	-0.017	-0.126	-0.143
	(0.019)	(0.019)	(55.997)	(55.958)	(5835.213)	(6442.003)	(179.046)	(180.271)	(0.009)	(0.009)	(0.122)	(0.122)
Firm age	-0.005***		14.644***		-264.512		-16.932*		-0.001***		-0.005	
	(0.001)		(4.305)		(374.526)		(8.456)		(0.000)		(0.003)	
Firm Size	-0.000***		1.915***		849.802***		2.018		0.000		-0.000*	
	(0.000)		(0.507)		(74.484)		(1.425)		(0.000)		(0.000)	
Sales Growth	0.022		138.508		1538.083		-38.529		0.099		0.337	
	(0.022)		(87.814)		(2430.439)		(61.064)		(0.078)		(0.331)	
Fixed effects	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year	Year
	Sector	Sector	Sector	Sector	Sector	Sector	Sector	Sector	Sector	Sector	Sector	Sector
Observations	11 968	11 968	11 968	11 968	11 968	11 968	11 968	11 968	11 968	11 968	11 968	11 968
Controls	✓		✓		✓		✓		✓		✓	

Notes: All columns show difference-in-differences estimates following Equation 4.1 and display the average effect of being a financially constrained firm ($Treat$), and the interaction between post-treatment year and our treatment variable $Post2018 * Treat$. Each column represents our outcome variables, both with or without controls. ***: p-value < 0.005, **: p-value < 0.01, *: p-value < 0.05

A.0.2.3 MRPK Dispersion

The parallel trend assumption holds for MRPK dispersion

Table A.6: Analysis of Log Variance MRPK

	Log Variance MRPK	
Treat	0.324	0.173
	(0.336)	(0.341)
Post2018*Treat	0.001	-0.008
	(0.065)	(0.050)
Firm age	-0.299*	
	(0.129)	
Firm size	-0.007*	
	(0.003)	
Sales growth	-3.250	
	(9.450)	
Fixed effects	Year	Year
Observations	29	29
Controls	✓	

Notes: the columns show difference-in-difference estimates following Equation 4.1 and display the average effect of being a financially constrained sector ($Treat$), and the interaction between post-treatment year and our treatment variable $Post2018 * Treat$. Each column represents our outcome variables, both with or without controls. ***: p-value < 0.005, **: p-value < 0.01, *: p-value < 0.05

A.0.3 Treatment Year Test

In this section we change the treatment year to the actual reform year 2019 to examine if this changes our results. We run the same regressions.

A.0.3.1 Sector Level

The parallel trend assumption holds for all outcome variables.

Table A.7: Alternative Year Test Sector Level

	Post2019*Treat
Productivity	−0.001
	(0.002)
Taxes	0.439
	(3.552)
Liabilities	−1184.250
	(1016.015)
Net Interest	−8.689
	(8.558)
Investment Labour	−0.010
	(0.007)
Investment Capital	−0.003
	(0.002)
Fixed effects	Year
Controls	
Firm Age	✓
Firm Size	✓
Sales Growth	✓
Observations	36 774

Notes: The table shows the difference-in-differences estimates following Equation 4.1 for the sector level alternative year test, and displays the interaction between post-treatment year and our treatment variable $Post2018 * Treat$. The column represents our outcome variables with controls. ***: p-value < 0.005, **: p-value < 0.01, *: p-value < 0.05

A.0.3.2 Firm Level

The parallel trend assumption holds for all outcome variables.

Table A.8: Alternative Year Test Firm Level

	Post2019*Treat
Productivity	−0.001
	(0.002)
Taxes	0.439
	(3.552)
Total Liabilities	−1184.250
	(1016.015)
Net Interest	−8.689
	(8.558)
Investment Labour	−0.010
	(0.007)
Investment Capital	−0.003
	(0.002)
Fixed effects	Year
	Sector
Controls	
Firm Age	✓
Firm Size	✓
Sales Growth	✓
Observations	36 774 obs

Notes: The table shows the difference-in-differences estimates following Equation 4.1 for the firm level alternative year test, and displays the interaction between post-treatment year and our treatment variable $Post2018 * Treat$. The column represents our outcome variables with controls. ***: p-value < 0.005, **: p-value < 0.01, *: p-value < 0.05

A.0.3.3 MRPK Dispersion

The parallel trend assumption holds MRPK dispersion.

Table A.9: Alternative Year Test MRPK Dispersion

36 744 obs.	**Post2019*Treat**
MRPK Dispersion	−0.011
	(0.045)
Year fixed effects	✓
Controls	
Firm Age	✓
Firm Size	✓
Sales Growth	✓

Notes: The table shows the difference-in-difference estimates following Equation 4.1 for MRPK-dispersion alternative year test, and displays the interaction between post-treatment year and our treatment variable $Post2018 * Treat$. The column represents our outcome variables with controls. ***: p-value < 0.005, **: p-value < 0.01, *: p-value < 0.05

A.0.4 Sample Composition

Table A.10: Results Sample Restriction

	Whole sample		Main sample		Restricted sample	
	Sector	Firm	Sector	Firm	Sector	Firm
Productivity	0.001	−0.027***	−0.013	−0.024*	−0.004	0.027
	(0.001)	(0.006)	(0.008)	(0.010)	(0.005)	(0.038)
Taxes	0.867	53.958***	45.330	80.894**	−7.572	−104.297
	(2.185)	(16.693)	(35.009)	(30.831)	(13.780)	(250.755)
Liabilities	−283.475	−9413.914	−2081.013	−20377.248*	7754.346	−130942.611
	(364.961)	(5058.440)	(8141.003)	(10268.936)	(5465.762)	(67045.597)
Net Interest	−0.604	172.775	195.108	315.424	64.912	−1308.483
	(2.890)	(132.079)	(198.021)	(270.259)	(48.885)	(4295.004)
Labour Investment	−0.005	0.245	0.417	0.641	−0.000	−1.584
	(0.004)	(0.420)	(0.422)	(0.851)	(0.002)	(1.572)
Capital Investment	0.000	−0.013	0.114	−0.026	−0.001	0.563
	(0.002)	(0.078)	(0.119)	(0.102)	(0.001)	(0.639)
Fixed effects	Year	Year	Year	Year	Year	Year
		Sector		Sector		Sector
Observations	75 256	75 256	36 744	36 744	2 808	2 808
Firm Age	✓	✓	✓	✓	✓	✓
Firm Size	✓	✓	✓	✓	✓	✓

Notes: The table shows the difference-in-differences estimates following Equation 4.1 for each sample restriction, and displays the interaction between post-treatment year and our treatment variable $Post2018 * Treat$. Each column represents our outcome variables with controls. ***: p-value < 0.005, **: p-value < 0.01, *: p-value < 0.05

A.0.5 Sector Descriptive Statistics

Table A.11: Number of Companies by Sector in 2018 in Sample

SNI	**Sector Description**	**Nr. of Companies**
1	Agriculture and hunting and related services	18
2	Forestry	12
3	Fishing and aquaculture	4
8	Other mining and quarrying	4
10	Food production	26
11	Beverage production	2
13	Textile manufacturing	8
15	Leather and leather goods manufacturing, etc.	2
16	Wood and wood products manufacturing, excluding furniture	36
17	Paper and paper products manufacturing	10
18	Graphic production and reproduction of recordings	13
20	Chemical and chemical product manufacturing	15
21	Manufacture of basic pharmaceutical products and pharmaceuticals	5
22	Rubber and plastic product manufacturing	25
23	Manufacture of other non-metallic mineral products	8
24	Steel and metal production	8

SNI	Sector Description	Nr. of Companies
25	Manufacture of metal products excluding machinery and equipment	80
26	Manufacture of computers, electronic and optical products	14
27	Manufacture of electrical equipment	14
28	Manufacture of other machinery	46
29	Manufacture of motor vehicles, trailers and semi-trailers	14
30	Manufacture of other transport equipment	8
31	Manufacture of furniture	14
32	Other manufacturing	8
33	Repair and installation of machinery and equipment	15
35	Electricity, gas, steam and air conditioning supply	16
41	Construction of buildings	45
42	Civil engineering	12
43	Specialized construction activities	168
45	Retail sale of automotive fuel and other new goods in specialized stores	89
46	Wholesale trade, except of motor vehicles	240
47	Retail trade, except of motor vehicles and motorcycles	86
49	Land transport; transport via pipelines	96
50	Water transport	4
52	Warehousing and support activities for transportation	26
53	Postal and courier activities	3
58	Publishing activities	17
59	Motion picture, video and television program production, sound recording and music publishing	5
60	Broadcasting and programming activities	47
61	Telecommunications	7
62	Computer programming, consultancy, etc.	6
63	Information service activities	5
69	Legal and accounting activities	20
70	Activities of head offices; management consultancy activities	26
71	Architectural and engineering activities; technical testing and analysis	48
73	Advertising and market research	13
74	Other professional, scientific and technical activities	7
75	Veterinary activities	6
77	Rental and leasing activities	19
78	Employment activities, staffing, and other human resources services	5
80	Security and investigation activities	5
81	Building cleaning and maintenance services, landscaping	29
82	Office administrative, office support and other business support activities	8
92	Gambling and betting activities	2
93	Sports, amusement and recreation activities	12
96	Other personal service activities	9

Notes: The table shows the number of companies in each sector in the treatment year (2018).

Table A.12: Sectors in Treatment Group in Sector Level Analysis

Activities of head offices, management consultancy activities
Agriculture and hunting and related services
Beverage production
Building cleaning and maintenance services, landscaping
Chemical and chemical product manufacturing
Civil engineering
Construction of buildings
Electricity, gas, steam and air conditioning supply
Employment activities, staffing, and other human resources services
Fishing and aquaculture
Food production
Forestry
Gambling and betting activities
Information service activities
Land transport; transport via pipelines
Manufacture of motor vehicles, trailers and semi-trailers
Manufacture of other non-metallic mineral products
Manufacture of other transport equipment
Other mining and quarrying
Other personal service activities
Other professional, scientific and technical activities
Paper and paper products manufacturing
Postal and courier activities
Rental and leasing activities
Retail sale of automotive fuel and other new goods in specialized stores
Retail trade, except of motor vehicles and motorcycles
Security and investigation activities
Sports, amusement and recreation activities
Telecommunications and related activities
Veterinary activities
Warehousing and support activities for transportation
Water transport
Wood and wood products manufacturing, excluding furniture

Notes: The table shows all sectors in the treatment group.