

Do Corporate Tax Cuts Increase Investments?*

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Abstract

This paper studies the effect of corporate taxes on investment. Since firms with a foreign parent have more cross-country profit shifting opportunities than domestically owned firms do, their effective tax rate and, consequently, their tax-induced costs to investment are lower. We therefore expect capital investment responses to a corporate tax cut to be heterogeneous across firms. Using firm-level data on German corporations, we exploit the 2008 tax reform, which substantially cut corporate taxes as an exogenous policy shock and expect domestically owned firms' investments to be more responsive to the reform. We show exactly this in a difference-in-differences setting. We find that the reduction in corporate tax payments led to a one-to-one increase in the real investments of domestic firms. The effect is stronger for domestic firms relying more on internal funds. Correspondingly, labor investment increased more for domestic firms, ensuring a constant mix of input factors. In addition, we show that domestic firms' sales grew faster after the tax cut than the sales of foreign-owned firms. Our results imply that corporate tax changes can increase corporate investment but that domestic firms benefit more than foreign-owned firms from a tax cut through higher investment responses resulting in greater sales growth.

Keywords: Corporate taxation, Investment

JEL Classification: G31, H24, H25

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1 Introduction

The effect of taxes on corporate investment is a key motivator for governmental reform strategies to boost domestic economy. For example, in April 2016, Barack Obama published an update to the earlier President’s Framework for Business Tax Reform from 2012, which suggests to “*lower the corporate tax rate to 28 percent, putting the United States in line with major competitor countries and encouraging greater investment in America.*”¹ In 2013, the Swedish government reduced corporate taxes to 22%, since a “*lower corporate tax rate will provide strong incentives for the business sector to increase its investments.*”² The German tax reform of 2008 that, among other reform elements, cut the corporate tax rate from about 39% to 29%, which we exploit in this paper, was implemented to “[*increase*] the German tax attractiveness for investments.”³ This paper aims to test how corporate investment responds to such a large corporate tax cut.

Empirical evidence from firm-level data on the direct effect of the statutory corporate tax rate on corporate investment is surprisingly rare (see, e.g., Ljungqvist and Smolyansky, 2014).⁴ Djankov, Ganser, McLiesh, Ramalho, and Shleifer (2010) analyze macro data from a cross section of 85 countries in 2004. They document a negative association of effective corporate tax rates with aggregate investment. However, they do not find robust evidence of an association of statutory corporate tax rates and aggregate investments. Auerbach (1983) uses macro data from the United States. Some studies (see, e.g., Summers, 1981; Feldstein, Dicks-Mireaux, and Poterba, 1983; Cummins, Hassett, and Hubbard, 1996; Auerbach, 2002; Devereux, Griffith, and Klemm, 2002) apply tax policy measures that combine tax rate and tax base elements using the q-approach. Other studies (e.g., Jorgenson, 1963; Hall and Jorgenson, 1967; Chirinko, Fazzari, and Meyer, 1999; Dwenger, 2014) implement the user cost of capital approach. One weakness

¹ See page 4 of The President’s Framework for Business Tax Reform: An Update, A Joint Report by The White House and the Department of the Treasury, available at <https://www.treasury.gov/resource-center/tax-policy/Documents/The-Presidents-Framework-for-Business-Tax-Reform-An-Update-04-04-2016.pdf> (last accessed April 19, 2016).

² See pages 20 and 21 of the Budget Statement from the Budget Bill 2013 in Sweden, available at <http://www.government.se/contentassets/24e79b514b5b4474aa3d6f5eadb738a4/from-the-budget-bill-for-2013-budget-statement> (last accessed April 19, 2016).

³ This quote is from the legislation draft of the tax reform act from March 27, 2007, available at dip21.bundestag.de/dip21/btd/16/048/1604841.pdf (also, Brandstetter, 2014, last accessed April 19, 2016).

⁴ There are several papers on the effect of corporate tax rates on foreign direct investments (see, e.g., de Mooij and Ederveen, 2003, for a literature review). This paper centers on all — domestic and foreign — investments. Hence, this paper is related to this literature but goes beyond studies on FDI flows since we specifically examine corporate investments by domestic firms which are a key factor of the economy in many countries.

of these studies is that tax rate and tax base elements such as depreciation allowances cannot be separated and that these studies typically do not exploit exogenous variation around large corporate tax rate cuts.

We argue that corporate taxes can have heterogeneous investment effects across firms in an economy. Corporate taxes are costs to investment that differ across firms. For example, some firms can take advantage of lower corporate tax rates abroad through profit shifting, and thereby reduce tax-induced investment costs. The literature documents that tax avoidance and profit shifting activities vary considerably across firms (see, e.g., Huizinga and Laeven, 2008; Dischinger and Riedel, 2011; Dharmapala and Riedel, 2013) and, consequently, so do tax-induced investment costs. We show empirically that investment responses to a reduced corporate tax burden differ between domestic and foreign firms. This holds not only for capital investment, but also for labor investment. These changes in input factors also lead to higher sales growth among domestic firms relative to foreign firms. Our study builds on the results of the profit shifting literature and adds more insight into how profit shifting affects firms' investment decisions.

There are three main challenges to studying the effect of corporate taxes on investment. First, one needs firm-level data on listed and unlisted firms, since the majority of firms in an economy are typically unlisted.⁵ We use a large panel of over 36,000 listed and unlisted firms from Germany over the period 2004–2011 with information on the location of the ultimate shareholder. The second requirement relates to identifying tax rate variation that stems from a large policy change. Our identification strategy exploits a large policy shock in Germany. The most significant reform element was the corporate tax rate cut from 39% to 29%. Third, since this tax cut applies to all German corporations, our identification of the tax effect is based on a difference-in-differences setting exploiting variation in the tax sensitivity within Germany. One caveat of this identification strategy is, however, that we cannot estimate elasticities for domestic or foreign firms. We compare domestically owned corporations to corporations where the ultimate owner is a foreign corporation and examine the difference in their responses to the reduction in the tax burden.

The intuition behind our empirical identification strategy relates to differences in profit shifting opportunities across firms. Consider two firms with similar economic activity but different

⁵ According to the OECD, over 95% of firms are small and medium sized enterprises and represent over half of the employment (<http://www.oecd.org/regional/leed/1918307.pdf>, last accessed October 28, 2014).

ownership structures. In contrast to a firm with a foreign parent, a domestically owned corporation has no, or fewer, opportunities to shift income across borders. Even if domestic firms have subsidiaries abroad, multinationals shift profits toward the parent company rather than in the opposite direction (e.g., Dischinger, Knoll, and Riedel, 2014). Therefore, we argue that domestically owned firms are less engaged in international profit shifting than firms with a foreign parent.

Empirical evidence suggests that, due to cross-border profit shifting, firms with foreign operations have lower effective tax rates on corporate profits than firms without foreign operations. For example, (Rego, 2003; Dyreng and Lindsey, 2009; Dyreng, Hanlon, and Maydew, 2010) document profit shifting but they base their results on U.S. data. Despite institutional differences between the United States and Germany, we transfer these findings to the German setting, since there is comparable and ample empirical evidence of profit shifting for German and other European firms (e.g., Weichenrieder, 2009; Dischinger and Riedel, 2011; Dischinger, Knoll, and Riedel, 2014). Based on this research, we assume a nominal tax cut to be effectively smaller for multinational firms than for domestic firms.

Thus, in our setting, we assume that foreign firms have an effective tax rate below the statutory tax rate and below the tax rate of domestically owned firms. Since taxes impose significant costs to investments, the tax costs of foreign firms are lower than those of domestic firms. We argue that a cut in the statutory tax rate for all firms has heterogeneous effects across firms. Assuming that the effective cut in corporate tax rates, and thus the cost reduction, is larger for domestically owned firms than for foreign-owned firms, we expect their investments to respond more than the investments of corporations with a foreign parent.⁶ In addition to reduced costs of capital, we identify a second channel through which the reduced tax burden triggers higher investments. Lower taxes increase after-tax cash flows, which is important for firms that rely more heavily on internal financing, such as small firms (e.g., Carpenter and Petersen, 2002). We hence additionally expect investment reactions to be stronger for domestic firms that are sensitive to both channels, lower costs of capital and higher after-tax cash flows.

⁶ In contrast to Overesch (2009), who examines the effect of cross-country corporate tax rate differences on German inbound investments, we analyze heterogeneous investment responses across firms with domestic and foreign shareholders. The data employed by Overesch include only the inbound investments of foreign firms, whereas we empirically study the effect of corporate tax rates on the allocation of investment across all firms in Germany, namely domestic and foreign investment. This makes our paper distinct from the literature on taxation and the location of foreign direct investment.

We first present graphical evidence on the difference in investments between domestically and foreign-owned firms. We observe a parallel trend in investments before the 2008 tax reform. In each pre-reform year, the difference in investments between domestically owned firms and corporations with a foreign parent is insignificant. Put differently, domestically and foreign-owned firms have similar investments before the tax reform. After the reform, domestically owned firms invest significantly more than firms with a foreign parent. The difference in investment is statistically significantly different from zero and persists over time. The effect is significant in each year following the tax rate cut. Our results suggest that corporate investments responded immediately to the tax cut.⁷

We then test our hypothesis in a matching difference-in-differences setting in which we compare the investment responses of domestically owned and foreign-owned German corporations around the 2008 reform. Our estimation includes firm fixed effects, year fixed effects, and firm-level control variables. After profitability, debt, size, sales, wages, and loss firms are controlled for, the difference-in-differences estimate is significant and positive. We also obtain similar effects when using an alternative measure of investment that accounts for potential scaling differences. That is, the 2008 tax reform increased the investment of firms whose ultimate owner is domestic relative to the investment of foreign-owned firms. A corporate tax cut of 10 percentage points has large investment effects on domestically owned firms. We find an increase of 5.9% in investment, equivalent to an average increase in investments in fixed assets of €3.0m (or USD 4.2m) for each domestic firm. To put this into perspective, the magnitude of this investment increase is similar to the decrease in corporate tax payments around the tax reform. In other words, the reduction in corporate tax payments leads to a one-to-one increase in real investments. However, this is just an average effect that comprises both channels, reduced costs of capital and higher after-tax cash flows. Overall, this shows that corporate taxes are a considerable cost to investments.

Our approach identifies tax effects through heterogeneous investment responses of domestically and foreign-owned firms. If the financial crisis affects the investment of foreign and domestic firms differently and in the same direction as the corporate tax reduction, we would potentially interpret crisis effects as tax effects. We therefore use several robustness tests to rule out the

⁷ In contrast, Dwenger (2014) focuses on the long-term effects of user costs on the capital stock. That model includes a long-term specification of a firm's demand for capital. Thus, it only allows an interpretation of long-run effects while misestimating short-run effects.

potential impact of the financial crisis: First, we analyze other EU member states without a tax reform as a counterfactual in a difference-in-difference-in-differences setting and show that the financial crisis does not explain our findings. The increase in investment of domestic firms is concentrated in Germany. Additionally, we confirm that heterogeneous investment responses are driven by the tax cut when analyzing nine of the EU-15 member states separately.⁸ There is a similar trend in the investments of domestic and foreign firms around the financial crisis in eight of these nine countries. The exception, Italy, cut its corporate tax by 5.5 percentage points in 2008. Finding a significant effect in Italy and Germany but in none of the other sample countries indicates that heterogeneous investment responses are driven by large corporate tax reductions and not by the financial crisis.

We next document that the effect of the tax reform differs as expected among domestic firms. Since an increase in investments can result from two channels—a lower required rate of return for profitable investments and higher after-tax cash flow due to lower tax payments—we assume that firms that depend on internal financing, for example, small firms (Carpenter and Petersen, 2002), react more strongly among the group of domestic firms. These firms benefit from both channels of reduced taxes triggering investment. Using a difference-in-difference-in-differences approach, we find that both small and large firms increase investments compared to foreign firms after the reform, but that the effect is stronger for those firms that rely on internal financing. This allows us to relate the investment response more precisely to firm characteristics.

We also examine whether there is a concurrent increase in labor investments that would ensure that firms maintain their mix of input factors. We use our baseline difference-in-differences setting, but with labor expenses as the dependent variable. We find that, for domestic firms, not only capital investments but also labor expenses increase compared to foreign firms after the reform. Finally, we analyze the consequences of a change in input factors on the sales growth of domestic versus foreign-owned firms. Assuming that investments are profitable and result in higher outputs, we expect higher sales growth for the group of domestic firms that increased investments. We again use our difference-in-differences approach and find that the change in investment is accompanied by changes in sales growth. The sales growth of domestic firms is 2.75 percentage points higher than the sales growth of foreign firms after the tax cut. We obtain

⁸ We do not conduct the test for Denmark (data availability), Belgium (large tax reform in the pre-pseudo reform period), and countries affected by the sovereign debt crisis (Greece, Spain, and Portugal).

similar results for labor expenses and sales growth in a triple difference setting using the sample of European firms to address concerns that, for example, the crisis led to increased labor input or growth in the sales of domestic firms. Overall, our results indicate that a reduced tax burden increases capital and labor investments as well as the sales growth of domestically owned firms relative to foreign-owned firms.

One main implication is that corporate taxes have large effects on domestic investment decisions. We show that the tax burden reduction translates on average into a one-to-one increase in real investments. Effects of a tax cut on investment costs are heterogeneous across domestic and multinational firms and correspondingly their allocation of investments and, ultimately, sales and revenues. In large economies with high tax rates, such as Germany, Japan, and the United States, there are many firms without foreign operations, since the domestic market is sufficiently large. These countries may benefit from an increase in domestic investments by cutting corporate tax rates to foster investment and revenues of domestically active firms. Conversely, in countries with many internationally active firms and a small domestic market, investment responses to corporate tax changes may be lower than expected. Our results also imply that a high corporate tax rate comes at the cost of lower investments by domestic firms. The ongoing “race to the bottom” in corporate tax rates therefore affects not only profit shifting activities of multinational firms (e.g., Clausing, 2003; Huizinga and Laeven, 2008; Dharmapala and Riedel, 2013), but also decisions on domestic investment of both domestically owned and foreign-owned firms.

Our paper also contributes to the literature on the effectiveness of tax policy changes on investment. Recent stimulus packages and large tax reforms in OECD countries include corporate tax cuts, dividend tax cuts, and bonus depreciation allowances.⁹ Previous literature on the effectiveness of such provisions shows mixed results, however. While there is empirical evidence that payout taxes affect the allocation of investments across listed firms (Becker, Jacob, and Jacob, 2013), ambiguous findings are obtained for unlisted firms (e.g., Yagan, 2015; Alstadsæter,

⁹ Over the past decades, many OECD countries have substantially reduced the corporate tax rate: for example, the United States around the Tax Reform Act in 1986, Australia in 1987, Austria in 1988 and 2004, Denmark in 1990, Germany in 2001, Italy in 1997, Japan around 1998, New Zealand in 1987, Norway and Sweden in 1991, and the United Kingdom between 1983 and 1986. Large dividend tax cuts (more than 10 percentage points) were, for example, observed in the United States in 2003, in Belgium in 1995, in Japan in 2004, in the Netherlands in 2001, in Spain in 1999, and in Sweden in 2006 for closely held, unlisted corporations. In response to the recent financial crisis, many European Union countries (e.g., Austria, Finland, France, Ireland, and the United Kingdom) implemented bonus depreciation schemes to increase corporate investment.

Jacob, and Michaely, 2016). In addition, evidence on the impact of bonus depreciation on corporate investment is mixed (e.g., House and Shapiro, 2008; Hulse and Livingstone, 2010). Our results show that corporate tax rate changes have heterogeneous effects across domestic and foreign firms and that investment and revenues by domestic firms respond strongly.

The remainder of the paper is organized as follows: Section 2 presents the institutional background and a simple investment model. Section 3 presents the data and our empirical estimation strategy. The empirical results and robustness tests are discussed in Section 4. Section 5 sets forth our conclusions.

2 Institutional Background and Hypothesis Development

2.1 2008 Tax Reform

The German Business Tax Reform Act of 2008 reduced the statutory corporate tax rate from 25% to 15%. In combination with the local business tax rate on corporations, which was also changed by the reform, this resulted in a decrease of the corporate tax rate by 10 percentage points, from about 39% until 2007 to 29% as of 2008. However, these provisions did not reduce overall levels of profit shifting to low-tax countries within German multinationals (Brandstetter, 2014).

The reform also introduced several elements to broaden the corporate tax base, for example, the interest barrier rule or stricter transfer pricing regulations. Given the considerable reduction of the nominal tax rate, the decrease in the tax burden was, even combined with other provisions, mostly a consequence of the tax rate change. The interest barrier rule, which limits the deductibility of interest payments from taxable profits, was established as an instrument to constrain financing structures within multinational firms. This thin capitalization rule could have potential investment effects if the rule were binding and if it thereby could reduce access to debt to finance new investment.

However, the German interest barrier with its exceptions and escape clauses is relevant only for very few firms (Blaufus and Lorenz, 2009; Buslei and Simmler, 2012).¹⁰ Further, the interest

¹⁰ Based on the database *dafne* (the same database as used for this paper), Blaufus and Lorenz (2009) find that fewer than 200 firms are potentially affected by the German thin capitalization rule, Buslei and Simmler (2012) identify between 76 and 564 firms to be potentially threatened.

barrier concerns both domestic and foreign firms, and therefore affects treatment and control group in our difference-in-differences approach similarly. Moreover, in an untabulated test, we exclude all companies with net interest payments over €3.0m that exceed 30% of the *EBITDA* in any sample year. We use these criteria as a rough approximation for firms that may be threatened by the interest barrier. Our results remain robust and our main coefficient is very similar. In fact, the vast majority (98%) of firms in our sample do not even exceed these criteria. Hence, it is unlikely that the thin capitalization rule biases our results.

Another change within the 2008 reform was a slight increase in the dividend tax rate for individual, non-incorporated shareholders. According to the partial income method, 60% of dividend income—compared to 50% before the reform—is taxed at the shareholder’s personal income tax rate, which ranges from 0% to 45%. This small increase in the dividend tax rate of zero to 4.5 percentage points for non-corporate shareholders could have, apart from any level effects, potential effects on the allocation of investments across firms (Becker, Jacob, and Jacob, 2013); however, evidence on this effect for unlisted corporations is mixed and uses much larger dividend tax cuts (e.g., Yagan, 2015; Alstadsæter, Jacob, and Michaely, 2016).¹¹

Eventually, due to the financial crisis, the German government allowed bonus depreciations for investments in fixed assets acquired in 2009 and 2010. This provision could have influenced the corporate investments of German firms in those two years (e.g., House and Shapiro, 2008, for the United States). However, in Table A.2 of the Online Appendix, we show that the investment effect is not limited to 2009 and 2010; thus, our results cannot be attributed to the temporary introduction of bonus depreciation. The persisting investment effect also contradicts a pure crisis effect, which would reverse for foreign firms in 2010 and 2011.

2.2 Hypothesis Development

We start by formulating a simple model that isolates the effect of a corporate tax rate reduction on investment followed by implications for other dimensions. We argue that a corporate tax cut has heterogeneous investment effects across firms. Empirical evidence (e.g., Rego, 2003; Dyreng and Lindsey, 2009; Dyreng, Hanlon, and Maydew, 2010) shows that firms with foreign

¹¹ Since higher payout taxes increase the costs of external equity, we test if investment effects are concentrated in firms with high profitability, which would bias our results. Table A.1 of the Online Appendix shows that growth in investment is not limited to firms with high earnings before interest and taxes (EBIT). Our results are not driven by the increase in the dividend tax rate.

operations have lower effective tax rates on corporate profits, and thus lower costs to investments. The degree to which firms have access to profit shifting across borders can therefore affect responsiveness to corporate tax changes. To illustrate this effect, we first consider a firm without the opportunity to shift profits. We then relax this assumption and allow profit shifting across borders.

We assume a one-period investment that yields a pre-tax return r . The return is subject to corporate taxation τ^{Corp} . This is the corporate tax rate in the country where the firm is located. The net of corporate tax return is distributed to the shareholder who is subject to dividend taxation τ^{Div} . We follow King (1977), Auerbach (1979), and Bradford (1981) and assume that the investment is financed with internal funds.¹² In sum, the net cash flow at $t + 1$ equals $(1 + r(1 - \tau^{Corp}))(1 - \tau^{Div})$.

Alternatively, the firm could pay out the cash flow immediately. In this case, shareholders pay dividend taxes at a rate of τ^{Div} . The remaining cash flow is invested at an after-tax return of i . Comparing these two investment alternatives, the firm will invest in the project if

$$r^* = i \cdot \frac{1}{1 - \tau^{Corp}} \quad (1)$$

Equation (1) shows that the required rate of return for a corporate investment, r^* , is sensitive to changes in the corporate tax:

$$\frac{\partial r^*}{\partial \tau^{Corp}} = i \cdot \frac{1}{(1 - \tau^{Corp})^2} > 0 \quad (2)$$

Equation (2) implies that a corporate tax cut will reduce the required rate of return of an investment (r^*). Thus, we expect corporate investment to increase following a corporate tax cut. The underlying assumption of Equation (2) is that the firm has no access to multinational profit shifting and is subject to the domestic marginal tax rate on corporate profits of τ^{Corp} .

We next relax the assumption that a firm has no access to profit shifting. We again assume a one-period investment that yields a pre-tax return r . The return is subject to an effective corporate tax rate, τ_{Eff}^{Corp} . This effective tax rate depends on the percentage of profits, α , shifted

¹² The implications of our simple model are similar when this assumption is relaxed. If we assume that the investment is financed with new equity (e.g., Harberger, 1962, 1966; Feldstein, 1970), the relevant required rates of return increase by $\frac{1}{1 - \tau^{Div}}$ in both cases. As the dividend tax also changes slightly around the reform, we show in the robustness section that this rate change has no effect.

to a foreign country where profits are taxed at a rate τ_{For}^{Corp} . The remaining part of the profits, $(1 - \alpha)$, is taxed at the domestic corporate tax rate τ_{Dom}^{Corp} . We simplify the determination of the percentage of profits α shifted abroad and assume that α is exogenous. In the Appendix, we endogenize α and allow $\alpha(\cdot)$ to be a function of τ_{For}^{Corp} and τ_{Dom}^{Corp} . Since the implications of our model are similar in this case, we use the simplified version of the model to illustrate the effects. In sum, a firm with access to profit shifting invests in the project if

$$r_{Shifting}^* = i \cdot \frac{1}{1 - \tau_{Eff}^{Corp}} \quad (3)$$

with

$$\tau_{Eff}^{Corp} = \alpha \cdot \tau_{For}^{Corp} + (1 - \alpha) \cdot \tau_{Dom}^{Corp}$$

From Equation (3), we can derive the effect of a corporate tax change ($\tau^{Corp} = \tau_{Dom}^{Corp}$) on the required rate of return of a firm with the opportunity to shift income:

$$\frac{\partial r_{Shifting}^*}{\partial \tau^{Corp}} = i \cdot (1 - \alpha) \cdot \frac{1}{(1 - \tau^{Corp})^2} > 0 \quad (4)$$

If the domestic tax rate is reduced, the effect on the required rate of return of a firm with profit shifting opportunities, $r_{Shifting}^*$, is mitigated by the fraction of income shifted abroad. Hence, as long as the firm does not shift any profits abroad, α equals zero and both firms with and without access to profit shifting will respond the same way. However, empirical analysis suggests that $\alpha > 0$ (e.g., Weichenrieder, 2009, for Germany). In this case, τ_{Eff}^{Corp} is smaller than τ^{Corp} if the foreign tax is below the domestic tax rate. Consequently, firms with the opportunity to shift income abroad are less responsive to changes in the corporate tax rate.

Equation 4 further implies that the effect of a change in the (domestic) corporate tax rate decreases with a higher degree of profit shifting (α close to one). In the extreme case that all profits are shifted abroad, firm investment will not respond to changes in the corporate tax rate at all. Generally, a difference in the investment response to the tax cut depends on α . Given similar economic activity, as long as domestically owned firms shift fewer profits abroad than firms with a foreign parent, investment responses to a tax cut are greater for domestic firms than

for foreign firms. Profit shifting is biased towards shifting to the parent firm (Dischinger, Knoll, and Riedel, 2014), and therefore more relevant for foreign-owned than domestically owned firms. These empirical observations translate into a lower α for domestic than for foreign firms. We thus formulate our main hypothesis as follows.

Hypothesis 1: Following a corporate tax cut, firms with limited profit shifting opportunities (*domestic firms*) will increase investments more than firms with more profit shifting opportunities (*foreign firms*).

The heterogeneous investment response of domestic and foreign firms can be explained by two channels. First, as shown in Equation (4), the required rate of return decreases around a reduction in the tax burden and, hence, firms find more profitable investments. We denote this *the cost of capital channel*, through which the corporate tax burden reduction can affect investment. Second, the reduction in corporate taxes increases after-tax cash flows. Since some firms rely more heavily on internal financing, their investment is sensitive to the level of internal cash flow (e.g., Fazzari, Hubbard, and Petersen, 1988; Faulkender and Petersen, 2012). This is *the cash flow channel*, through which the corporate tax burden reduction can affect investment. We expect the response to the tax reform to be stronger among firms that rely more on internal cash, since they are responsive through both channels. For those firms that are most affected by the tax cut (domestic firms), we thus formulate the following hypothesis.

Hypothesis 2: Following a corporate tax cut, firms with limited profit shifting opportunities will increase investments more if they rely heavily on internal cash flow to fund investments.

Building on Hypothesis 1, we can also derive predictions on other forms of investments. A firm's production function has two input factors, capital and labor. When capital investments increase, as predicted in Hypothesis 1, firms may need to increase labor input as well. Otherwise, the relation of input factors changes and the firm could move to a suboptimal mix of input factors. Hence, firms are expected to increase labor input as well. This increase is again expected to be more pronounced among firms with limited profit shifting opportunities, because they

experience the largest reduction in the required rate of return. Since we have only data on labor expenditures,¹³ we formulate our hypothesis as follows.

Hypothesis 3: Following a corporate tax cut, firms with limited profit shifting opportunities (*domestic firms*) will increase labor expenses more than firms with more profit shifting opportunities (*foreign firms*).

The first three hypotheses focus on the heterogeneous effect of corporate taxation on the capital or labor investments of domestic and foreign-owned firms. If the additional investments are profitable, one would expect domestic firms to also experience more growth in sales and revenues than foreign firms. To be more precise, we expect firms' incremental investments to translate into sales. While this appears to be intuitive at first glance, there are several reasons why these investments may not necessarily increase sales. In firms with separation between ownership and control, managers could use the increase in after-tax cash flows to invest in perks (Jensen and Meckling, 1976).¹⁴ If, on average, managers invest in productive investments, then we would expect an increase in capital and labor investment (Hypotheses 1 and 3) to also translate into higher sales and revenues. We thus formulate our fourth hypothesis, as follows.

Hypothesis 4: Following a corporate tax cut, firms with limited profit shifting opportunities (*domestic firms*) will experience more growth in sales and revenues than firms with more profit shifting opportunities (*foreign firms*).

3 Estimation Strategy and Data

3.1 Empirical Identification

We test our hypotheses in a difference-in-differences framework that compares the investments of domestic and foreign-owned German firms around the 2008 tax reform. The resulting estimation

¹³ There is also data on the number of employees but this data item is not sufficiently reliable.

¹⁴ Even in firms that are managed by the owner, there can be unproductive investments, such as consumer durables that create utility but no output. The result of Alstadsæter, Jacob, and Michaely (2016), that cash-rich closely held private firms reduce investments following a dividend tax cut, indicates that even closely held firms invest in unproductive investments.

equation for Hypothesis 1 is

$$\begin{aligned}
Inv_{i,t} = & \alpha_0 + \beta_1 Domestic \times Reform + \beta_2 EBIT_{i,t-1} + \beta_3 Sales_{i,t-1} \\
& + \beta_4 Labor_{i,t-1} + \beta_5 Debt_{i,t-1} + \beta_6 Loss_{i,t} + \beta_7 Ln(TA)_{i,t-1} + \alpha_i + \alpha_t + \epsilon_{i,t}
\end{aligned} \tag{5}$$

where the investment of firm i in year t ($Inv_{i,t}$) is the dependent variable. To test Hypothesis 3 (Hypothesis 4) we use labor expenses over total assets (growth in sales) as dependent variables. The independent variable of interest is the interaction between *Domestic* and *Reform*, where *Reform* is a dummy variable equal to one for all the years after the tax reform (2008 to 2011). We define a German corporation as domestic if the enterprise's overall shareholder resides in Germany. The overall shareholder is defined as having a direct or indirect interest in the German affiliate of more than 50%. The country of the foreign overall shareholder is known; however, this more detailed information is not needed for the analysis.

This difference-in-differences approach identifies the investment effects of the reform on domestic firms vis-à-vis foreign firms. Thus, the interaction of *Domestic* and *Reform* captures differences in the level of investment between domestic and foreign companies after the 2008 tax reform. According to our hypothesis, corporate investment increases after the tax cut, but the effect is larger for domestic firms than for foreign firms. Thus, the β_1 coefficient is predicted to be positive. Our approach captures a causal effect of the corporate tax cut in 2008 on corporate investment in Germany. However, we are not able to identify the tax elasticity of investment of domestic and foreign firms as we cannot measure the extent of income shifting of firms, and as a consequence we do not have sufficient information on the effective tax rate of the ultimate owner.

There could be concerns that, besides ownership structure, potential differences in economic activities between the treatment group (domestic firms) and the control group (foreign firms) bias our results. Clearly, multinational corporations and purely domestic firms differ in many aspects, for example, in their asset and financing structure or their size. To account for these differences, we use an exact one-on-one propensity score matching procedure without replacement before estimating Equation (5). Each foreign firm is matched to a domestic firm according to the natural logarithms of sales, wages, liabilities, and fixed and total assets of each pre-reform

sample year. We additionally match on the industry code.¹⁵ This approach has two advantages. First, the reform does not affect assignment to the treatment or control group, since sorting and matching are based on pre-reform characteristics. Second, firms cannot enter the treatment or control group after the reform. This ensures that our results are not driven by new firms and their investments after the 2008 tax reform. We thus obtain two groups with the same number of firms prior to the reform that are comparable in firm size, asset structure, and leverage but that differ in ownership structure. We use the matched sample in addition to the full sample when estimating Equation (5). The matching strategy eliminates differences in observable firm characteristics. Additionally, the difference-in-differences approach accounts for time-invariant differences between the treatment and control groups. Consequently, we are confident that our analysis with a large tax change effectively captures the investment effect and is not driven by general differences between the compared corporations.

The regression model controls for several firm-variables that affect corporate investment decisions following the prior literature (e.g., Cummins, Hassett, and Hubbard, 1996; Baker, Stein, and Wurgler, 2003). We include the ratio of EBIT over the prior year’s total assets and expect that more profitable firms invest more because of higher availability to fund investments internally (see, e.g., Fazzari, Hubbard, and Petersen, 1988; Lamont, 1997; Faulkender and Petersen, 2012).¹⁶ Likewise, we use sales over the prior year’s total assets to proxy for growth opportunities (e.g., Abel and Blanchard, 1986) and, therefore, expect firms with higher sales to invest more. We additionally include the ratio of labor costs to the prior year’s total assets as well as the ratio of total debt to the prior year’s total assets to control for leverage (e.g., Lang, Ofek, and Stulz, 1996; Ahn, Denis, and Denis, 2006). Further, we include a dummy for experiencing losses ($EBIT < 0$) and expect loss-incurring firms to invest less. Finally, the variable $Ln(TA)$, the natural logarithm of total assets, accounts for the size of the firm, since smaller firms have

¹⁵ The propensity score results from a probit model. We match on firm-level variables from 2005, 2006, and 2007 simultaneously. Specifically, we match foreign and domestic firms according to the nearest-neighbor propensity score based on firm characteristics for all three years. We thus obtain pairs of nearest neighbors for three years and not only one year.

¹⁶ Due to data limitations, we do not include cash as a control variable. Moreover, since we use a difference-in-differences approach, including cash would only change our main coefficient to the extent that cash changes disproportionately around 2008 for our treatment and control groups and that this disproportional change is not correlated with the individual firm’s earnings or its debt financing. We are confident that the variables $EBIT_{i,t-1}$ and $Debt_{i,t-1}$ capture the potential effect. Moreover, in an untabulated test, we estimated the difference-in-differences coefficient for specifications with and without cash holdings and the change in cash holdings. The results do not change if we include cash.

better investment opportunities (e.g., Carpenter and Petersen, 2002). We lag all firm-level control variables once to avoid an endogeneity bias. All variables are described in Table 1. The model contains firm fixed effects to capture time-invariant firm-specific influences on levels of investment. Firm-fixed effects also control for differences in investments across industries. We include year fixed effects that account for the business cycle and other macroeconomic effects.¹⁷ Note that the inclusion of firm-fixed effects captures the main effect of *Domestic*, which is time-invariant. Likewise, the main effect of *Reform* is captured by year-fixed effects. Therefore, we cannot report *Domestic* and *Reform* in our main specification. We base our statistical inference on robust standard errors clustered at the firm level.

The identification of a causal effect of corporate taxes on investment is based on the assumption that the tax reform is the only event affecting relative investment of domestic and foreign firms around 2008. However, the financial crisis could potentially have an impact on the difference between domestic and foreign firms. Compared to other European countries, Germany's economy has not been hit as hard by the crisis.¹⁸ However, the effect on investments in Germany is ambiguous. If subsidiaries with a foreign parent had less investment opportunities than their domestic counterparts due to a worse economic situation in the parent country, funds may flow back to the parent and investments in Germany decrease. In contrast to this argument, Becker and Riedel (2012) find that, in case of a slower economy in the parent's country, investments are rather taken out in the affiliate's country in expectation of higher returns, which would act against finding our effect. Importantly, our results are robust to the inclusion of yearly gross domestic product (GDP) growth rates of the parent countries to account for their economic circumstances.¹⁹ We also address the concern regarding a potential crisis effect by comparing investment behavior of German firms to investment in nine of the EU-15 member states after excluding Belgium due to a large tax reform before 2008 and countries that were affected by the sovereign debt crisis. The remaining countries suffered from the financial crisis similarly to Germany, but were not subject to a tax reform in 2008. Therefore, these countries should

¹⁷ Our results are robust to the inclusion of industry-year-fixed effects. The estimated coefficient of *Domestic* × *Reform* is then 0.0610 and statistically significant ($p < 0.01$), and thus very close to our preferred baseline estimate from Table 3, Column (4).

¹⁸ We control for potential exit effects and bankruptcies during the financial crisis by restricting the sample to firms that survive at least seven of eight sample years. Table A.3 of the Online Appendix shows that our results are robust to the restriction.

¹⁹ As presented in Table A.4 of the Online Appendix, the estimated coefficient of GDP growth is negative, which is in line with Becker and Riedel (2012); however, it is non-significant.

allow the identification of a potential crisis-related investment effect. We compare investment by domestic and foreign firms in Germany and other EU-15 member states by using a difference-in-difference-in-differences approach, which rejects that the influence of the crisis is different on domestic firms than on foreign firms. Respective tests are presented in Section 4.3.

3.2 Data Sample and Summary Statistics

We use firm-level panel data from Bureau van Dijk’s *dafne* database. The database contains the data of German companies,²⁰ including unconsolidated financial data, as well as information about the company activity, ownership structure, and branch. Industries are divided into 21 categories according to the EU NACE Rev. 2 code. Companies offering financial or insurance services are excluded. Our sample consists of data from 36,072 corporations over the period 2004–2011, a total of 93,856 firm–year observations. All the financial data we use are based on German accounting rules.²¹

The data also include information on the location of the ultimate owner.²² We differentiate between domestic and foreign companies according to the primary place of business of the overall shareholder. We define the dummy variable *Domestic* as equal to one for companies with a German overall shareholder and zero otherwise.²³ The mean of *Domestic* equals 0.829 (see the summary statistics in Table 1). That is, the vast majority of enterprises in the sample are domestic. In the matched sample, 51% of firm–year observations stem from domestic firms. Table 2 provides information on the quality of our matching procedure. In the matched sample, there are no differences between matched domestic and foreign firms with respect to observable firm characteristics.

²⁰ These cover limited liability companies with the German legal forms *Aktiengesellschaft*, *Gesellschaft mit beschränkter Haftung*, and *Kommanditgesellschaft auf Aktien* (*KGaA*, *GmbH & Co. KGaA*, and *AG & Co. KGaA*), and other corporations. Small corporations are not included in our sample due to the lack of filing requirements.

²¹ We provide more detailed information on the data selection process in Table A.5 of the Online Appendix.

²² Note that this information is updated by *dafne* based on the most recent information available for the corporation. The database does not track changes in the ultimate owner; therefore, this information is time invariant. We use data available as of August 2013, when we first collected the data. However, the ownership information of an individual firm could be older, depending on data availability.

²³ We have basic information about the ultimate owner, but we cannot identify the exact legal status. We assume profit shifting opportunities to be limited in the case of a foreign individual shareholder. This would drive the β_1 coefficient towards zero, since we would then expect similar reactions for both foreign and domestic firms. In an untabulated test, we restrict the sample to industrial firms. Results remain significant and of similar size. We are thus confident that this data limitation cannot drive any positive findings on relative investments of domestically and foreign owned firms.

Table 1 also presents the summary statistics and variable definitions of independent variables.²⁴ Extreme observations in the upper and lower percentiles of the variables are truncated. Our investment variable *Inv* is defined as the difference in fixed assets and intangible assets from t to $t - 1$ relative to the prior year’s fixed and intangible assets.²⁵ The average growth of fixed and intangible assets compared to the prior year’s amounts to 9%. We further use information on EBIT (*EBIT*), turnover (*Sales*), wages to employees (*Labor*), and debt (*Debt*). These four variables are scaled by the prior year’s total assets. On average, firms in the full sample (matched sample) have an EBIT-to-assets ratio of 9.4% (9.6%), a turnover-to-assets ratio of 242% (223%), a wages-to-assets ratio of 64% (45%), and a debt-to-assets ratio of 61% (52%). We further include the natural logarithm of total assets (average 8.4 and 10.2, respectively) as a measure of firm size, and a dummy variable for loss firms (average 12.3% and 12.4%, respectively).

[Insert Table 1 about here]

[Insert Table 2 about here]

4 Empirical Results

4.1 Graphical Evidence

The simplest way of testing our hypothesis is to track the investments of domestic and foreign-owned firms over time. Figure 1 uses the matched sample of firms and plots the investment (*Inv*) for each group over 2005–2011. We observe a parallel trend in the investments of domestic and foreign firms prior to the reform. Both sets of firms invest about 5% to 10% of their fixed and intangible assets each year. Following the 2008 tax reform, the investments of these two groups diverge. The investments of domestically owned firms exceed those of firms with a foreign parent each sample year. This effect is visible immediately after the reform, since reduced tax prepayments increased cash available for investments already in the first year after

²⁴ Tables A.6 and A.7 of the Online Appendix further present descriptive statistics for all our variables for the pre-reform and post-reform years and for domestic and foreign firms, respectively.

²⁵ Our data do not include capital expenditures. Therefore, we use the change in fixed and intangible assets. Our preferred measure *Inv* is highly correlated with capital expenditures (using the same scaling variable) for listed U.S. firms as well as for listed German firms. Using Compustat (Compustat Global) data over the period 1977–2013 (1999–2014), we find a correlation coefficient between *Inv* and *CapEx* of 0.44 (0.45). Our results also hold if we define investment only as change in fixed assets compared to prior year fixed assets. The estimated coefficient of *Domestic* \times *Reform* is then 0.0544 and statistically significant ($p < 0.01$), and thus very close to our preferred baseline estimate from Table 3, Column (4). As further robustness test, we account for depreciation and scaling effects (see Section 4.2).

the implementation. More importantly, lower taxes resulted in lower required rates of return for investments. The general trend of both sub-groups reflects the economic downturn. Most important to our study is, however, the relative investment of domestically owned firms vis-à-vis foreign owned firms.

[Insert Figure 1 about here]

Figure 2 plots the corresponding difference in investment between these two groups (black line). The gray lines indicate the upper and lower 95% confidence intervals. Prior to the reform, the difference is below zero indicating that foreign-owned firms invest more. This difference is, however, statistically not different from zero. After the reform, domestically owned firms invest about 5% of their fixed and intangible assets more than foreign-owned firms. This difference is significant at the 1% level every sample year. That is, domestically owned firms with fewer opportunities for international profit shifting respond much more strongly to the 2008 tax reform than firms with a foreign owner and access to profit shifting.

[Insert Figure 2 about here]

The advantage of the graphical illustration in Figure 2 is that the effect is independent from the business cycle in Germany, since all firms are affected similarly. However, we also consider concerns that the financial crisis may have different effects on the two groups of firms. Figure 2 shows that the effect is persistent over time. Differences in post-reform investment are statistically not different from each other over time but are different from zero in each post-reform year. This indicates that the financial crisis (alone) cannot explain our result. If foreign firms are hit to a larger extent by the crisis in 2008 and 2009 than domestic firms, we would have seen a reversal in the difference in 2010 and 2011. As the effect is persistent, this is a first indication that the effect is driven by the tax reform.

As the next step, we compare the German case to investment in seven EU-15 member countries without a tax reform in the observation period.²⁶ These countries were hit by the financial crisis and the global recession comparably to Germany but did not change their corporate tax

²⁶ These countries comprise Austria, Finland, France, Ireland, Luxembourg, Netherlands, and the United Kingdom. We exclude Sweden and Italy from this analysis because the corporate tax rates changed in these two countries in 2009 and 2008, respectively.

rate. Figure 3 and Figure 4 replicate Figure 1 and Figure 2 using data on foreign and domestic firms in these other EU states.

[Insert Figure 3 about here]

[Insert Figure 4 about here]

Figure 3 shows that investment of domestic and investment of foreign firms in the compared countries pursue a similar trend before and after the pseudo-reform. According to Figure 4, the differences in investment between the groups are close to zero in every sample year. In other words, in EU countries without a tax cut, investment of foreign and domestic firms follows a common trend over the entire sample period. This supports the assumption that the heterogeneous investment responses across firms in Germany are not a result of the financial crisis, but a consequence of the reduced tax burden.

4.2 Difference-in-Differences Results on the Investment Effect

We next test Hypothesis 1 using the difference-in-differences approach.²⁷ Table 3 presents the coefficient estimates from testing Equation (5). For our baseline tests, we regress investments on the interaction of *Domestic* and *Reform*. Columns (1) and (2) of Table 3 use the full sample. In Columns (3) and (4), we use the matched sample of domestic and foreign firms. We present the results with and without firm-level control variables. We include year fixed effects and firm fixed effects in all four specifications.

[Insert Table 3 about here]

The estimated coefficient of $Domestic \times Reform$ is positive and significant in all specifications. The coefficient estimates are very similar when excluding or including firm-level control variables. This shows that firm-level characteristics do not affect our results. For the matched sample, which accounts for differences in the economic activities of foreign and domestic firms,

²⁷ Difference-in-differences estimations could suffer from serial correlation (e.g., Bertrand, Duflo, and Mullainathan, 2004). We address this concern by using standard errors clustered at the firm level. To additionally address this comment, we collapse pre-reform and post-reform sample years. This results in one pre-reform average for the dependent variable and each independent variable and one post-reform average for each variable per firm. Table A.8 of the Online Appendix shows that the difference-in-differences estimate is still significant and close to the baseline estimate.

the coefficient is 0.0592 and is statistically significant ($p < 0.01$). The economic magnitudes are large: The increase of 5.9% in investments of domestic firms compared to foreign firms is equivalent to an average increase in investments in fixed assets by €3.0m (or USD 4.2m) for each domestic firm. Let us put this into perspective. Firms pay about 4% of their total assets as corporate income tax before the reform, and the reform-induced tax burden reduction amounts to about 1% of total assets (going from 39% to 29%, or a decrease by 25.7%). Relative to total assets, the 5.9% investment increase translates to an increase by 1% of total assets (see also Table 4 below). Firms thus appear to substitute one Euro of tax payments with a Euro of real investments. In other words, corporate taxes are a considerable cost to investments and a reduction in corporate tax payments leads, on average, to a one-to-one increase in real investments in domestic firms. In sum, the estimates indicate that a corporate tax cut of 10 percentage points can have large investment effects on domestically owned firms.

The results for our firm-level control variables show that investments increase for firms that are more profitable (*EBIT*), that have higher turnover (*Sales*) or that are smaller ($\ln(TA)$). More precisely, for the full sample (matched sample), a one standard deviation increase in EBIT results in 4.0% (3.2%) more investment, a one standard deviation increase in *Sales* results in 8.0% (7.9%) more investment, and a one standard deviation decrease in $\ln(TA)$ results in 63.1% (35.3%) more investment. The latter can be explained by the better growth and investment opportunities of smaller firms.²⁸ We measure investment relative to existing fixed assets. Therefore, small and high-growth firms have higher investment rates. Investments decrease by about 1.9% (3.5%) if the firm has negative income (*Loss*). We find no significant effect for leverage, and only a weakly significant effect for labor costs.

We test the robustness of our results using an alternative definition of our dependent variable that accounts for potential scaling effects.²⁹ Instead of using fixed and intangible assets as scaling variable, we scale changes in fixed and intangible assets by total assets. Table 4 presents the coefficient estimates for the difference-in-differences estimator ($Domestic \times Reform$) for

²⁸ Typically, smaller firms have higher market-to-book ratios, which is a common proxy for growth opportunities. Using the *Datastream* sample of firms around the world, the correlation between $\ln(TA)$ and market-to-book ratios is -0.2940. For German firms, the correlation is -0.2709. This suggests that smaller firms have higher market-to-book ratios and, thus, also higher growth opportunities.

²⁹ We test the robustness of our firms to the inclusion of small firms and excluded firms below the median of total assets distribution. The results are robust and similar to the baseline estimates. For the matched sample, the coefficient of $Domestic \times Reform$ is 0.0429 and significant (t -stat = 2.38).

the full and matched samples. In line with our hypothesis, we find a positive and significant coefficient estimate for β_1 . For the full sample with controls, the coefficient estimate is 0.0074 (t -stat = 2.06). In the matched sample, β_1 is 0.0098 and significant (t -stat = 2.57). Panel B uses an investment measure where we additionally account for depreciation. We define investment as the difference in fixed assets and intangible assets plus depreciation from t to $t-1$ relative to prior year's fixed and intangible assets. Using this alternative dependent variable does not change our results. For the full sample with controls, the coefficient estimate is 0.0378 (t -stat = 2.15). In the matched sample, β_1 is 0.0555 and significant (t -stat = 2.77).

[Insert Table 4 about here]

Our differentiation between domestic and foreign firms is based on the location of the ultimate owner as profits are shifted toward the parent company rather than toward a foreign subsidiary (e.g., Dischinger, Knoll, and Riedel, 2014). However, we cannot rule out that domestic firms have foreign subsidiaries and, therefore, have access to international profit shifting to some extent. This is due to limited data on the structure of the enterprise. In another robustness test, we divide the group of domestic firms into companies with a German parent, but with other European subsidiaries (*GermanMultinationals*) and corporations with a German parent and no subsidiaries in other European countries (*DomesticOnly*). If corporations use foreign subsidiaries for profit shifting activities, purely domestic firms without foreign subsidiaries (*DomesticOnly*) should react more strongly to the tax cut. Due to data availability, the location of the subsidiary is based on information from 2014 only. Moreover, we have information only about European subsidiaries and, unfortunately, no information about subsidiaries in other countries. Thus, we decided not to use this test as our main specification. Instead of *Domestic* \times *Reform*, we now include two interaction terms for *DomesticOnly* and *Reform*, and for *GermanMultinationals* and *Reform* in our regression; i.e., we now have two treatment groups. Both treatment groups together represent the group of domestic firms in our baseline specification. Foreign-owned corporations are still the control group.

Table 5 presents results for the matched sample without control variables in Column (1) and with control variables in Column (2). The estimated coefficient for *DomesticOnly* \times *Reform* is positive and significant ($p < 0.01$) in both specifications. The estimated coefficient for

GermanMultinationals \times *Reform* is not significant. While German corporations with subsidiaries abroad in a European country do not invest more than the control group of foreign firms, we find that the purely German firms increase their investments by more than 7% after the reform compared to foreign firms. Moreover, firms without European subsidiaries (*DomesticOnly*) invest significantly more than firms with European subsidiaries (*GermanMultinationals*) (t -stat = 1.82 for Column (1) and t -stat = 1.88 for Column (2)). This is in line with our rationale that firms with better opportunities for international profit shifting (in this specification, German multinationals and foreign firms) react less strongly to the tax cut. The results suggest that German firms engage similarly in profit shifting, whether they have a foreign ultimate owner or a foreign subsidiary. The investment effect as obtained from the baseline regression consequently results from those subsidiaries that do not have international profit shifting opportunities for either an ultimate owner or a subsidiary abroad. We therefore believe that, while we cannot exclude some profit shifting opportunities for the domestic firms in our original treatment group, the potential misclassification works against finding an effect in our baseline specification. Relative to an estimated coefficient of 0.0592 in the baseline specification, the estimated coefficient for purely domestic firms is 0.0730. The results in Table 5 suggest that the investment response mainly stems from purely domestic firms.

[Insert Table 5 about here]

4.3 Robustness to the Financial Crisis

One main concern about our setting is potential influence of the financial crisis in 2008 and 2009. If, compared to domestic firms, foreign firms invest less in Germany due to the economic crisis, we may misinterpret crisis effects as tax responses. To test to what extent our results are driven by the financial crisis, we employ our difference-in-differences setting around pseudo-reforms in EU-15 member countries. From these countries we exclude Denmark (due to lack of data availability), Belgium, Italy and Sweden (due to tax reforms in the observation period) and countries affected by the sovereign debt crisis (Greece, Spain, and Portugal). For the remaining seven countries, we obtain data from *amadeus*, a database similar to *dafne* expanded to all European countries.

As the first step, we extend our main approach and estimate a triple difference model. To be more precise, we examine differences in corporate investment before to after 2008 (*first difference*), between domestic and foreign firms (*second difference*), and between Germany and other EU countries without a tax rate change (*third difference*). If the financial crisis explains our result, the difference-in-differences coefficient $Domestic \times Reform$ is positive. That is, the financial crisis increases the difference between domestic and foreign firms. If, however, the German corporate tax cut explains the investment responses documented above, $Domestic \times Reform$ is insignificant and the triple difference coefficient $Domestic \times Reform \times Germany$ becomes positive.

[Insert Table 6 about here]

The regressions contain all three double interaction terms, but we list only the interaction terms of interest. Table 6 presents the results for the other EU countries in Columns (1) and (2), and results for the triple difference setting in Columns (3) and (4). The estimated coefficients for $Domestic \times Reform$ are insignificant in Columns (1) and (2). That is, in countries that suffer from the financial crisis but that did not change the statutory corporate tax rate, investments of domestic relative to those of foreign-owned firms do not change around 2008. In the triple difference setting, we again find insignificant $Domestic \times Reform$ coefficients. This shows that the financial crisis does not have heterogeneous investment effects across domestic and foreign firms. Moreover, the triple difference coefficient is positive and significant in both specifications. The economic magnitude is comparable to the baseline results. Accordingly, German domestic firms invest more after 2008 compared to foreign-owned firms in Germany as well as relative to domestic vis-à- foreign-owned firms in other EU countries.

As another robustness test to the triple difference analysis, we follow the same approach as in Table 3 and estimate the pseudo-reform effects separately for each EU sample country analyzed in the previous test. If the financial crisis explains our findings, we would find a positive coefficient for $Domestic \times PseudoReform$ when comparing domestic and foreign firms in all seven EU sample countries observed. We additionally include Italy and Sweden where corporate taxes were reduced in 2008 and 2009, respectively. Table 7 presents the coefficient estimates for the nine European sample countries. With the exception of Italy, we observe insignificant coefficients for $Domestic \times PseudoReform$ across samples. Two estimated coefficients are positive and

borderline significant ($p < 0.1$) and two other coefficients are significantly negative. From the results presented in Table 7, we conclude that domestic and foreign firms in eight EU-15 member states responded similarly to the crisis in terms of investment. This result is independent of size, industry composition, and the institutional setting of the country.

The fact that the coefficient of *Domestic* \times *PseudoReform* is positive and highly significant in the case of Italy supports our hypothesis and our findings, since Italy reduced the statutory corporate tax rate in 2008 by 5.5 percentage points.³⁰ Therefore, our model implications also hold in a different market during exactly the same global macroeconomic conditions. We are confident that the documented effect for German corporations is driven by the reduced corporate tax burden and not by the financial crisis.

[Insert Table 7 about here]

4.4 Cash Flow versus Cost of Capital Channel

In a second step, we analyze heterogeneity in investment reactions within the group of domestic firms (Hypothesis 2). We argue that there are two channels that are responsible for firms' increased investments: First, a lower corporate tax burden reduces the required rate of return of investments. Consequently, more investment options are profitable for firms (*Cost of Capital Channel*). This channel applies to all firms. A second reason for higher investment activity is the higher after-tax cash flow (*Cash Flow Channel*). This channel is most important for corporations that rely more heavily on internal funds to invest. When looking at domestic firms only, we expect firms that depend more on internal funds to react more strongly to the tax cut, since they are affected through both channels, whereas the other firms are only affected by the cost of capital channel. Prior literature has shown that the growth of small firms is limited by the quantity of internal finance (e.g., Carpenter and Petersen, 2002). Hence, small firms are more likely to be affected by the cash flow channel. Using the empirical observation that small firms are more likely to rely on internal cash, we create the dummy variable *Small* for firms with total assets in the lowest quartile of the sample. We use a difference-in-difference-in-differences approach that analyzes if, in the group of domestically owned firms, small corporations increased

³⁰ Note that Sweden reduced its corporate tax rate by 1.7 percentage points in 2009. The reform coefficient partially picks up this tax rate cut; however, the results are insignificant. One possible explanation for this finding is that the tax rate cut was too small to have a material influence on investment decisions.

investments comparably more than bigger corporations did. We additionally include all other interactions so that we also compare our treated group (small and domestic) to all other groups, for example, small and foreign owned firms. Table 8 presents the results for the matched sample without control variables in Column (1) and with control variables in Column (2).

[Insert Table 8 about here]

The estimated coefficients of the triple interaction term are positive and significant in both specifications ($p < 0.056$ and $p < 0.071$, respectively). Accordingly, the investment effect is higher for small firms than for larger firms. Moreover, the estimated coefficients of the interaction term between *Domestic* and *Reform* are also positive and significant ($p < 0.05$), that is, larger firms increase investments compared to foreign firms as well. Consequently, domestic firms increased their investments after the reform whether they depend on internal funds or not. The joint effects of both interaction terms are 0.1467 and 0.1421, respectively ($p < 0.01$). Hence, the effect is stronger for firms that rely more on internal funds, indicating that they take advantage of the lower tax burden through both channels. The test shows that the higher investment of domestic firms results from two channels and that, in particular, firms relying on internal cash flow benefit from the tax reduction.

4.5 Effect on Labor Input

We next test if labor input increased correspondingly with higher investments (Hypothesis 3). We therefore use our main regression but replace *Inv* by the change in labor expenses relative to the prior year. Table 9 presents the results for the full sample in Columns (1) and (2) and for the matched sample in Columns (3) and (4).

The positive and significant estimated coefficient ($p < 0.01$) is in line with our expectation that those firms with higher increases in investments, that is, domestic firms with limited profit shifting opportunities, also increase labor expenses more than firms with lower investment responses, that is, foreign firms with more profit shifting opportunities.

In addition, we apply a difference-in-difference-in-differences analysis that compares the increase in the labor expenses of German domestic firms relative to those of foreign firms with those of domestic and foreign firms in the other EU countries (comparable to Table 6, but with

the increase in labor expenses as the dependent variable). The results in Columns (5) and (6) of Table 9 show that the effect is only visible for German domestic firms and not for domestic firms in the other EU countries, contradicting concerns that the increase in labor expenses is a result of the financial crisis.

[Insert Table 9 about here]

4.6 Effect of the 2008 Tax Reform on Sales and Revenues

Having established that domestic firms increased investments relative to foreign-owned firms, we next examine output responses (Hypothesis 4). We test whether the changes in input factors—investments—also lead to changes in output, namely sales and revenues. To examine this empirically, we rerun our difference-in-differences model from Equation (5) and use sales growth relative to the prior year as the dependent variable. Note that this does not contradict our main model, where we use the lagged ratio of sales to total assets as the independent variable. We now use the current growth in sales, which is conceptually different from the sales-to-assets ratio, as the dependent variable. Columns (1) to (4) of Table 10 replicate Table 3 using the new dependent variable. We find that, relative to foreign firms, domestic firms' sales grow significantly faster. After the reform, the sales growth of domestic firms is 2.75 percentage points higher than the sales growth of foreign firms. Consequently, the tax reform does not only increase the investments of domestic firms. Additional input translates into an increase in the sales of domestic firms.

[Insert Table 10 about here]

To address concerns that the differences in sales growth are just an artifact of the financial and economic crisis around 2008, we repeat the triple difference analysis of Table 6. We compare the change in sales growth between domestic and foreign-owned firms in Germany to the change in sales growth between domestic and foreign-owned firms in other European countries. Again, if our result is driven by the crisis, we should find a significant change in sales growth between domestic and foreign firms in other European countries and an insignificant coefficient for the triple interaction (Domestic×Reform×Germany).

Columns (5) and (6) of Table 10 present the regression results from the triple difference analysis. Consistent with the argument that the difference in sales growth is driven by the tax cut and not by the financial crisis, we find that German domestic firms show higher growth in sales than German foreign-owned firms ($\text{Domestic} \times \text{Reform} \times \text{Germany} > 0$). Importantly, there is no significant difference in sales growth between domestic and foreign firms in countries without a tax cut. Taken together, our results suggest that a corporate tax cut can trigger investments in capital and labor that ultimately translate into higher growth in sales.

5 Conclusion

This paper tests the effect of the 2008 corporate tax cut on firm investment in Germany. Our simple investment model suggests that firms with only limited access to international profit shifting respond more strongly to a corporate tax cut than firms with foreign operations and the opportunity to shift income across borders. We test this expectation in a difference-in-differences setting, which has the advantage of being independent of macroeconomic effects. We find that domestically owned firms respond much more strongly to the tax cut than firms with an ultimate owner in a foreign country. Using other EU countries as a counterfactual in a triple difference setting, we can rule out that this effect is driven by the financial crisis. Thus, we conclude that firms' investment strategies are sensitive to corporate tax changes and that the corporate tax rate affects the allocation of investments across domestically and foreign-owned firms. We find stronger investment effects for firms that depend more on internal financing. These firms benefit not only from reduced costs of capital, but also from higher after-tax cash flows to fund investments. Corresponding to the increase in capital investments, we identify an increase in the labor investments of domestic firms after the reform, which ensures that firms maintain their relation of input factors. Finally, we empirically show that the increase in investments is accompanied by the greater sales growth of domestic firms.

Our results have several policy implications. Large economies with high tax rates, such as Germany, Japan, and the United States, have both a strong domestic market and large multinational corporations. Countries can increase the investments of domestically active corporations by reducing corporate tax rates and thus investment costs. Conversely, the reactions of firms with foreign operations may be weaker than expected, since they are less responsive to changes

in the local statutory tax rate. These heterogeneous investment responses are also relevant for countries with many internationally active firms and a small domestic market. The effect of a corporate tax cut may be weaker than expected in these countries.

The results also point toward differences in the tax sensitivity of firm policies across corporations, which may affect not only investment strategies, but also financing decisions (e.g., MacKie-Mason, 1990; Graham, 1996a,b). Differences in tax sensitivity are closely related to a firm's effective tax rate, which decreases, for example, for companies with foreign operations (e.g., Rego, 2003; Dyreng and Lindsey, 2009; Dyreng, Hanlon, and Maydew, 2010). Testing the tax responses of domestic versus foreign-owned firms on other business decisions is therefore an interesting avenue for future research.

Finally, the ongoing race to the bottom of corporate tax rates affects not only profit shifting activities of multinational firms (e.g., Clausing, 2003; Huizinga and Laeven, 2008; Dharmapala and Riedel, 2013), but also the allocation of investments and market share across domestically and foreign-owned corporations. Given that the governments of European Union member countries have recently cut corporate tax rates to reduce profit shifting (e.g., Sweden cut the corporate tax rate from 26.3% to 22% in 2013), the effect of these reforms on corporate investment is a highly relevant empirical question. Our results suggest that firms without access to international income shifting will increase their domestic investment activity and revenues of domestic firms following the recent wave of tax rate reductions in the race to the bottom.

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Appendix

We extend our main model and allow $\alpha(\cdot)$ to be a function of τ_{For}^{Corp} and τ_{Dom}^{Corp} . That is, the level of profit shifting of a multinational firm depends on the corporate tax rates in the countries of the subsidiaries. The implications we derived for the simplified model are still valid. Hence, a firm with access to profit shifting invests in a project if

$$r_{Shifting}^* = i \cdot \frac{1}{1 - \tau_{Eff}^{Corp}} \quad (\text{A.1})$$

with

$$\tau_{Eff}^{Corp} = \alpha(\cdot) \cdot \tau_{For}^{Corp} + (1 - \alpha(\cdot)) \cdot \tau_{Dom}^{Corp}$$

and

$$\alpha(\cdot) = \alpha\left(\tau_{For}^{Corp}, \tau_{Dom}^{Corp}\right)$$

From Equation (A.1), we can derive the effect of a corporate tax change on the required rate of return of a firm with the opportunity to shift income (foreign firm):

$$\frac{\partial r_{Shifting}^*}{\partial \tau_{Dom}^{Corp}} = i \cdot \frac{1 - \alpha'(\cdot)(\alpha(\cdot) - \tau_{For}^{Corp})}{1 - \left(\alpha(\cdot) \cdot \tau_{For}^{Corp} + (1 - \alpha(\cdot)) \cdot \tau_{Dom}^{Corp}\right)^2} \quad (\text{A.2})$$

Showing that the effect of a corporate tax change on the required rate of return is still larger for domestic firms than for foreign firms is straightforward:

$$\underbrace{i \cdot \frac{1}{\left(1 - \tau_{Dom}^{Corp}\right)^2}}_{\text{Effect on Domestic Firm}} > \underbrace{i \cdot \frac{1 - \alpha'(\cdot)(\alpha(\cdot) - \tau_{For}^{Corp})}{1 - \left(\alpha(\cdot) \cdot \tau_{For}^{Corp} + (1 - \alpha(\cdot)) \cdot \tau_{Dom}^{Corp}\right)^2}}_{\text{Effect on Foreign Firm}} \quad (\text{A.3})$$

The necessary condition is that $\alpha'(\cdot) \geq 0$ and $\alpha'(\cdot) \leq 1$. That is, the proportion of profits shifted abroad is either unaffected by the domestic tax rate ($\alpha'(\cdot) = 0$) or increases with the domestic tax rate ($\alpha'(\cdot) > 0$). If we assume that $\alpha(\cdot)$ is a logistic function that takes on values between zero and one ($0 \leq \alpha(\cdot) \leq 1$ and $0 \leq \alpha'(\cdot) \leq 1$), the effect of a tax cut on domestic firms is larger than on foreign firms.

Figure 1: Average Investment: Domestic versus Foreign-Owned Firms

This figure plots the average investments of domestic firms (black line) and foreign-owned firms (dashed line). Investment is defined as the percentage change in fixed and intangible assets from $t - 1$ to t . The dashed vertical line separates the pre-reform from the post-reform years.

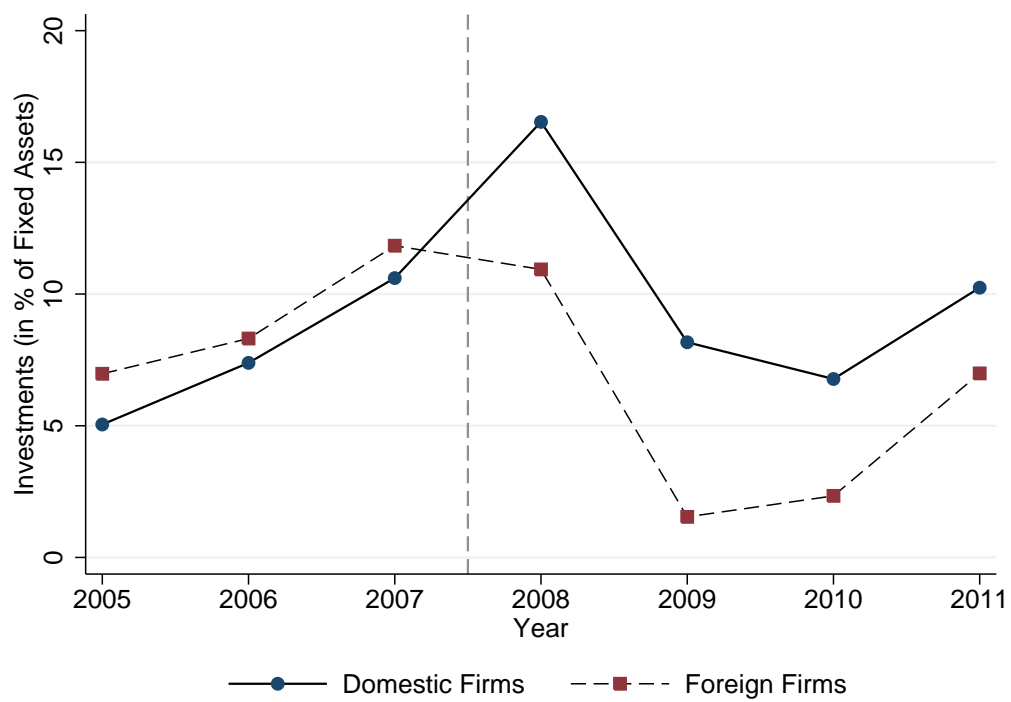


Figure 2: Difference in the Investments of Domestic and Foreign-Owned Firms

This figure plots the difference in investments between domestic firms and foreign-owned firms (black line). Investment is defined as the percentage change in fixed and intangible assets from $t - 1$ to t . The gray lines are the upper and lower 95% confidence intervals of the difference. The dashed vertical line separates the pre-reform from the post-reform years. The dashed horizontal lines indicate the average difference in investments between domestic firms and foreign-owned firms before and after the reform.

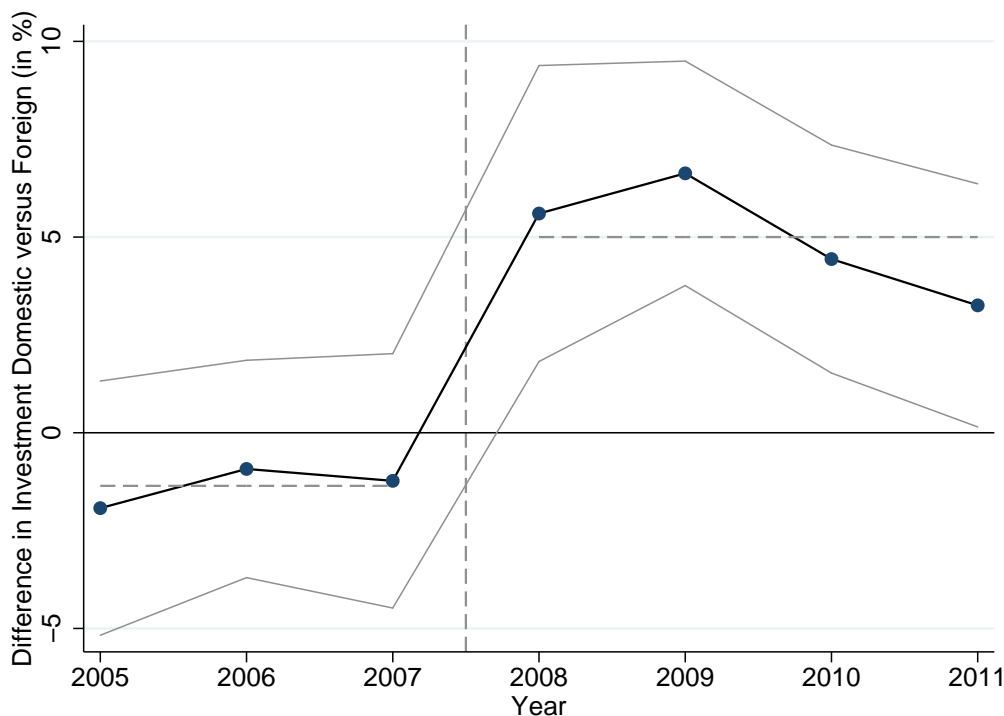
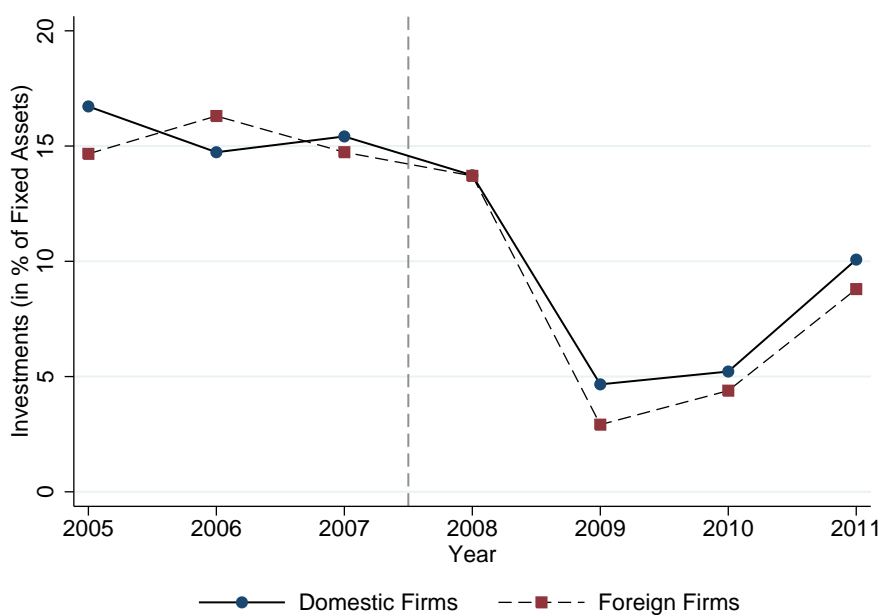


Figure 3: Average Investment: Domestic versus Foreign-Owned Firms—Counterfactual Analysis

This figure plots the average investments of domestic firms (black line) and foreign-owned firms (dashed line) in EU-member states without a corporate tax cut. Investment is defined as the percentage change in fixed and intangible assets from $t - 1$ to t . The dashed vertical line separates the pre-reform from the post-reform years.



**Figure 4: Difference in the Investments of Domestic and Foreign-Owned Firms—
Counterfactual Analysis**

This figure plots the difference in investments between domestic firms and foreign-owned firms (black line) in EU-member states without a corporate tax cut. Investment is defined as the percentage change in fixed and intangible assets from $t - 1$ to t . The gray lines are the upper and lower 95% confidence intervals of the difference. The dashed vertical line separates the pre-reform from the post-reform years. The dashed horizontal lines indicate the average difference in investments between domestic firms and foreign-owned firms before and after the reform.

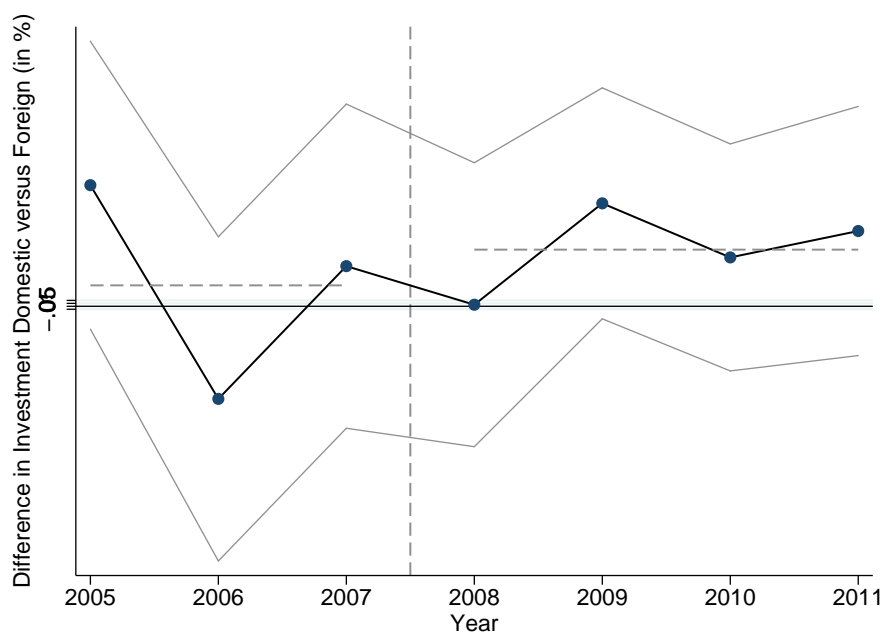


Table 1: Descriptive Statistics

This table presents the summary statistics and variable descriptions of our variables. The full sample (Panel A) comprises 36,072 firms and 93,856 firm-year observations. The matched sample (Panel B) uses 4,000 firms and 18,140 observations. If not otherwise indicated, the data source is the *dafne* database. *Inv* is our investment measure. It is defined as the difference in fixed assets and intangible assets from t to $t-1$ relative to the prior year's fixed and intangible assets. *Domestic* is a dummy variable equal to 1 if the ultimate owner is located in Germany. *EBIT* is the ratio of EBIT relative to the prior year's total assets. *Sales* is turnover relative to the prior year's total assets. *Labor* is the ratio of wages to the prior year's total assets. *Debt* is the ratio of long-term and short-term liabilities to the prior year's total assets. *Ln(TA)* is the natural logarithm of total assets. *Loss* is a dummy variable equal to 1 if $\text{income} < 0$. *GDP Growth* is the percentage point growth in GDP from $t-1$ to t in the country where the ultimate owner is located. Source: World Bank.

Variable	Panel A: Full Sample				
	Mean	Std Dev.	p25	Median	p75
Dependent variable					
<i>Inv</i>	0.125	0.602	-0.110	-0.011	0.152
Independent variables					
<i>Domestic</i>	0.829	0.376	1	1	1
<i>EBIT</i>	0.094	0.153	0.020	0.067	0.146
<i>Sales</i>	2.416	1.892	1.123	2.009	3.181
<i>Labor</i>	0.640	0.663	0.230	0.458	0.812
<i>Debt</i>	0.606	0.394	0.323	0.569	0.816
<i>Ln(TA)</i>	8.383	1.976	6.900	8.375	9.838
<i>Loss</i>	0.123	0.328	0	0	0
<i>GDP Growth</i>	1.517	3.234	1.083	3.029	3.700
<i>TA (in €1,000)</i>	34,200	264,602	1,044	4,527	19,328
<i>FA (in €1,000)</i>	17,540	199,047	135	833	5,739
Variable	Panel B: Matched Sample				
	Mean	Std Dev.	p25	Median	p75
Dependent variable					
<i>Inv</i>	0.087	0.472	-0.089	-0.009	0.116
Independent variables					
<i>Domestic</i>	0.510	0.500	0	1	1
<i>EBIT</i>	0.096	0.141	0.022	0.072	0.152
<i>Sales</i>	2.234	1.669	1.141	1.876	2.875
<i>Labor</i>	0.446	0.454	0.171	0.338	0.567
<i>Debt</i>	0.518	0.326	0.278	0.481	0.705
<i>Ln(TA)</i>	10.150	1.518	9.206	10.128	11.073
<i>Loss</i>	0.124	0.329	0	0	0
<i>GDP Growth</i>	1.417	3.062	0.992	2.285	3.314
<i>TA (in €1,000)</i>	102,850	523,063	10,303	26,049	66,786
<i>FA (in €1,000)</i>	51,414	411,313	1,119	5,542	21,763

Table 2: Matching Quality

This table presents descriptive statistics. We present averages of matching variables for the full sample and the matched sample separately for domestic firms and for foreign firms. We also present the t-statistic ([t-stat]) of the significance of the difference between domestic and foreign firms.

Variable	Year	Full Sample			Matched Sample		
		Average Domestic	Average Foreign	[t-stat] Difference	Average Domestic	Average Foreign	[t-stat] Difference
ln(Sales)	2005	7.788	9.670	54.36	10.252	10.335	1.76
	2006	7.901	9.780	54.34	10.364	10.440	1.66
	2007	8.050	9.870	51.93	10.415	10.494	1.70
ln(Labor)	2005	6.558	7.923	46.13	8.524	8.568	0.97
	2006	6.747	7.983	44.71	8.578	8.625	1.06
	2007	6.966	8.094	41.65	8.616	8.667	1.16
ln(Debt)	2005	6.136	7.903	55.19	8.917	8.988	1.42
	2006	6.022	7.789	62.99	8.949	9.031	1.62
	2007	6.055	7.834	64.32	9.005	9.073	1.31
ln(TA)	2005	6.841	8.643	64.07	9.758	9.827	1.40
	2006	6.745	8.543	73.71	9.829	9.902	1.50
	2007	6.797	8.597	75.13	9.897	9.969	1.46
ln(FA)	2005	5.285	7.032	49.01	7.888	7.912	0.32
	2006	5.203	6.953	56.88	7.921	7.942	0.28
	2007	5.253	7.020	58.67	7.977	7.988	0.15

Table 3: Investment and the 2008 Tax Reform

This table presents the regression results on firms' investment policies over 2005–2011. The dependent variable is defined as the difference in fixed assets and intangible assets from t to $t-1$ relative to the prior year's fixed and intangible assets. The independent variables are defined in Table 1. We report the regression results for the full sample and a matched sample. We include firm fixed effects and year fixed effects in all specifications. We report robust standard errors clustered at the firm level in parentheses. ***, **, and * denote a significant difference at the 1%, 5%, and 10% levels, respectively.

	Full Sample		Matched Sample	
	(1)	(2)	(3)	(4)
Domestic \times Reform	0.0356** (0.017)	0.0364** (0.017)	0.0584*** (0.018)	0.0592*** (0.018)
EBIT $_{t-1}$		0.2583*** (0.042)		0.2243*** (0.066)
Sales $_{t-1}$		0.0425*** (0.007)		0.0471*** (0.013)
Labor $_{t-1}$		-0.0447* (0.025)		-0.0687 (0.051)
Debt $_{t-1}$		0.0119 (0.021)		0.011 (0.037)
Ln(TA) $_{t-1}$		-0.3192*** (0.021)		-0.2327*** (0.034)
Loss $_t$		-0.0187* (0.010)		-0.0349** (0.017)
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	93,856	93,856	18,140	18,140
Adj. R-squared	0.193	0.210	0.086	0.102

Table 4: Investment and the 2008 Tax Reform—Alternative Dependent Variable

This table replicates Table 3 but uses the difference in fixed assets and intangible assets from t to $t - 1$ relative to the prior year's total assets (Panel A) and the difference in fixed assets and intangible assets plus depreciation from t to $t - 1$ relative to prior year's fixed and intangible assets (Panel B) as dependent variable. The independent variables are defined in Table 1. We report the regression results for the full sample and a matched sample. We include firm fixed effects and year fixed effects in all specifications. We report robust standard errors clustered at the firm level in parentheses. ***, **, and * denote a significant difference at the 1%, 5%, and 10% levels, respectively.

<i>Panel A: Scaling by Total Assets</i>				
	Full Sample		Matched Sample	
	(1)	(2)	(3)	(4)
Domestic×Reform	0.0070* (0.004)	0.0074** (0.004)	0.0094** (0.004)	0.0098** (0.004)
Control Variables	No	Yes	No	Yes
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	93,856	93,856	18,140	18,140
Adj. R-squared	0.171	0.206	0.129	0.159
<i>Panel B: Accounting for Depreciation</i>				
	Full Sample		Matched Sample	
	(1)	(2)	(3)	(4)
Domestic×Reform	0.0363** (0.018)	0.0378** (0.018)	0.0535*** (0.020)	0.0555*** (0.020)
Control Variables	No	Yes	No	Yes
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	48,294	48,294	15,443	15,443
Adj. R-squared	0.218	0.240	0.156	0.174

Table 5: Investment and the 2008 Tax Reform—Purely Domestic versus German Multinationals

This table replicates Table 3 but separates the treatment group into domestic firms without subsidiaries (*DomesticOnly* × *Reform*) and German-owned firms with subsidiaries in the EU (*GermanMultinationals*). The independent variables are defined in Table 1. We report the regression results for the matched sample only. We include firm fixed effects and year fixed effects in both specifications. We report robust standard errors clustered at the firm level in parentheses. ***, **, and * denote a significant difference at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)
DomesticOnly × Reform	0.0708*** (0.024)	0.0730*** (0.024)
GermanMultinationals × Reform	-0.0033 (0.026)	-0.0040 (0.026)
t-stat of Difference in Coefficients	1.82	1.88
Control Variables	No	Yes
Firm FE	Yes	Yes
Year FE	Yes	Yes
Observations	24,595	24,595
Adj. R-squared	0.038	0.053

Table 6: Investment and the 2008 Tax Reform—Triple Difference Analysis

This table presents the regression results on firms' investment policies over 2005–2011. The dependent variable is defined as the difference in fixed assets and intangible assets from t to $t - 1$ relative to the prior year's fixed and intangible assets. The independent variables are defined in Table 1. We report the regression results for the sample of non-EU countries (Column (1) and (2)) and a sample including Germany ((Column (3) and (4))). We use the matched sample in all columns. We include firm fixed effects and year fixed effects in all specifications. We report robust standard errors clustered at the firm level in parentheses. ***, **, and * denote a significant difference at the 1%, 5%, and 10% levels, respectively.

	EU-Member States		Triple Difference Sample	
	(1)	(2)	(3)	(4)
Domestic×Reform	0.0079 (0.012)	0.0120 (0.012)	0.0079 (0.012)	0.0120 (0.012)
Domestic×Reform × Germany			0.0516** (0.021)	0.0483** (0.021)
Matched Sample	Yes	Yes	Yes	Yes
Controls	No	Yes	No	Yes
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	93,754	93,754	111,894	111,894
Adj. R-squared	0.021	0.034	0.022	0.035

Table 8: Investment and the 2008 Tax Reform—Cash Flow vs. Cost of Capital Channel

This table replicates Table 3 but separately identifies the effect for small domestic firms that rely more on internal financing in the treatment group (*Domestic* \times *Reform* \times *Small*). The independent variables are defined in Table 1. We report the regression results for the matched sample only. We include firm fixed effects and year fixed effects in both specifications. We report robust standard errors clustered at the firm level in parentheses. ***, **, and * denote a significant difference at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)
Domestic \times Reform	0.0355** (0.018)	0.0373** (0.018)
Domestic \times Reform \times Small	0.1112* (0.058)	0.1048* (0.058)
Joint Effect	0.1467***	0.1421***
T-statistic	2.66	2.58
Control Variables	No	Yes
Firm FE	Yes	Yes
Year FE	Yes	Yes
Observations	18,140	18,140
Adj. R-squared	0.0865	0.103

Table 9: Labor expenses and the 2008 Tax Reform

This table presents the regression results on firms' growth in labor expenses over 2005–2011. The dependent variable is defined as growth in labor expenses from $t - 1$ to t relative to the prior year's labor expenses. The independent variables are defined in Table 1 but exclude lagged labor expenses. We report the regression results for the full sample and a matched sample in Columns (1) & (2) and (3) & (4), respectively. Columns (5) & (6) report regression results for the matched sample of EU countries including Germany. We report robust standard errors clustered at the firm level in parentheses. ***, **, and * denote a significant difference at the 1%, 5%, and 10% levels, respectively

	German Sample				European Sample	
	(1)	(2)	(3)	(4)	(5)	(6)
Domestic×Reform	0.0217*** (0.005)	0.0216*** (0.005)	0.0216*** (0.005)	0.0222*** (0.005)	-0.0017 (0.003)	-0.0009 (0.003)
Domestic×Reform × Germany					0.0122*** (0.005)	0.0108** (0.005)
Controls	No	Yes	No	Yes	No	Yes
Matched Sample	No	No	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	77,653	77,653	17,694	17,694	93,250	93,250
Adj. R-squared	0.294	0.322	0.148	0.175	0.124	0.154

Table 10: Sales Growth and the 2008 Tax Reform

This table presents the regression results on firms' sales over 2005–2011. The dependent variable is defined as the difference between sales in t and sales in $t-1$ relative to the prior year's sales. The independent variables are defined in Table 1 but exclude lagged sales. We report the regression results for the full sample and a matched sample in Columns (1) & (2) and (3) & (4), respectively. Columns (5) & (6) report regression results for the matched sample of EU countries including Germany. We report robust standard errors clustered at the firm level in parentheses. ***, **, and * denote a significant difference at the 1%, 5%, and 10% levels, respectively

	German Sample				European Sample	
	(1)	(2)	(3)	(4)	(5)	(6)
Domestic×Reform	0.0426*** (0.009)	0.0445*** (0.009)	0.0250*** (0.010)	0.0275*** (0.009)	0.0002 (0.003)	0.0008 (0.0003)
Domestic×Reform × Germany					0.0163*** (0.005)	0.0159*** (0.005)
Controls	No	Yes	No	Yes	No	Yes
Matched Sample	No	No	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	73,801	73,801	17,282	17,282	106,083	106,083
Adj. R-squared	0.134	0.217	0.068	0.154	0.104	0.165

Online Appendix—Not for publication

Table A.1: Effect on the Allocation of Investments

This table presents the regression results on firm investment policy over 2005–2011. We use domestic firms only. We include firms in the top and bottom quintiles of the EBIT distribution as a measure of internal resources. The dependent variable is defined as the difference in fixed assets and intangible assets from t to $t - 1$ relative to the prior year's fixed and intangible assets. The dependent variable of interest is the interaction between high-EBIT firms and the reform dummy ($HighEBIT \times Reform$). The control variables are defined in Table 1. We report the regression results for the full sample and a matched sample. We include firm fixed effects and year fixed effects in all specifications. We report robust standard errors clustered at the firm level in parentheses. ***, **, and * denote a significant difference at the 1%, 5%, and 10% levels, respectively.

	Full Sample		Matched Sample	
	(1)	(2)	(3)	(4)
High EBIT \times Reform	-0.0648** (0.031)	0.0487 (0.034)	-0.0113 (0.047)	0.0698 (0.053)
Control Variables	No	Yes	No	Yes
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	14,804	14,804	2,825	2,825
Adj. R-squared	0.160	0.184	0.096	0.114

Table A.2: Investment and the 2008 Tax Reform, by Year

This table replicates Table 2 but presents regressions results, which estimate the reform effect separately for each year. The dependent variable is defined as the difference in fixed assets and intangible assets from t to $t - 1$ relative to the prior year's fixed and intangible assets. The independent variables are defined in Table 1. We report the regression results for the full sample and a matched sample. We include firm fixed effects and year fixed effects in all specifications. We report robust standard errors clustered at the firm level in parentheses. ***, **, and * denote a significant difference at the 1%, 5%, and 10% levels, respectively.

	Full Sample		Matched Sample	
	(1)	(2)	(3)	(4)
Domestic×2008	0.0256 (0.021)	0.0261 (0.021)	0.0663*** (0.026)	0.0676*** (0.025)
Domestic×2009	0.0514** (0.020)	0.0488** (0.020)	0.0668*** (0.023)	0.0650*** (0.022)
Domestic×2010	0.0420** (0.021)	0.0425** (0.020)	0.0415* (0.024)	0.0407* (0.024)
Domestic×2011	0.0250 (0.020)	0.0304 (0.020)	0.0537** (0.024)	0.0582** (0.023)
Control Variables	No	Yes	No	Yes
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	93,856	93,856	18,140	18,140
Adj. R-squared	0.193	0.210	0.085	0.102

Table A.3: Investment, the 2008 Tax Reform, and Firm Survival

This table replicates Table 2 but restricts the sample to firms that survived at least seven sample years (Panel A) or all eight sample years (Panel B). The dependent and independent variables are defined in Table 1. We report the regression results for the full sample and a matched sample. We include firm fixed effects and year fixed effects in all specifications. We report robust standard errors clustered at the firm level in parentheses. ***, **, and * denote a significant difference at the 1%, 5%, and 10% levels, respectively.

Panel A: Firms that Survived at Least Seven Sample Years

	Full Sample		Matched Sample	
	(1)	(2)	(3)	(4)
Domestic×Reform	0.0312* (0.017)	0.0331** (0.017)	0.0558*** (0.018)	0.0572*** (0.018)
Control Variables	No	Yes	No	Yes
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	92,002	92,002	17,986	17,986
Adj. R-squared	0.191	0.209	0.080	0.097

Panel B: Firms that Survived All Eight Sample Years

	Full Sample		Matched Sample	
	(1)	(2)	(3)	(4)
Domestic×Reform	0.0315* (0.017)	0.0321* (0.017)	0.0571*** (0.018)	0.0563*** (0.018)
Control Variables	No	Yes	No	Yes
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	82,592	82,592	16,790	16,790
Adj. R-squared	0.185	0.204	0.078	0.100

Table A.4: Investment and the 2008 Tax Reform, Controlling for GDP Growth

This table presents the regression results on firms' investment policies over 2005–2011. The dependent variable is defined as the difference in fixed assets and intangible assets from t to $t - 1$ relative to the prior year's fixed and intangible assets. We add a control for growth in GDP in the ultimate owner's country. The control variables are defined in Table 1. We report the regression results for the full sample and a matched sample. We include firm fixed effects and year fixed effects in all specifications. We report robust standard errors clustered at the firm level in parentheses. ***, **, and * denote a significant difference at the 1%, 5%, and 10% levels, respectively.

	Full Sample		Matched Sample	
	(1)	(2)	(3)	(4)
Domestic \times Reform	0.0368** (0.017)	0.0375** (0.017)	0.0590*** (0.018)	0.0596*** (0.018)
GDP Growth _{t}	-0.0035 (0.004)	-0.0031 (0.003)	-0.0031 (0.004)	-0.0025 (0.004)
Control Variables	No	Yes	No	Yes
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	93,657	93,657	18,045	18,045
Adj. R-squared	0.193	0.210	0.085	0.102

Table A.5: Data selection

This table describes the data selection in the database *dafne*, and the continuing selection process in the statistics program. All financial data used is based on German GAAP and unconsolidated financial statements. The analysis includes data between 2004 and 2011. Our dataset consists of 36,072 firms and 93,856 firm-year observations.

- 1 Solvent firms
- 2 Legal form: corporations
- 3 Industries: no insurance or financial services
- 4 Corporations with an ultimate owner and information on the parent country
- 5 Truncating: first and last percentile of variables
- 6 Excluding all observations without variables required for the baseline specification

Table A.6: Descriptive Statistics: Pre- vs. post-reform observations

This table presents the summary statistics separately for the pre-reform and post-reform periods. The full sample (Panel A) comprises 36,072 firms and 93,856 firm–year observations. The matched sample (Panel B) uses 4,000 firms and 18,140 observations. If not otherwise indicated, the data source is the *dafne* database. *Inv* is our investment measure. It is defined as the difference in fixed assets and intangible assets from t to $t - 1$ relative to the prior year’s fixed and intangible assets. *Domestic* is a dummy variable equal to 1 if the ultimate owner is located in Germany. *EBIT* is the ratio of EBIT relative to the prior year’s total assets. *Sales* is turnover relative to the prior year’s total assets. *Labor* is the ratio of wages to the prior year’s total assets. *Debt* is the ratio of long-term and short-term liabilities to the prior year’s total assets. $\ln(TA)$ is the natural logarithm of total assets. *Loss* is a dummy variable equal to 1 if $\text{income} < 0$.

Variable	Panel A: Full Sample			
	Pre		Post	
	Mean	Std Dev.	Mean	Std Dev.
Dependent variable				
<i>Inv</i>	0.145	0.634	0.119	0.591
Independent variables				
<i>Domestic</i>	0.836	0.371	0.827	0.378
<i>EBIT</i>	0.099	0.146	0.092	0.156
<i>Sales</i>	2.461	1.922	2.400	1.881
<i>Labor</i>	0.640	0.643	0.640	0.670
<i>Debt</i>	0.597	0.370	0.609	0.402
$\ln(TA)$	8.410	1.973	8.374	1.977
<i>Loss</i>	0.091	0.288	0.133	0.340
<i>GDP Growth</i>	3.438	0.655	0.865	3.491
<i>TA (in €1,000)</i>	36,056	278,703	33,571	259,643
<i>FA (in €1,000)</i>	19,682	230,162	16,813	187,316
Variable	Panel B: Matched Sample			
	Pre		Post	
	Mean	Std Dev.	Mean	Std Dev.
Dependent variable				
<i>Inv</i>	0.098	0.475	0.081	0.470
Independent variables				
<i>Domestic</i>	0.511	0.500	0.509	0.500
<i>EBIT</i>	0.101	0.141	0.093	0.141
<i>Sales</i>	2.324	1.737	2.189	1.632
<i>Labor</i>	0.465	0.470	0.437	0.445
<i>Debt</i>	0.548	0.338	0.503	0.319
$\ln(TA)$	10.063	1.556	10.193	1.496
<i>Loss</i>	0.102	0.303	0.134	0.341
<i>GDP Growth</i>	3.366	1.097	0.433	3.258
<i>TA (in €1,000)</i>	99,718	510,581	104,427	529,252
<i>FA (in €1,000)</i>	51,447	429,506	51,398	401,856

Table A.7: Descriptive Statistics: Domestic vs. foreign firms

This table presents the summary statistics separately for domestic and foreign firms. The full sample comprises 36,072 firms and 93,856 firm-year observations. The matched sample uses 4,000 firms and 18,140 observations. If not otherwise indicated, the data source is the *dafne* database. *Inv* is our investment measure. It is defined as the difference in fixed assets and intangible assets from t to $t-1$ relative to the prior year's fixed and intangible assets. *Domestic* is a dummy variable equal to 1 if the ultimate owner is located in Germany. *EBIT* is the ratio of EBIT relative to the prior year's total assets. *Sales* is turnover relative to the prior year's total assets. *Labor* is the ratio of wages to the prior year's total assets. *Debt* is the ratio of long-term and short-term liabilities to the prior year's total assets. $\ln(TA)$ is the natural logarithm of total assets. *Loss* is a dummy variable equal to 1 if $\text{income} < 0$.

Variable	Panel A: Full Sample			
	Domestic		Foreign	
	Mean	Std Dev.	Mean	Std Dev.
Dependent variable				
<i>Inv</i>	0.134	0.616	0.081	0.526
Independent variables				
<i>EBIT</i>	0.094	0.151	0.095	0.167
<i>Sales</i>	2.443	1.924	2.283	1.720
<i>Labor</i>	0.676	0.686	0.465	0.504
<i>Debt</i>	0.615	0.394	0.563	0.392
$\ln(TA)$	8.101	1.927	9.752	1.605
<i>Loss</i>	0.117	0.322	0.149	0.356
<i>GDP Growth</i>	1.605	3.283	1.085	2.946
<i>TA (in €1,000)</i>	25,372	242,132	77,134	350,956
<i>FA(in €1,000)</i>	14,682	197,765	31,438	204,605
Variable	Panel B: Matched Sample			
	Domestic		Foreign	
	Mean	Std Dev.	Mean	Std Dev.
Dependent variable				
<i>Inv</i>	0.099	0.460	0.075	0.483
Independent variables				
<i>EBIT</i>	0.097	0.129	0.094	0.152
<i>Sales</i>	2.231	1.763	2.237	1.565
<i>Labor</i>	0.462	0.498	0.430	0.402
<i>Debt</i>	0.509	0.312	0.527	0.340
$\ln(TA)$	10.143	1.557	10.156	1.476
<i>Loss</i>	0.109	0.312	0.139	0.346
<i>GDP Growth</i>	1.585	3.182	1.240	2.919
<i>TA (in €1,000)</i>	103,532	598,667	102,139	430,562
<i>FA(in €1,000)</i>	59,527	517,943	42,973	256,822

Table A.8: Investment and the 2008 Tax Reform—Collapsed Model

This table presents the regression results on firms' investment policies over 2005–2011. The dependent variable is defined as the difference in fixed assets and intangible assets from t to $t - 1$ relative to the prior year's fixed and intangible assets. The independent variables are defined in Table 1. We report the regression results for the full sample and a matched sample. Following Bertrand, Duflo, and Mullainathan (2004), all variables are included as the pre-reform and post-reform average for each firm to control for serial correlation. We report robust standard errors clustered at the firm level in parentheses. ***, **, and * denote a significant difference at the 1%, 5%, and 10% levels, respectively

	Full Sample		Matched Sample	
	(1)	(2)	(3)	(4)
Domestic×Reform	0.0387*** (0.011)	0.0197* (0.011)	0.0680*** (0.014)	0.0654*** (0.014)
Domestic	0.0283*** (0.009)	0.0151 (0.009)	-0.0131 (0.011)	-0.0115 (0.011)
Reform	-0.0486*** (0.010)	-0.0290*** (0.010)	-0.0443*** (0.011)	-0.0244** (0.011)
Mean(EBIT)		0.3645*** (0.021)		0.3246*** (0.038)
Mean(Sales)		-0.0003 (0.001)		-0.0023 (0.003)
Mean(Labor)		0.0122*** (0.002)		0.0049 (0.003)
Mean(Debt)		0.0295*** (0.004)		0.0114 (0.010)
Mean(Ln(TA))		0.2387*** (0.010)		0.1546*** (0.018)
Mean(Loss)		-0.0623*** (0.010)		-0.0274* (0.017)
Observations	54,976	54,976	7,451	7,451
Adj. R-squared	0.002	0.056	0.004	0.043