The Role of Personal Income Taxes in Corporate Investment Decisions

Martin Jacob and Robert Vossebürger*

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ABSTRACT

This paper examines the role of personal income taxes in corporate investment decisions. Since personal income taxes increase the cost of labor, firms' investment decisions can be affected because of the inevitable link of production input factors. Using data on personal income taxes in 30 European countries and a large sample of private firms, we find that personal income taxes substantially reduce investment. The magnitude is comparable to the effect of corporate and value-added taxes. The effect is stronger for low-income earners vis-à-vis high-income earners and for firms with a stronger link between capital and labor input.

Keywords: Personal income taxation, corporate investment

JEL classification: H25; H32; J23; M54; J31

* Jacob is at WHU – Otto Beisheim School of Management (martin.jacob@whu.edu); Vossebürger is at WHU – Otto Beisheim School of Management (robert.vossebuerger@whu.edu). We thank Peter Brok, Antonio De Vito, Hannes Döring, Jesse van der Geest, Luzi Hail, Christian Peters, Rey Safaei, Thorben Wulff, and Guosong Xu, as well as seminar participants at Strathclyde Business School, WHU – Otto Beisheim School of Management, the TRR 266 Accounting for Transparency Annual Conference 2020, and the 2020 PhD Seminar at the University of Zürich for helpful comments. We thank Constance Kehne for excellent research assistance. We acknowledge funding by the German Research Foundation (*Deutsche Forschungsgemeinschaft*), Project-ID 403041268 – TRR 266 Accounting for Transparency.

1. Introduction

In this paper, we examine the role of personal income taxes (PIT) paid by employees in corporate investment decisions. While prior literature has extensively analyzed the effect of corporate taxes (e.g., Djankov et al. 2010; Giroud and Rauh 2019), consumption taxes (Jacob et al. 2019), and dividend taxes (Becker et al. 2013; Yagan 2015; Alstadsæter et al. 2017) on corporate investment, there is little evidence on the effect of PIT paid on employees' wage income on corporate investment.[1] This is surprising, because PIT account for roughly one-third of the Organisation for Economic Co-operation and Development (OECD) countries' tax revenues. Given that nearly every employee is affected by PIT, examining the PIT effect on employers' investment decisions is important to better understand how taxing one of the most important stakeholder groups of firms, namely, employees, can affect corporate decision making.

In contrast to corporate taxes, where the predicted investment effect is unambiguous, the effect of PIT on investment is ex ante unclear and cannot be inferred from prior empirical literature (e.g., Djankov et al. 2010). Our theoretical prediction on how PIT affect corporate investment is guided by the "all taxes, all parties" framework of Scholes et al. (2015). Following the seminal works of Lindsey (1987) and Feldstein (1995), prior literature finds that the economic incidence of PIT is shared between the employer and the employee (e.g., Gruber and Saez 2002; Blomquist and Selin 2010; Piketty et al. 2014). To the extent that firms bear part of the PIT burden (e.g., because the labor supply is decreased and firms compete for the remaining labor supply via higher wages), PIT affect labor costs and thus also corporate investment, because a firm's capital and labor inputs are inevitably linked. One the one hand, PIT can decrease investments if capital and labor are

[1] In a working paper, Frank et al. (2010) find that dividend taxes, which are highly correlated with PIT, affect investment. In our setting, this correlation is much weaker (with a correlation coefficient between PIT and dividend taxes below 0.3), because dividend tax systems in Europe often implement flat dividend tax rates that are independent of PIT.

complements: higher labor costs reduce labor demand, which also reduces capital demand. On the other hand, when firms can substitute labor with capital, firms could respond to higher PIT by tilting the factor input mix toward capital. Hence, whether (and how much) PIT matter empirically for corporate investments is an open empirical question.

To examine the role of PIT in corporate investment decisions, we use a cross-country approach and a sample of European private firms. The use of private firms has the advantage that firms' employees are most likely subject to PIT in the same country in which the firm is located. In case of (large listed) firms with cross-border operations, this is not necessarily the case. Not knowing the location of employees would blur the identification and the estimation of magnitude. Our final sample comprises 1,823,311 firm–year observations from 30 countries from 2006 to 2018.

For these countries and years, we collect personal tax rates and information on social security contributions (SSC) paid by the employer and the employee. To account for the progressivity of the PIT, we calculate the respective average tax burden at various annual gross income levels, for example, 10,000 EUR, 30,000 EUR, 70,000 EUR, and 100,000 EUR.[2] We observe multiple changes in PIT, with slightly more tax decreases than increases. Changes in the PIT are, among other reasons, motivated by policymakers to balance budget deficits (to justify tax increases) or to foster employment (to justify tax decreases). We employ a first-difference specification to absorb any time-invariant characteristics associated with investment and/or taxation and to accommodate multiple tax changes per country. We further choose a fixed effects structure that ensures that we compare firms in the same industry and in country clusters with similar economic conditions in

[2] To ensure that these gross income levels adequately represent income variation in the sample countries, we also estimate the baseline regression using country–year-specific income percentiles. Our results are also robust to using firm- or industry-specific wages to define the PIT rate. While each approach has its drawbacks and advantages, we view it as important to document robustness across (arguably imperfect) approaches.

terms of level and growth in the gross domestic product (GDP) per capita. We also take multiple steps to account for unobserved economic conditions as best as possible.

We find that firms increase capital investments by up to 0.25% if the employees receive 1% more salary net of PIT. The effect is largest if we calculate the average PIT burden at low income levels. This elasticity of about –0.25 for personal taxes with respect to investment is close to the effect corporate taxes and value-added taxes (VAT) have on investment among our sample firms during our sample period.[3] This shows that PIT can have a sizeable effect on corporate investment. The effect of PIT, however, declines for higher income levels: it is about 0.13% when the average personal tax on income of 100,000 EUR increases by 1%. At an income of 320,000 EUR, the effect of PIT on investment is nonsignificant.[4] We also provide empirical evidence for two potential explanations for this declining effect. First, firms are, on average, more exposed to workers at lower income levels. Second, the complementary link between labor and capital is stronger at lower income levels than at higher income levels, resulting in a stronger investment response to PIT.

We subject this finding to several additional tests. First, we show that increases as well as decreases in PIT rates affect corporate investment, suggesting a symmetric effect. Second, tax changes in future years do not systematically affect investment decisions, supporting the parallel trends assumption. Investment appears to react to tax changes in a timely manner, that is, within a year. Third, we find support for our results when using aggregate investment at the country level. This test also addresses concerns that our sample of private firms might not be relevant for

[3] In our sample, the elasticity of corporate taxes (VAT) on investment is –0.21 (–0.19). Using other samples, Giroud and Rauh (2019) estimate an elasticity of investment with respect to corporate taxes of –0.4 to –0.45, Patel et al. (2017) find an elasticity of real investment with respect to the corporate tax rate of –0.21. Jacob et al. (2019) estimate an elasticity of investment with respect to the vat rate of –0.36 to –0.40.

[4] We further find that firms' investments do not respond to changes in the SSC burden. We attribute this result to the different natures of PIT and SSC. While PIT abstractly finance the government, SSC reflect direct benefits such as healthcare and unemployment payments. This finding is in line with those of Ooghe et al. (2003), who show that the more direct benefits employees receive, the stronger their SSC burden.

aggregate investment, since we exclude listed firms. Fourth, we run a test zooming in on firms located at borders. Since PIT are typically charged in the country in which a worker is employed for more than six months, we can further control for local economic conditions by controlling for neighboring country characteristics, while the PIT applicable to workers are still determined in the country in which the firm is located. We continue to find very similar results as in our main test.

In the final step, we assess the mechanisms through which corporate investment can be affected by employees' personal taxation. Theoretically, PIT can affect investment, because firms bear part of the economic burden of the PIT. We thus exploit several dimensions that all try to capture the notion that "taxes are borne by those who cannot easily adjust" (Kotlikoff and Summers 1987, p. 1047). We use firms' operating margin, productivity, and border proximity as proxies for firms' ability to flexibly adjust. We find that firms with lower operating margins, PIT changes in personal taxation than firms that are relatively elastic. This finding suggests that, in particular, inflexible firms' investment is affected by PIT.

Another mechanism relates to the complementarity between capital and labor. Theory suggests that, if the link between capital and labor is stronger (weaker), a shock to labor input can trigger a larger (weaker) capital investment response. Consistent with this prediction, we find that the effect of PIT on investment is strongest (weaker but still significant) in industries with a stronger (weaker) link between capital and labor inputs. Additionally, we examine cross-country differences in the size of the informal sector, which relates to the idea that a greater informal sector means that changes in PIT do not considerably change the actual labor supply, because these taxes are evaded. Consistent with these arguments, we find that firms located in a country with a large (small) informal sector or shadow economy react more weakly (more strongly) to PIT. Finally, we document one necessary channel through which changes in investment are triggered by changes in

PIT. We show that higher PIT reduce the number of employees (i.e., labor input), indicating that part of the PIT burden is borne by firms.

Overall, our paper contributes to two major streams of the literature. First, we add to the literature on taxes and investment. Prior literature has focused on corporate taxes (e.g., Djankov et al. 2010; Giroud and Rauh 2019), payout taxes (Becker et al. 2013; Yagan 2015; Alstadsæter et al. 2017), and consumption taxes (Jacob et al. 2019). We provide empirical evidence that taxes paid by one of the arguably largest stakeholder group in firms, namely, employees, shape corporate investment decisions, consistent with the "all taxes, all parties" framework of Scholes et al. (2015). Our paper thus also relates to the literature on the relation between capital and labor input (e.g., Acemoglu and Finkelstein 2008; Agarwal et al. 2020; Bai et al. 2020). While a change in PIT can be interpreted as a shock to labor costs, triggering investment responses, two results of our study cannot be inferred from these papers. First, we document that workers' PIT at lower income levels affect corporate investment with similar magnitudes as corporate taxes or VAT. This finding supports the idea that, irrespective of who pays a tax, what matters for investment decisions is who bears the tax burden (see also Jacob et al. 2019). Second, we document important heterogeneities in the effect of PIT on investment, for example, with respect to the income level, the complementarity of labor and capital input, or the size of the informal sector.

Second, our paper is also related to the literature on PIT and labor supply (e.g., Blomquist and Selin 2010; Piketty et al. 2014). We add to this literature by providing evidence on corporate investment decisions and the heterogeneity in this effect across firms. While Saez et al. (2019) document that lower SSC for young workers in Sweden increase firm growth in terms of total assets, we add to their paper by documenting that PIT matter for investment and that this effect is strongest at PIT rates at lower income levels vis-à-vis higher income levels.

Our results are also policy relevant because we show that, while PIT affect corporate investment, the level of annual gross income at which PIT are measured matters for economic magnitudes. Hence, governments might be able to balance budgets while circumventing negative investments effects by decreasing (moderately increasing) the tax rate at lower (higher) income levels. However, we acknowledge that we base our results on a sample of private firms. Hence, we cannot make claims about listed firms. However, given that private firms contribute very substantially to overall economic activity, not only in Europe but also in the United States and other countries, our results can still inform policy debates, particularly on the potential consequences of taxing employees.

2. Institutional Setting and Data

2.1 Prior Literature on PIT and Labor Supply

Prior literature, including the seminal works of Lindsey (1987) and Feldstein (1995), examines taxpayers' response to changes in personal taxation. This literature generally finds that the economic incidence of PIT is partly borne by employees and partly by employers (Egebark and Kaunitz 2018; Giroud and Rauh 2019; Johnston 2019; Saez et al. 2019), which reduces labor supply and, thus, employment. Gruber and Saez (2002), Blomquist and Selin (2010), and Piketty et al. (2014) estimate the elasticity of PIT and find that an increase in PIT by 1% leads to a reduction in net-of-tax wages of 0.14–0.57%. Therefore, these results imply that, on average, firms bear part of the burden of PIT through higher wages and a lower labor supply. This, in turn, could also influence firm's capital investment decisions, because higher wages reduce firm profitability.

2.2 Simple Illustration of the Influence of PIT on Capital

To illustrate in a highly stylized and simple way how PIT influence firms' factor inputs, we start with a simple Cobb–Douglas production function. The firm maximizes its output Y by optimizing its labor and capital inputs, L and K, respectively. The production function $F(K, L) =$

$K^{\alpha} L^{\beta}$ satisfies the standard assumptions $F_K > 0$, $F_L > 0$ that imply that more inputs of capital or labor result in greater output, but at a decreasing rate ($\alpha + \beta < 1$). The cost of capital r and wages w represent the cost of employing one unit of capital and labor, respectively. The cost of labor $w(PIT)$ includes the cost of PIT to account for the fact that the incidence of the PIT might not fully lie on the employee but is instead shared with the employer.[5] Therefore, higher PIT should increase wage costs. We are interested in the investment consequences of this increase. To keep the model simple, we abstract from corporate taxes, since they do not change the inferences on the role of PIT in investment decisions. This results in a profit of $K^{\alpha} L^{\beta} - w(PIT) \times L - r \times K$. We calculate the optimal capital input K^* (while also optimizing labor input) and express the optimal K^* in natural logarithmic form to illustrate how PIT influence investment:

$$\ln(K^*) = \frac{1-\beta}{1-\alpha-\beta} * \ln(\alpha) - \frac{1-\beta}{1-\alpha-\beta} * \ln(r) + \frac{\beta}{1-\alpha-\beta} * \ln(\beta) - \frac{\beta}{1-\alpha-\beta} \ln(w(PIT)) \quad (1)$$

We take the first difference to obtain an expression for capital investment (i.e., a change in $\ln(K^*)$). Since we assume constant productivity α and β, we arrive at the following condition:

$$\Delta \ln(K^*) = -\Delta \frac{1-\beta}{1-\alpha-\beta} * \ln(r) - \Delta \frac{\beta}{1-\alpha-\beta} * \ln(w(PIT)) \quad (2)$$

This equation states that changes in optimal capital input stem from changes in the cost of capital and from changes in wages. Under reasonable assumptions ($0 < \alpha + \beta < 1$ and thus $0 < \frac{1-\beta}{1-\alpha-\beta}$) an increase in the cost of capital r reduces a firm's optimal level of capital. Since higher PIT increase the costs of labor w ($\frac{\partial w}{\partial PIT} > 0$), equation (2) suggests that higher PIT reduce capital

[5] This simplification does not imply that PIT are fully borne by the firm. What this simplification is trying to reflect is that PIT are not fully borne by the employee and, hence, the wages paid by the firm have an effect. Even if workers fully bear the burden, they have less disposable income to spend on consumption. The reduced private consumption can also result in lower investments, albeit in the long/medium run.

investments. However, this model is a simplification. It is also possible that, at the margin, firms substitute labor with capital when facing an increase in wages. Two effects can now happen: First, because labor becomes more costly, firms have an incentive to shift from labor to capital input. Second and as suggested by equation (2), since higher wages reduce the firm's overall input, firms invest less in labor, as well as in capital. To summarize, while firms can tilt their production toward relatively more capital input (i.e., the ratio of K to L increases), overall investment could still decline because the firm's scope decreases (K and L decline).[6] Whether investments decrease (as suggested by the first effect) or whether investments increase (as suggested by the second channel) after an increase in PIT is an empirical question.[7]

2.3 PIT: Background and Country Data Sources and Assumptions

Also referred to as individual income taxes, PIT are levied on income earned by individuals, including, among other items, wages. PIT are determined as a percentage of an employee's contractual gross wages. In 2017, PIT contributed 23% to the total tax revenue of European OECD countries (OECD 2019), which makes it one of the most important sovereign revenue sources. Germany raised 27% of its tax revenue through PIT, Great Britain 26%, Italy 26%, and France 19%. The United States, as a comparison, raised 35% of its total tax revenues through PIT in 2017. PIT is thus, next to consumption taxes, the most important tax revenue source of all OECD countries, surpassing other revenue sources, such as corporate or payout taxes.

We collect data on the personal tax rates of the 27 European Union (EU) countries plus Norway, the Republic of Serbia, and the United Kingdom from 2006 to 2018.[8] These data are

[6] Prior empirical literature finds evidence for both a positive relation between labor supply and investment (e.g., Bai et al. 2020) and a negative one (e.g., Acemoglu and Finkelstein 2008; Agarwal et al. 2020).
[7] Further, it is possible that firms further pass on the PIT burden to consumers or suppliers. To the extent that these stakeholder groups are not fully inelastic (a reasonable assumption), part of the PIT burden is borne by the firm, leading to investment responses.
[8] Appendix 1 and Figures A.1 and A.2 in the Online Appendix provide an overview of these rates.

obtained from tax advisors' handbooks issued by EY and KPMG.[9] The data and values are cross-checked with different sources from the EU, the OECD, and the EUROMOD Survey.[10]

For data collection, we assume an unmarried non-state employee who lives alone, with no children. If the employee were married and/or had children, the standard allowances and deductions would generally increase, and the employee would therefore face a lower average tax burden, especially at lower incomes. Since we use changes in tax rates in our setting, the implicit assumption is that average tax changes would also affect these groups. Generally, we neglect the tax deductibility of SSC, work-related expenses, and earned income tax credits. We consider standard deductions, standard allowances, and other basic tax-free amounts. Moreover, we combine federal and regional PIT, such as in Croatia, Italy, and Spain. Federal PIT are constant within a country, whereas regional or municipal PIT can differ across counties or municipalities. For this analysis, in case a country employs a regional income tax, the population-weighted average regional tax rate is considered (e.g., for Denmark, Finland, Italy, and Sweden). In case there is no population-weighted average in our sources (e.g., for Spain and Croatia), the capital's regional rate is chosen. We include additional compulsory surcharges, such as solidarity taxes as part of austerity measures during the European debt crisis (e.g., for Portugal, Spain, and Greece). Voluntary taxes, such as church taxes in Germany, are not considered. The data for each country are collected from the same source, ensuring consistency within a country over time. The detailed assumptions for each country are presented in Table A.1 of the Internet Appendix, with details on selected tax reforms in Table A.2. We also collect information on the combined SSC (employer and employee).

[9] See EY's The Global Executive tax guide (until 2011), Worldwide Personal Tax and Immigration Guide (from 2012 on) and KPMG's Global Individual Tax Handbook (published by KPMG, issued by the International Bureau of Fiscal Documentation, or IBFD).

[10] See, for the EU, the Taxes in Europe database, available from https://ec.europa.eu/taxation_customs/economic-analysis-taxation/taxes-europe-database-tedb_en; for the OECD, Taxing Wages, available from https://www.oecd.org/tax/tax-policy/tax-database; and, for EUROMOD, Country Reports, available fromhttps://www.euromod.ac.uk/using-euromod/country-reports.

We add employer and employee combined compulsory SSC expressed as a percentage of the employee's contractual gross wage. Voluntary contributions, for example, for better health insurance or increased pensions, are not considered.[11]

We calculate the average PIT for each country–year combination for annual incomes of 10,000 EUR, 30,000 EUR, 70,000 EUR, and 100,000 EUR, respectively, in the main analysis, but we also present the results for other levels.[12] We select these income levels to account for differences in average wages across Europe.[13] With an overall average wage of approximately 30,000 EUR, the EU shows variation that ranges from an average wage of approximately 10,000 EUR in Latvia or the Czech Republic to approximately 70,000 EUR per year in Luxembourg or Denmark. We focus on average personal taxes because, in contrast to marginal taxes, they adequately represent the overall tax burden an employee faces on his or her annual income. In Table A.4 of the Internet Appendix, we show the correlations of average PIT and SSC between various income classes. The respective PIT rates are generally highly correlated between adjacent income classes. In a robustness test, we use an alternative approach where we use country-specific annual incomes at various income percentiles to calculate the PIT (see Section 4.4.4). This way, we compare tax burdens at similar income percentiles, instead of similar absolute income amounts.

Figure A.3 of the Internet Appendix provides examples of the different PIT rates of our sample. One might wonder why the contributions in some countries appear disproportionately large in

[11] To account for the decision to opt out of mandatory social security systems in some countries, we only consider compulsory social security payments. This makes the contribution burden within countries comparable. If we considered voluntary contributions, the effect would be stronger. A few countries, such as United Kingdom, Poland, and Romania, reduce their tax-free amount with rising income, according to a specific formula provided by the respective tax authorities. We do not consider such cases and use the full tax-free amount as the basis for our calculations.

[12] Thus, we calculate PIT at the country–year level, since we can only observe average firm wage data. Table A.3 of the Online Appendix uses firm and industry average wages per employee as the income level to calculate net-of-average PIT. Our baseline results increase in magnitude.

[13] Details of the EU average wages are obtained from https://de.statista.com/statistik/daten/studie/183571/umfrage/bruttomonatsverdienst-in-der-eu.

magnitude. The reason is that the SSC share, being paid by the employer, is expressed as a percentage value of the employee's contractual gross salary. In all countries with employer SSC, the total labor costs for an employer amount to more than the employee's contractual gross salary. Consider Germany in 2018 as an example (see Figure 1): the total average labor costs for a gross salary of 70,000 EUR (equal to 100% of the gross salary) amount to 82,194 EUR (equal to 117.42% of the gross salary) because the employer pays parts of the SSC (12,194 EUR, or 17.42% of the gross salary). The employee pays 12,341 EUR (17.63% of gross salary) to social security institutions and 21,917 EUR (31.31%) to the tax authority. This leaves the employee with 35,735 EUR (51.05% of gross salary) in net salary. We use the gross salary as the basis for our calculations, because PIT are commonly expressed as a percentage of the gross salary. For PIT, we then calculate the net-of-PIT value by subtracting the taxes from 100%. This result can be interpreted as the percent of total gross income received by the employee after PIT.

2.4 Changes in PIT

We observe various changes in average PIT throughout our sample. Figures A.4 and A.5 in the Internet Appendix provide an overview of these changes. Depending on the income class, we find up to 46 increases and 20 decreases that are larger than 1%. Generally, we observe that left-oriented governments increase PIT for higher income classes, since they tend to support the working class, in contrast to their liberal-oriented counterparts, who generally decrease taxes, since they tend to support entrepreneurs. The aim of tax decreases is usually to stimulate the economy and increase investment (e.g., Belgium in 2018, the Czech Republic in 2008, and Poland in 2009), while tax increases are often implemented to balance the budget (e.g., Portugal in 2010, Greece in 2016, and Spain in 2012). Table A.2 of the Internet Appendix provides an overview of these reforms. Taken together, during the European debt crisis, we observe additional surcharges in Portugal, Spain, and Greece. For example, Portugal increased the PIT of all taxpayers by 3.5 percentage points in 2011.

Another concern is that such policy changes do not necessarily occur independently from other tax policy choices. To document how these tax changes relate to other tax policy tools, specifically to changes in corporate taxes and VAT, we present statistics on whether changes in PIT coincide with changes in VAT or corporate taxes (CIT) in Tables A.5 and A.6. However, we find that PIT largely do not coincide with changes in these other tax policy tools, and, even if they do, there is no obvious recurring pattern for increases and decreases in the respective tax policy tool.

2.5 Firm Data Sources

Our analysis is based on the unconsolidated financial statements of private corporations in Europe. One key advantage of using private firms is that their employees are exposed to local employment taxes. Using listed firms, such as in Compustat, bears the problem that the workforce of multinationals can be spread across different tax jurisdictions, which could blur the identification of an effect. We source our firm data from Bureau van Dijk's Amadeus database, starting with all active companies from 2006 to 2018. These data comprise listed and unlisted firms. We exclude companies that do not report earnings before interest and taxes (EBIT) and companies that have total or fixed assets of less than 100,000 EUR (see also Bethmann et al. 2018). We also exclude observations with negative sales, total assets, or cash.

We follow a three-step approach to ensure we are targeting standalone, that is, independent firms, which ensures that any profit shifting or corporate tax avoidance incentives in multinational firms will not affect our findings (Drake et al. 2019). First, we exclude firms with an unknown ownership concentration (Bureau van Dijk independence indicator U). Second, for firms with medium ownership concentration (independence indicators C, C+, and D), we assess their respective legal form to keep unlisted corporations in the sample. Third, we use firm observations from companies with unconsolidated accounts only (Bureau van Dijk account type U1). Our initial sample consists of 3,779,416 observations in 382 country–years. The regression sample is reduced

to 1,823,311 observations due to the construction of first differences. Table A.6 in the Internet Appendix summarizes the sample composition.

2.6 Descriptive Statistics

We present descriptive statistics in Table 1 and variable definitions in Appendix 2. Panel A of Table 1 shows the net-of-PIT values. The mean net-of-PIT values range from 67% to 93% for incomes from 10,000 EUR to 100,000 EUR.[14] Generally, PIT increase with rising income, due to progressive personal tax rates.[15] In Table 1, Panel B, we present descriptive statistics for the firm and country control variables. All firm variables are winsorized at the first and 99th percentiles. Our main dependent variable is the change in firms' capital stock (*Firm Capital Investment*), which is the logarithmic growth in fixed assets from $t-1$ to t, with a mean of 1.56%. Since a firm's capital stock can decrease if depreciated assets are not replaced, the change in capital stock can be negative.[16] The average (median) firm has a ratio of wages per assets (*Wage per Assets*) of 24.78% (17.35%), a leverage (*Leverage*) of 13.50% (5.54%), a return on assets (*Return on Assets*) of 3.09% (1.57%), and sales (*Sales*) of 5,694,207 EUR (1,404,051 EUR). The median sample firm has total assets of about 1.7 million EUR.

3. Empirical Specification

We use the simple model in Section 2.2 to guide our empirical tests. Building on equation (2), we test the following first-difference regression:

[14] The magnitude of PIT and SSC together appears large; however, one should keep in mind that, our sample countries typically do not charge high PIT and high SSC at the same time and that parts of the SSC are paid by the employer.
[15] More details are presented in Figure A.3 in the Online Appendix. The SSC, however, generally declines with rising incomes. This is attributable to countries, such as Germany, France, and United Kingdom, that employ a regressive social contribution scheme. An overview of the development of SSC over time is presented in Figure A.7 of the Online Appendix.
[16] See also Dobbins and Jacob (2016), who report negative median changes in fixed assets using data from Bureau van Dijk's Amadeus.

$$\Delta K_{i,j,t} = \alpha_0 + \beta_1 \Delta Net\text{-}of\text{-}PIT_{j,t} + \beta_2 \Delta Net\text{-}of\text{-}SSC_{j,t} + \beta_3 \Delta Wage\ per\ Assets_{i,t}$$
$$+ \beta_4 \Delta Leverage_{i,t} + \beta_5 \Delta ROA_{i,t} + \beta_6 \Delta Sales_{i,t} + \beta_7 \Delta X_{i,t} \varepsilon_{i,t,j} \quad (3)$$

where, for firm *i* in country *j* in year *t,* ΔK is the dependent variable that represents the change of the natural logarithm of fixed assets from $t - 1$ to t, winsorized at the first and 99th percentiles. The variable $\Delta Net\text{-}of\text{-}PIT_{j,t}$ denotes the change in net wages as a percent of gross wages after PIT. We expect β_1 to be negative (positive) if labor and capital are complements (substitutes). We separately use statutory PIT rates based on different income classes (ranging from 10,000 EUR to 100,000 EUR), because including all income classes at the same time results in multicollinearity. Since our model is a first-difference specification, our design can facilitate multiple tax changes per country, and we absorb all time-invariant firm-, industry-, or country-specific characteristics.

In our regression, we also control for changes in wage cost ($\Delta Wages\ per\ Assets_{i,t}$), leverage ($\Delta Leverage_{i,t}$), return on assets ($\Delta ROA_{i,t}$), and growth in the natural logarithm of sales ($\Delta Sales_{i,t}$), following prior investment literature (e.g., Baker et al. 2003). We include growth in sales as a proxy for growth opportunities for unlisted firms, and profitability as a proxy for the availability of internal funds. We also include several country control variables per country–year $X_{j,t}$ that are also used in prior literature (Jacob et al. 2019), such as the natural logarithm of $GDP\ per\ Capita_{j,t}$ and $GDP\ Growth_{j,t}$. Most importantly, we include SSC ($\Delta Net\text{-}of\text{-}SSC_{j,t}$) for the same income levels as the control variable. Additionally, we include the natural logarithm of $Openness_{j,t}$, measured by the sum of imports and exports divided by the GDP, measuring how much the economy depends on foreign trade. Moreover, we include the average of six World Bank Worldwide Governance Indicators in our regression ($\Delta Governance_{j,t}$). We also control for other taxes that could influence the optimal capital output of firms, and we regress the natural logarithm of the net-of-corporate income tax rate ($\Delta Net\text{-}of\text{-}CIT_{j,t}$) and net-of-VAT rate ($Net\text{-}of\text{-}VAT_{j,t}$) from

Jacob et al. (2019).[17] Additionally, to ensure that budget-balancing measures are not influencing our results, we regress the deficit-to-GDP ratio *(*Δ*Gov. Deficit to GDP*$_{j,t}$) in percent.[18] All country-level variables are included, also in first differences.

Furthermore, we use a fixed effects structure that ensures that we compare firms not only in the same industry and year, but also in comparable countries with respect to economic development. To do so, we sort countries into four clusters of GDP growth and level of GDP per capita (see Table A.8 in the Internet Appendix for an overview of these clusters). We then include industry–year–GDP quartile fixed effects in all the regressions. These consist of the one-digit NACE industry code, the year, and the respective GDP growth–GDP per capita cluster. We note that our results are robust to variations and combinations of fixed effects and control variables (see Table A.9 in the Internet Appendix). We follow Hsu et al. (2014) and He et al. (2020) and cluster our standard errors at the country–industry level to avoid small cluster bias from a limited number of countries.

4. Empirical Results

4.1 Baseline Results: Corporate Capital Investment and PIT

Our baseline tests of the effects of average PIT on corporate investment are presented in Table 2. We estimate the effects of the changes of net-of-PIT values for annual incomes of 10,000 EUR, 30,000 EUR, 70,000 EUR, and 100,000 EUR, respectively. Columns (1) to (4) present the results without control variables other than SSC. In Columns (5) to (8), we include control variables to account for alternative firm or country characteristics that could influence firms' investment decisions. The results in Columns (1) to (4) indicate that capital investment is

[17] We do not consider dividend taxes paid by firm owners. Controlling for dividend taxes does not change our inferences (see Table A.7 in the Online Appendix).
[18] We control for macroeconomic drivers of PIT, such as the GDP, government deficits, and governance factors, but we additionally use industry–year–GDP quartile FE.

influenced by changes in net-of-average PIT. All the net-of-average PIT coefficients are significant at the 1% level. The elasticity of PIT with respect to capital investments is estimated at –0.13 to –0.25, depending on the income used to calculate average PIT. At an income of 10,000 EUR (Column (1)), a decrease of PIT by 1% (i.e., an increase of net salary by 1%) results in an increase of firm investments of about 0.25%. When control variables are included (Column (5) to (8)), the results are very similar and consistent with our simple model: if employees receive a higher net salary and labor supply increases (we show the latter in Section 4.6), increased labor input following a tax decrease increases the capital demand if labor and capital are complements (see Section 4.5).

We also find that the effect of PIT on investment appears to decline at higher income levels. At an income of 100,000 EUR (Column (4)), a decrease in PIT by 1% increases investments by 0.13%, compared to 0.25% at an income of 10,000 EUR (Column (1)). To examine the effect across income classes further, we estimate the role of PIT in corporate investments in of increments 10,000 EUR up to an income of 500,000 EUR. This approach also mitigates concerns that the choice of income classes influences our results. Figure 2 plots the coefficient estimates. We find that PIT matter most for lower annual gross incomes. The effect gradually declines with increasing incomes. At an income of about 320,000 EUR, the effect becomes statistically nonsignificant and the coefficient estimates for higher income levels are very close to zero. In Section 4.3, we discuss potential explanations for this result.

Regarding the influence of SSC on capital investments, we do not find significant results. This finding can be explained by the different natures of PIT and SSC payments. First, while PIT abstractly finance the government without any direct benefits to the employee, SSC are more directly linked to employee benefits such as healthcare or retirement benefits, thus confirming the findings of Ooghe et al. (2003).

Another empirical result that is worth noting relates to the role of CIT and VAT. Consistent with prior literature on corporate taxes (e.g., Djankov et al. 2010; Giroud and Rauh 2019) and VAT (Jacob et al. 2019), we find that lower corporate taxes and value added taxes (higher values of *net-of-$CIT_{j,t}$* and *net-of-$VAT_{j,t}$*, respectively) increase investments. Importantly, the economic magnitude for lower PIT levels is very close to the magnitude of corporate tax and VAT levels, supporting the economically important role that PIT play in corporate investment decisions. One potential explanation for this finding is that it does not matter who pays the tax (firms, employees, or consumers), because, for all these taxes, it just matters who bears the burden. Despite the fact that the PIT are only borne by the firm through higher input factor costs (labor), it appears as if the magnitudes of the economic burdens of PIT, CIT, and VAT are comparable. Taken together, these taxes seem to be comparable with respect to their effects on investment.

4.2 Increases versus Decreases in Average PIT

Next, we examine if firms respond differently to increases versus decreases in PIT. Such asymmetry could result from differences in adjusting the level of capital (and labor) input up versus down. We create dummy variables for increases and decreases in PIT and use three different cutoffs (±0%, ±0.5%, and ±1.0%, respectively). We then use these dummy variables in our baseline estimation. Table 3 shows that, across all cutoff points (Panels A to C) and income classes, increases in PIT reduce firm investments with similar magnitudes as in our baseline regression when we compare the dummy variable coefficients to those of our continuous variables from the baseline approach.[19] The effect increases in magnitude with rising cutoff points. This result appears logical, since the dummy variable captures larger changes. Generally, we also find that decreases

[19] Table 3 shows the investment response to *percentage point* changes of PIT. Considering that PIT increases larger than one percentage point ((Column (1) of Panel C) are, on average, 3.35 percentage points, which is approximately 9.5% of the average PIT rate of 35%, one needs to multiply the coefficient estimate by this amount to compare the effect to our baseline estimate. This yields an estimate of about –0.22 (= –0.0212 × 9.5%), which is similar to our baseline result.

in PIT increase capital investments, suggesting that the effects of PIT on investment are symmetric.[20]

4.3 Why is the Investment–Tax Relation Stronger at Lower Income Levels?

Our baseline results indicate that PIT exhibit a stronger relation with investment if lower versus higher incomes underlie statutory PIT. There are two potential explanations for this result. First, at higher income levels, the number of employees is likely to be smaller than at lower income levels. Put differently, firms are more exposed to workers at the lower end of the income distribution than at the higher end. To support this argument, Figure 3 shows the distribution of firms per average wage. We find that the majority of firms pay an average wage of less than 30,000 EUR and thus employ more low-wage earners than high-wage earners. Hence, capital is expected to be more exposed to the taxes of lower-income employees.

Second, our theory suggests that the effect of PIT depends on the relation between capital and labor. A stronger complementary relation between labor and capital would result in a stronger effect of PIT on labor income (as we show in Section 4.5). With respect to our main result, we argue that the link between capital and labor could differ across income classes and, in particular, that the labor–capital relation is stronger for low-wage earners than for high-wage earners, resulting in a stronger investment response to PIT changes. In Figure 4, we plot the coefficients from regressing changes in labor on changes in capital for different groups of firms that differ in their average wage per employee. Higher coefficient estimates indicate that capital and labor are more strongly linked. We find evidence consistent with the explanation that capital and labor input exhibit a stronger complementary relation at lower that at higher income levels. This decline in the

[20] For SSC, increases generally reduce firm investments, especially at lower income levels. We attribute this result to higher incomes valuing the benefits of social security (e.g., health or pension) more than additional distributable income.

relation is also statistically significant and could thus explain why the PIT at lower wage levels affect investments more strongly than for higher income levels.[21]

4.4 Supplemental Tests

4.4.1 Lead–Lag Tests

One important test relates to the parallel trends assumption underlying our approach. While tax policy, in our case, arguably does not offer clean exogenous variation, we still want to document trends in investment around PIT changes. To test if firm capital investment reacts to changes of future PIT, we follow prior literature (Yagan 2015; Bethmann et al. 2018; Giroud and Rauh 2019) and re-estimate our baseline regression from Section 4.1 by including changes in PIT one year ahead ($t + 1$), two years ahead ($t + 2$), one year earlier ($t - 1$), and two years earlier ($t - 2$). The results are reported in Table 4. We use the same controls as in our baseline regression and industry–year–GDP quartile FE and again cluster our standard errors at the country–industry level. Consistent with the parallel trends assumption, we would expect nonsignificant coefficients on the lead terms ($t + 1$ and $t + 2$), which capture a response to future tax changes. We do not find evidence of future PIT influencing capital investment, supporting the parallel trends assumption.

As in our baseline regression, we find that current increases in net-of-average PIT increase capital investments. Gulen and Ion (2016), Bethmann et al. (2018), and Jacob et al. (2019) also show a timely investment response to (tax) policy changes or to uncertainty. Intuitively, an immediate response makes sense, especially since many major PIT reforms are part of a multiyear tax reform plan, (see also Table A.2 in the Internet Appendix). One concern could be that, because

[21] The stronger response at low incomes could also be explained by the *income* and *substitution* effects (e.g., Ashenfelter and Heckman 1974; Dickert et al. 1995). The income effect states that, with rising incomes, people can afford more leisure time, which reduces the labor supply. In contrast, the substitution effect argues that, as leisure becomes more costly due to opportunity costs, people work more to keep their utility constant, which increases the labor supply. Our empirical finding that investments and the labor supply appear to be more strongly affected by PIT at lower wages would be consistent with the income effect being larger than the substitution effect.

wages are sticky (e.g., Jacoby and Mitchell 1990; Lehmann et al. 2013), an immediate response could seem unreasonable at first glance. However, since firms and employees can anticipate how PIT changes translate into future wages, firms can adjust their investments right away. We sporadically find that changes in past PIT change capital investments, albeit to a much smaller extent. This result suggests an immediate response of investment to changes in PIT, and, especially for high incomes, this effect increases slightly a year later (indicating adjustment time).

4.4.2 Collapsed Analysis

One potential concern of our analysis is that not every country is represented by the same number of firm–year observations. Due to different reporting requirements and country sizes, larger countries, such as Italy, Spain, and France, provide more firm–year observations than smaller countries, such as Cyprus, Malta, and Luxembourg. To avoid some countries being over- or underrepresented, we also run a collapsed analysis at the country–year level. Specifically, we regress the change in net-of-average PIT on the change of a country's gross capital formation in constant 2010 US dollars, sourced from the World Bank data (see Table 5). We control for the change of net-of-average SSC, country control variables, the country–year mean of each firm-level control variable, and country and year FE and cluster standard errors at the country level. We estimate that, depending on the income class, an increase of net-of-average PIT of 1% increases gross capital formation by 0.41–0.63%. This finding indicates that our results are robust to a collapsed country-level analysis.

4.4.3 Robustness Tests: Addressing Concerns about Unobserved Economic Conditions

One obvious concern is that local economic conditions could be driving our results. Hence, we re-estimate the baseline regression in Table 6 with a sample that does not include countries in the years they received investment stimulus packages from the EU (so-called bailout countries; see Table A.10 of the Internet Appendix). We thus drop 251,951 observations from Portugal, Spain,

Greece, Ireland, Cyprus, and Romania in times when they received EU aid.[22] We find that, for non-bailout countries, a 1% increase in net-of-PIT values increases capital investments by approximately 0.26–0.43%. This is about 30% larger in magnitude than the results from our baseline regression. We also find that higher income classes react less to PIT changes in this setting.[23]

Another way to account for local unobserved variation in economic conditions is to zoom into border regions and to control for the economic conditions and taxes in the home country, as well as in the neighboring country. In this test, we limit the sample to firms located in a two-digit postal code bordering another sample country. Because of the Schengen Agreement and the right of free labor mobility in the EU, employees frequently seek employment in other countries. Nevertheless, according to Article 15 of the 2017 OECD Model Tax Convention and most EU countries' tax laws, employment is generally taxed in the country in which it is exercised, if the employment is exercised for more than six months.[24] Put differently, even if firms employ someone from the neighboring country, the PIT are applied in the firm's host country. In Table 7, we thus include personal taxes as well as country controls from the neighboring country in our baseline regression and estimate the effect for firms in close proximity of a border. We define this group based on the two-digit postal code. We find that a 1% increase in domestic net-of-average PIT increases investment by 0.16–0.26%, an effect that is comparable in magnitude to our baseline regression. Hence, our results hold when expanding the controls for local economic conditions

[22] Following De Vito et al. (2020), in Table A.11 of the Online Appendix, we exclude years with austerity measures. A 1% increase in net-of-average PIT appears to increase investment by 0.46% for lower income classes.
[23] Sections A.2 and A.3 and Tables A.7, A.9, and A.12 of the Online Appendix show additional robustness tests using alternative dependent variables and controls. The results are robust to a host of different choices.
[24] For further reference, see the official EU website, at https://europa.eu/youreurope/citizens/work/taxes/income-taxes-abroad/faq/index_en.htm.

through the inclusion of controls for neighboring countries' characteristics. However, we note that we cannot perfectly address this important concern, because tax rates are not set randomly.

4.4.4 Alternative Choice of Income Levels

One potential concern could be that the chosen income classes do not adequately represent comparable economic incomes in the respective countries. An annual gross income of 10,000 EUR in Romania, for example, yields more purchasing power than in Norway. Therefore, we recalculate the baseline regression for country–year income percentiles using Eurostat data.[25] In Table 8 and as shown in Figure 2, we chose the 10th, 25th, 50th, 75th, 90th, and 99th income percentiles to represent a broad population. Using the same fixed effects structure, controls, and clusters as in our baseline regression, we find that a 1% increase in net-of-average PIT increases investment. As in the baseline regression, the effect of PIT on investment declines with increasing income percentiles. This result further corroborates our main findings. Additionally, we assess the robustness of our findings to using a PIT rate based on firm-specific average wages or country–industry-specific wages (and different percentiles thereof) in Table A.3 of the Internet Appendix. Since, in this calculation, we use wages from year $t - 1$, PIT cannot influence the level of wages at which the tax rate is defined. Overall, the results in Table A.3 support our main findings and indicate that the magnitude of the PIT–investment relation is greatest at lower levels of industry-level wages.

4.5 Assessing the Heterogeneity in the Effect of PIT on Corporate Investment

We next examine cross-sectional differences in the role of PIT in investment decisions across firms. The general objective of these tests is to examine if PIT have a stronger link to corporate investment if theory predicts a greater effect. One channel through which PIT can affect

[25] We use data from EU Statistics on Income and Living Conditions and European Community Household Panel, available from https://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=ilc_di01&lang=en.

firms' capital investment decisions is where part of PIT is borne by the firm. Hence, if firms do not have sufficient flexibility to adjust labor and/or capital (i.e., the firm is relatively inelastic compared to its workers), theory suggests that firms bear more of the personal tax burden. We thus would expect a stronger capital investment response among these firms to changes in PIT. In this section, we use several different dimensions to test this explanation. For each of these tests, we first run our baseline model for the respective subsample and then test for statistical differences across partitions. In all cross-sectional tests, we include firm and country controls from our baseline regression and industry–year–GDP quartile fixed effects.

In Panel A of Table 9, we split the sample according to firms' operating margins. The level of the operating margin is indicative of a firm's relative market power vis-à-vis its stakeholders and thus the firm's flexibility to respond to external shocks. Put differently, firms with high (low) margins are more elastic (inelastic) relative to their stakeholders. Hence, they bear a smaller (greater) share of the personal tax and we expect a weaker (stronger) investment response. This test thus also addresses the concern that firms can simply pass on the PIT burden to customers or suppliers, because this ability to pass on taxes is a function of a firm's market power (e.g., Jacob et al. 2019). The results in Panel A are generally consistent with the idea that firms with low margins bear more of the PIT: the investments of firms with lower margins are more sensitive to PIT than the investments of firms with higher margins. Specifically, a PIT change of 1% for an incomes of 70,000 EUR leads to an increase of investments of 0.18% for low-margin firms and an increase of only 0.10% for high-margin firms. Again, this effect diminishes with rising income and is greater for smaller incomes. We find significantly different PIT coefficients between the groups for annual incomes of 70,000 EUR and 100,000 EUR.

In Panel B of Table 9, we split the sample according to total factor productivity. Our prediction is that, when firms are highly productive, they bear less of the PIT burden, because such

firms can more easily move to capital. To measure productivity, we follow Chemmanur et al. (2010), Cappellari et al. (2012), Kim and Ouimet (2014), and Krishnan et al. (2015) and the application to European private firms of Bethmann et al. (2018). Total factor productivity is the residual from a firm-level regression, estimated separately for each country–industry–year. The dependent variable is the natural logarithm of the value added (EBIT plus depreciation and wage expenses), and the independent variables are the natural logarithm of wage expenses and the natural logarithm of fixed assets. We find that firms with above-median (below-median) productivity react less (more) to changes in net-of-average PIT. For incomes of 70,000 EUR, for example, an increase of net-of-average PIT by 1% increases investment by 0.16% for low-productivity firms and by 0.12% for high-productivity firms. The coefficients differ across partitions in two of four cases.

Panel C, Table 9 splits our sample based on the location, with border versus inner-country firms. We base the definition on the two-digit postal code, as explained above. Our expectation is that, at a border, firms are less elastic relative to their employees, because, when taxes increase, the employees could go to the neighboring country, working at lower tax rates. Hence, border firms' investments should exhibit a stronger correlation with PIT than inner-country firms' investments. We find that, for border firms, an increase of 1% in net-of-average PIT increases the corporate investment of border firms by 0.17–0.30%. For inner-country firms, the estimates are statistically significant, but smaller. The difference across partitions is significant in two cases.

In the next step, we test another mechanism of our theoretical model that relates to the complementarity of factor inputs. Changes in PIT can unfold an effect on investment only insofar as capital and labor inputs are linked. We thus sort industries according to their relations regarding changes in capital and changes in labor input. Specifically, for each country–industry, we regress changes in capital on changes in employees. A higher coefficient for changes in employees suggests that capital and labor have a stronger relation in an industry; a smaller coefficient suggests

a weaker relation between capital and labor inputs in an industry. We then perform a median split based on these coefficients. Panel D of Table 9 splits the sample between industries with a stronger positive relation between capital and labor and those with a weaker one. We find an effect comparable to the baseline among industries that treat capital and labor rather complementarily (stronger relation). The effect of PIT on investment is weaker but still significant in industries in which labor and capital exhibit a weaker positive relation. Importantly, the effects differ across groups. This result supports the theoretical prediction that PIT influence corporate investment via changes in the labor supply, because the investments of firms with strong ties between capital and labor react the strongest to changes in PIT.

As our final cross-sectional test, we examine the role of effective versus statutory tax rates for employees. Specifically, if parts of employment activity occur in the informal sector (i.e., taxes are evaded), changes in statutory tax rates should have a weaker effect than when employment is exercised in the formal sector. To test this notion empirically, Panel E of Table 9 divides the sample into countries with a smaller versus a larger informal economy relative to their GDP.[26] Theoretically, in countries with a larger informal sector, firms should react less to changes in PIT, because employees of the informal sector are unlikely to be officially registered and thus do not effectively pay PIT. Indeed, we find that the coefficients are smaller for informal sector-to-GDP country–years above the median. In contrast, in countries with a small informal sector, firms' investment responds significantly to changes in PIT. Again, the differences across partitions are statistically significant. This result supports our theory, that PIT influence corporate investment.

[26] We obtain data on the size of the informal sector from the International Monetary Fund's website, at https://www.imf.org/en/Data/Statistics/informal-economy-data. We also present the results using the size of the shadow economy in Table A.13 of the Online Appendix.

Overall, these cross-sectional tests corroborate our interpretation of the main results that capital investment is reduced because firms bear part of the employees' personal income tax burden. These tests additionally address concerns about omitted correlated variables and unobserved economic conditions explaining our findings (to the extent that our cross-sectional splits are unrelated to local economic conditions).

4.6 PIT and Labor Input

In the final step, we examine a necessary (theoretical) channel through which PIT can influence corporate investment. Specifically, we examine whether higher PIT reduce employment for our sample firms. If PIT affect investment through the labor supply, firms are expected to reduce the number of employees. In Table 10, we change the dependent variable of our baseline regression accordingly. We show that the number of employees is positively related to an increase in net-of-average PIT. Put differently, higher taxes (i.e., lower net-of-average PIT) reduce employment, consistent with our theoretical considerations. For lower incomes, firms employ 0.23% more employees per 1% decrease in PIT. This result reassures our theoretical prediction that PIT change the labor supply, which, in turn, influences investment decisions. Our estimates in Table 10 are consistent with prior literature that shows the burden of PIT is shared between the employer and the employees (Gruber and Saez 2002; Blomquist and Selin 2010; Piketty et al. 2014).[27]

5. Conclusion

This paper investigates the effect of personal income taxation on capital investment. We use a sample of European private firms, since their workforce is arguably exposed to PIT in the respective country. The elasticity for lower incomes at which the statutory rate is calculated is –

[27] We acknowledge, however, that the employee data from Bureau van Dijk's Amadeus database are not mandatory reporting items. Hence, the data quality is not necessarily comparable to balance sheet data.

0.25, and it declines for higher incomes. The magnitude of investment responses to personal tax changes at lower income levels is comparable to that of the investment responses to corporate taxes or consumption taxes in our sample. At higher income levels, the PIT effect decreases. We further find that the effect of personal taxation is more pronounced in firms that have lower operating margins, in industries with a stronger link between capital and labor input, in border firms, and in countries with a smaller informal sector.

Our findings have important implications for the debate on tax policy design, since personal taxation is one of the main sources of revenue for governments.[28] Our results indicate that personal taxes have a comparable effect on investment as corporate taxes, particularly income taxes at lower income levels. Hence, our results provide important input for tax policy considerations. The reduced magnitude of distortive firm effects at higher income levels suggests that governments can balance their budgets while circumventing negative investment externalities, for example, by lowering taxes at lower income levels and financing this by modest increases in income taxes at higher income levels. Of course, our paper does not provide a full welfare analysis, since we focus on capital investment decisions. Still, given that corporate investment is a key driver of overall economic growth, we believe that we have documented investment responses that are important for both academics and policymakers.

[28] In addition to the effects we document, we also note that prior literature suggests that PIT can adversely affect the owners of partnerships, since they directly pay PIT (e.g., Carroll et al. 2001, Giroud and Rauh 2019), additionally contributing to potential distortions created by PIT.

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Appendix 1: Overview of Average PIT and SSC Rates per Country

This table presents the average and marginal PIT and SSC rates for our sample countries. We estimate the respective taxes at incomes of 10,000 EUR, 30,000 EUR, 70,000 EUR, and 100,000 EUR. We estimate the mean values from 2006 to 2018. The numbers are the percent of the gross income earned. We estimate the average PIT and SSC for the displayed income classes by dividing taxes paid by gross income earned.

Country	Average PIT (%)				Average SSC (%)			
	10k	30k	70k	100k	10k	30k	70k	100k
Austria	0.0	8.9	49.1	49.1	49.1	49.1	43.9	33.6
Belgium	9.6	30.9	46.8	46.8	46.8	47.9	47.8	47.5
Bulgaria	11.6	12.2	31.1	31.1	31.1	13.7	5.9	4.1
Cyprus	0.0	0.0	17.8	17.8	17.8	17.8	13.6	10.1
Czech Republic	11.2	20.9	45.6	45.6	45.6	45.6	37.2	30.2
Germany	2.9	17.7	39.9	39.9	39.9	39.9	33.5	23.8
Demark	16.0	37.2	8.0	8.0	8.0	8.0	8.0	8.0
Estonia	16.6	20.9	27.2	27.2	27.2	33.4	35.2	35.6
Spain	11.1	22.7	4.0	4.0	4.0	25.5	16.3	11.4
Finland	0.0	0.0	29.2	29.2	29.2	29.2	29.2	29.2
France	1.5	8.8	63.1	63.1	63.1	63.1	61.3	60.8
Great Britain	2.3	11.1	3.7	3.7	3.7	17.8	19.2	17.9
Greece	1.7	11.7	42.9	42.9	42.9	42.9	42.9	33.3
Croatia	17.1	29.6	21.0	21.0	21.0	31.6	34.3	29.9
Hungary	18.5	22.7	47.6	47.6	47.6	47.0	44.5	43.9
Ireland	3.0	20.0	8.7	8.7	8.7	13.1	16.5	17.3
Italy	5.8	24.2	41.5	41.5	41.5	41.5	41.8	39.9
Lithuania	12.1	15.0	38.6	38.6	38.6	38.6	38.6	38.6
Luxembourg	0.0	0.0	23.8	23.8	23.8	24.4	24.5	24.2
Latvia	22.0	23.9	34.0	34.0	34.0	34.0	28.5	26.3
Malta	2.4	15.4	3.7	3.7	3.7	7.6	3.3	2.3
Netherlands	4.7	4.7	49.1	49.1	49.1	49.1	27.1	19.0
Norway	2.4	22.6	16.9	16.9	16.9	19.6	20.4	20.5
Poland	16.6	19.1	43.0	43.0	43.0	38.6	25.5	22.5
Portugal	12.0	26.7	34.8	34.8	34.8	34.8	34.8	34.8
Romania	14.4	15.5	42.9	42.9	42.9	40.8	31.0	28.7
Serbia	0.0	0.0	29.8	29.8	29.8	33.9	18.4	14.5
Sweden	27.5	31.8	37.3	37.3	37.3	38.2	36.1	34.8
Slovenia	13.9	27.5	6.2	6.2	6.2	27.5	33.6	35.0
Slovak Republic	12.3	19.0	47.3	47.3	47.3	43.3	28.0	20.7

Appendix 2: Variable Definitions

This table shows the descriptions for all the regression variables.

PIT Variables		Source
Net-of-PIT 10k *Net-of-PIT 30k* *Net-of-PIT 70k* *Net-of-PIT 100k*	Net salary after deducting the average PIT in a country–year at incomes of 10,000 EUR, 30,000 EUR, 70,000 EUR, and 100,000 EUR, in percent (100 – PIT)	Tax advisors' handbooks (EY,[1] KPMG[2]), cross-checked and appended with different sources from the EU,[3] the OECD,[4] and the EUROMOD Survey[5]
Firm and Country Variables[6]		**Source**
Net-of-SSC 10k *Net-of-SSC 30k* *Net-of-SSC 70k* *Net-of-SSC 100k*	The net salary after deducting average SSC in a country–year at incomes of 10,000 EUR, 30,000 EUR, 70,000 EUR, and 100,000 EUR, in percent (100 – SSC)	Tax advisors' handbooks (EY,[7] KPMG[8]), cross-checked and appended with different sources from the EU,[9] the OECD,[10] and the EUROMOD Survey[11]
Firm Capital Investment	Fixed Assets – lagged Fixed Assets	Bureau van Dijk's Amadeus
Country Gross Cap. Inv.	Gross Total Capital Formation – lagged Gross Total Capital Formation	World Bank
Wages per Assets	Staff Costs/Total Assets	Bureau van Dijk's Amadeus
Leverage	Long-term Debt/Total Assets	
Return on Assets	Profit/lagged Total Assets	
Sales	Turnover	
GDP per Capita	GDP per capita in constant 2010 USD	World Bank
GDP Growth	GDP growth, in percent	
Governance	World Governance Indicators: voice and accountability, political stability, government effectiveness, regulatory quality, rule of law, control of corruption	
Openness	(Imports + Exports)/GDP	World Development Indicators
Net-of-CIT	Net receipts after CIT, in percent (100 – CIT)	Bethmann et al. (2018)
Net-of-VAT	Net receipts after VAT, in percent (100 – VAT)	Jacob et al. (2019)
Gov. Deficit to GDP	Central government deficit to GDP, in percent	Eurostat

[1] Global Executive tax guide (until 2011) and Worldwide Personal Tax and Immigration Guide (from 2012 on). Available from https://www.ey.com/gl/en/services/tax/global-tax-guide-archive.
[2] Global Individual Tax Handbook (published by KPMG, issued by IBFD).
[3] Taxes in Europe database. Available from https://ec.europa.eu/taxation_customs/economic-analysis-taxation/taxes-europe-database-tedb_en.
[4] Taxing Wages. Available from https://www.oecd.org/tax/tax-policy/tax-database.
[5] EUROMOD Country Reports. Available from https://www.euromod.ac.uk/using-euromod/country-reports.
[6] Unless indicated otherwise, all balance sheet items are end-of-year values.
[7] Global Executive Tax Guide (until 2011) and Worldwide Personal Tax and Immigration Guide (from 2012 on). Available from https://www.ey.com/gl/en/services/tax/global-tax-guide-archive.
[8] Global Individual Tax Handbook (published by KPMG, issued by IBFD).
[9] Taxes in Europe database. Available from https://ec.europa.eu/taxation_customs/economic-analysis-taxation/taxes-europe-database-tedb_en.
[10] Taxing Wages. Available from https://www.oecd.org/tax/tax-policy/tax-database.
[11] EUROMOD Country Reports. Available from: https://www.euromod.ac.uk/using-euromod/country-reports.

Firm Size	Log of Total Assets	Bureau van Dijk's Amadeus
Firm Margin	Operating Profit Margin: EBIT/Turnover (Sales)	Bureau van Dijk's Amadeus
Firm Productivity	Residual of value added (EBIT + Depreciation + Wages) regressed on Wages, and Fixed Assets (by country-industry-year)	Bureau van Dijk's Amadeus
Debt Crisis Bailout	Dummy if country–year associated with EU aid to mitigate the European debt crisis	Knight and Steward (2016)

Figure 1: Composition of Remuneration for an Income of 70k EUR in Germany

This figure shows the components of gross wages and the share of PIT and SSC that are subtracted to calculate net wages for Germany.

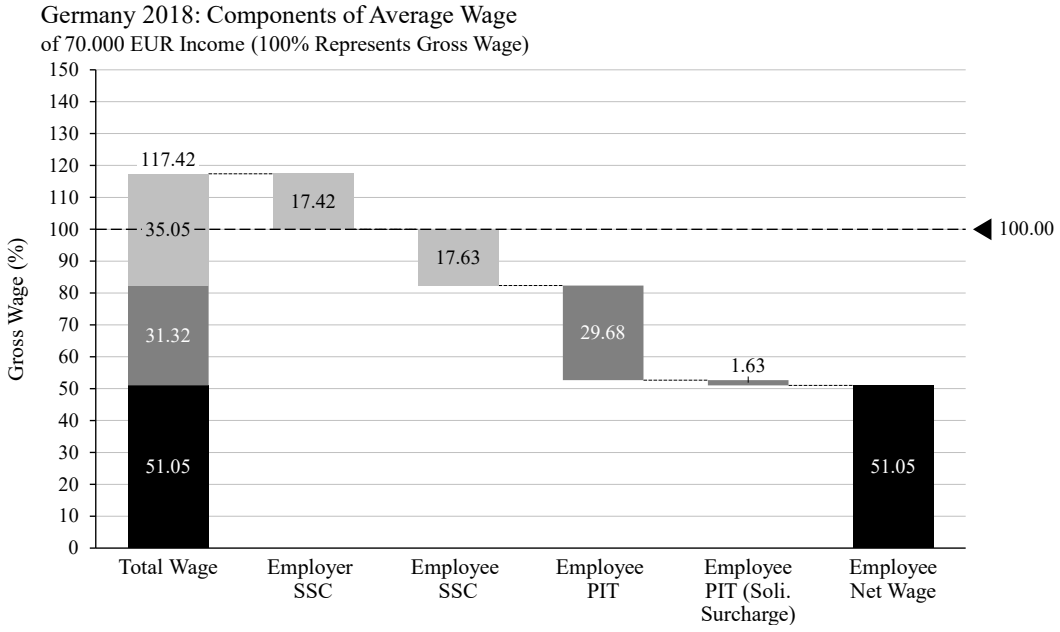
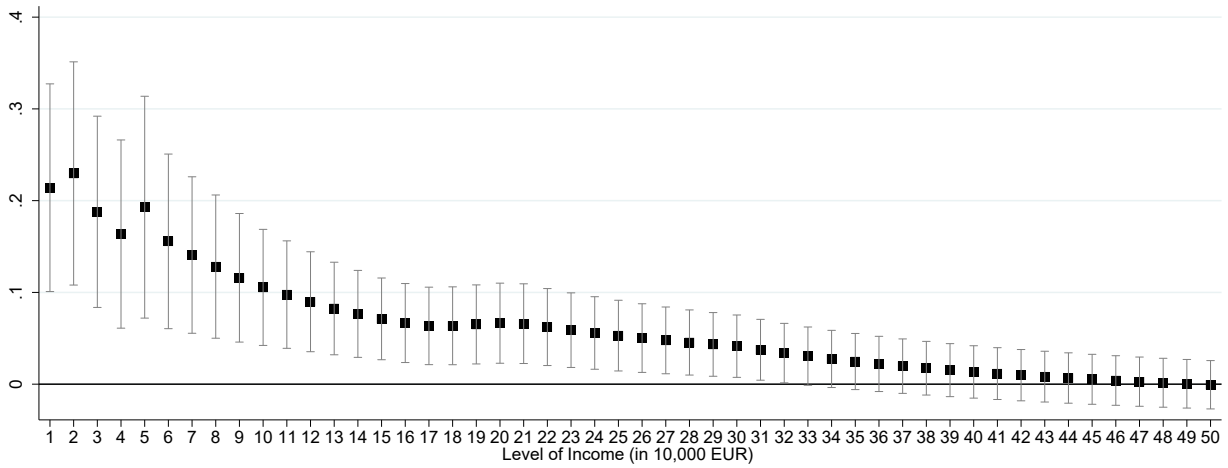


Figure 2: Coefficients of the Baseline Regression at Various Income Levels

This figure shows the coefficients of our baseline regression in Section 4.1, where the average PIT and SSC are calculated for income levels from 10,000 EUR to 500,000 EUR (Panel A) and using income percentiles (Panel B).

Panel A: Breakdown by Income Levels



Panel B: Breakdown by Income Percentiles

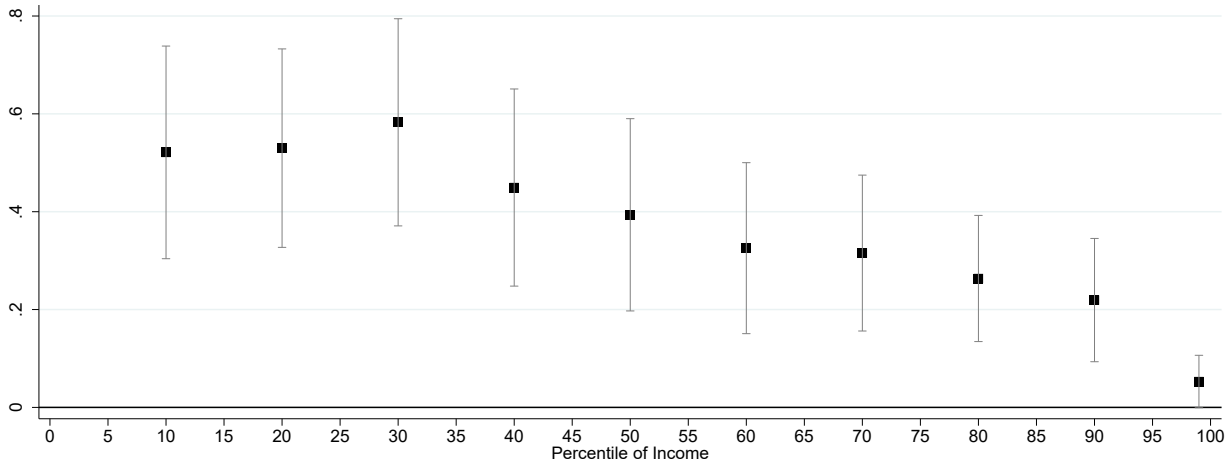


Figure 3: Distribution of Firms per Average Wage per Employee

This figure shows the fraction of firms in our sample within a 2,500-EUR bin of average wages per employee.

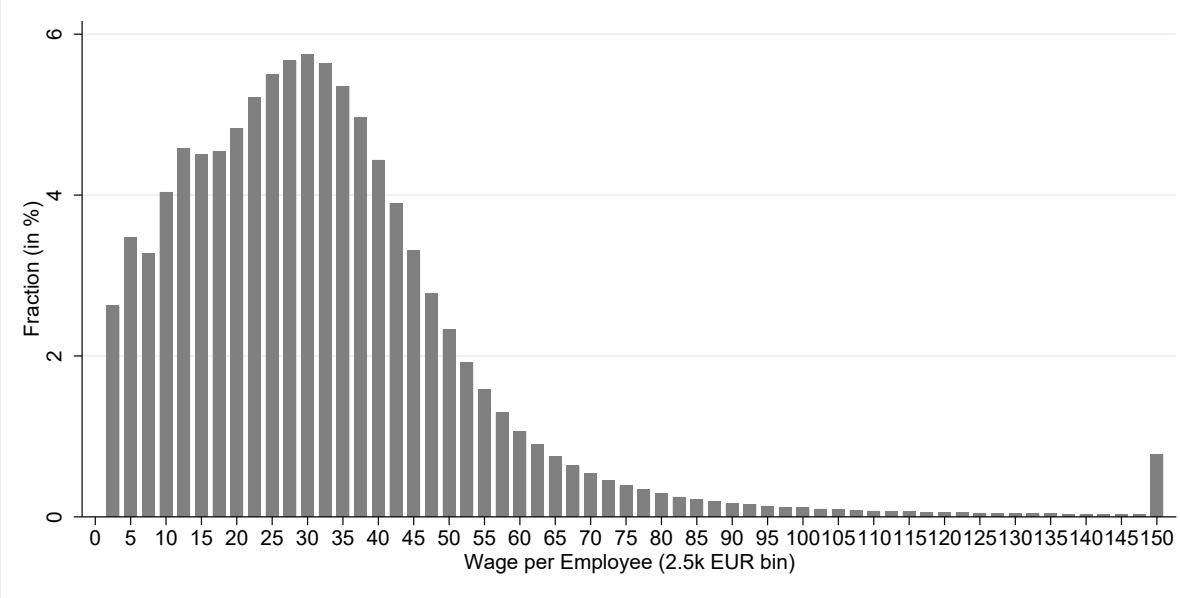


Figure 4: Link between Capital and Labor

This figure shows the regression coefficients from regressing changes of employees (L) on changes in capital (K) per 5,000-EUR employee wage bin.

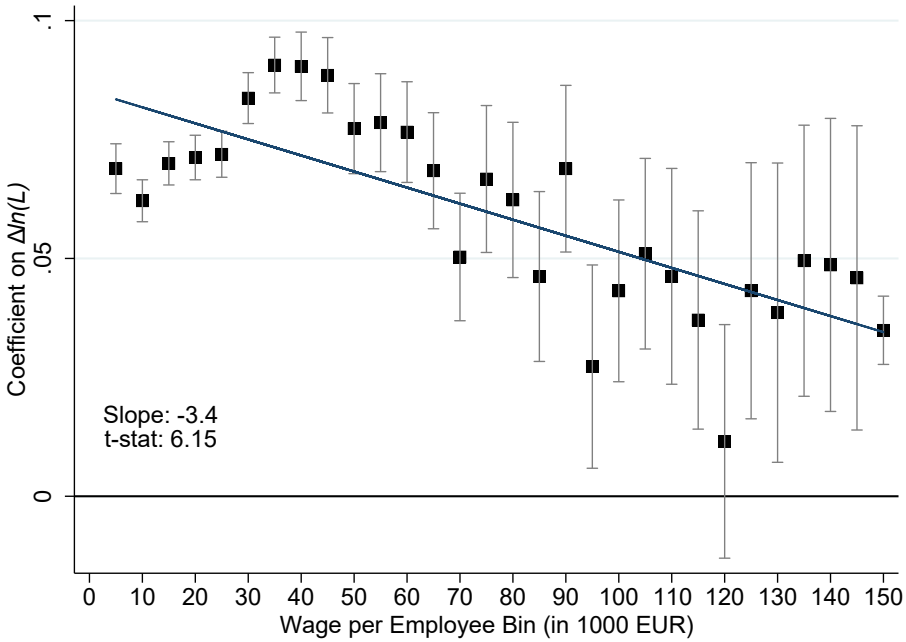


Table 1: Descriptive Statistics

This table presents descriptive statistics of our main variables for 1,823,311 observations from 2006 to 2018. Panel A reports the PIT variables, and Panel B the firm- and country-level variables. Appendix 2 defines the variables. Table A.14 of the Internet Appendix reports the first differences of these variables.

Panel A: PIT Variables					
Variable	**Mean**	**St. Dev.**	**P25**	**P50**	**P75**
Net-of-PIT 10k	0.9301	0.0443	0.8922	0.9430	0.9437
Net-of-PIT 30k	0.8085	0.0501	0.7910	0.7930	0.8310
Net-of-PIT 70k	0.7097	0.0620	0.6787	0.6814	0.7500
Net-of-PIT 100k	0.6731	0.0674	0.6428	0.6457	0.7109
Net-of-PIT 10th	0.9787	0.0415	0.9747	1.0000	1.0000
Net-of-PIT 25th	0.9253	0.0374	0.9247	0.9313	0.9457
Net-of-PIT 50th	0.8798	0.0374	0.8656	0.8731	0.9075
Net-of-PIT 75th	0.8428	0.0404	0.8238	0.8290	0.8721
Net-of-PIT 90th	0.8069	0.0410	0.7837	0.7914	0.8392
Net-of-PIT 99th	0.7253	0.0577	0.6935	0.7047	0.7331
Panel B: Firm and Country Variables					
Firm Capital Inv.	0.0156	0.2378	-0.0766	-0.0193	0.0569
Country Gross Cap. Inv.	22.6826	1.2047	21.9801	23.1166	23.6555
Net-of-SSC 10k	0.6618	0.1890	0.5843	0.5863	0.8268
Net-of-SSC 30k	0.6175	0.1246	0.5843	0.5893	0.7431
Net-of-SSC 70k	0.6463	0.1443	0.5806	0.5860	0.7977
Net-of-SSC 100k	0.6675	0.1576	0.5809	0.6147	0.8042
Net-of-SSC 10th	0.6716	0.2019	0.5843	0.5886	0.8093
Net-of-SSC 25th	0.6681	0.1971	0.5843	0.5886	0.8039
Net-of-SSC 50th	0.6433	0.1593	0.5843	0.5886	0.8005
Net-of-SSC 75th	0.6257	0.1346	0.5843	0.5863	0.7855
Net-of-SSC 90th	0.6155	0.1211	0.5843	0.5863	0.7444
Net-of-SSC 99th	0.6224	0.1226	0.5813	0.5838	0.7422
Wages per Assets	0.2478	0.2547	0.0735	0.1719	0.3316
Leverage	0.1350	0.1839	0.0000	0.0554	0.2044
Return on Assets	0.0309	0.0863	0.0006	0.0157	0.0572
Sales	5,694,207	14,700,000	498,229	1,404,051	3,926,127
GDP per Capita	34,103	13,762	29,496	33,969	35,994
GDP Growth	0.5789	2.2177	-0.0962	0.9520	1.8987
Governance	-0.4183	0.6949	-0.9567	-0.4873	-0.0111
Openness	0.7139	0.2978	0.5475	0.5995	0.7014
Net-of-CIT	0.7148	0.0571	0.6871	0.6900	0.7300
Net-of-VAT	0.7911	0.0179	0.7800	0.7900	0.8000
Gov. Deficit to GDP	-3.4964	3.5365	-5.1000	-3.0000	-2.4000
Debt Crisis Bailout	0.0744	0.2624	0.0000	0.0000	0.0000
Firm Size	6,924,875	19,100,000	758,536	1,725,514	4,514,305
Firm Margin	-0.0021	0.5767	0.0091	0.0387	0.0929

Table 2: Main Regression Results: Capital Investment and PIT

This table presents the main results. The dependent variable is *Capital Investment*, the change of the natural logarithm of fixed assets in comparison to the prior year's fixed assets. The primary independent variable is *Net-of-PIT*, one minus the average PIT value, as the logarithm and first difference from the lagged value at various income levels. All variables are measured as of year *t*. Controls are included in Columns (5) to (8), with industry–year–GDP quartile FE in all the regressions. We report robust standard errors clustered at the country–industry level in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Dependent Variable	**ΔCapital Investment**				**ΔCapital Investment**			
Income Class	10k	30k	70k	100k	10k	30k	70k	100k
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ΔNet-of-PIT	0.2513***	0.2273***	0.1630***	0.1266***	0.2141***	0.1878***	0.1407***	0.1054***
	(0.0510)	(0.0652)	(0.0502)	(0.0395)	(0.0572)	(0.0526)	(0.0431)	(0.0319)
ΔNet-of-SSC	0.0022	-0.1501	-0.0563*	-0.0451	0.0178	-0.1545*	-0.0405	-0.0244
	(0.0602)	(0.1061)	(0.0288)	(0.0311)	(0.0478)	(0.0912)	(0.0284)	(0.0314)
ΔWages per Assets					-0.6396***	-0.6396***	-0.6397***	-0.6397***
					(0.0351)	(0.0351)	(0.0351)	(0.0351)
ΔLeverage					0.3000***	0.2999***	0.2999***	0.2998***
					(0.0262)	(0.0262)	(0.0262)	(0.0262)
ΔReturn on Assets					-0.1101***	-0.1101***	-0.1101***	-0.1101***
					(0.0166)	(0.0166)	(0.0166)	(0.0166)
ΔSales					0.0609***	0.0609***	0.0609***	0.0609***
					(0.0064)	(0.0064)	(0.0064)	(0.0064)
ΔGDP per Capita					0.0904***	0.0941***	0.0898**	0.0956***
					(0.0340)	(0.0353)	(0.0359)	(0.0354)
ΔGDP Growth					0.0012**	0.0012**	0.0013**	0.0013**
					(0.0005)	(0.0005)	(0.0006)	(0.0006)
ΔGovernance					0.0198**	0.0182**	0.0177*	0.0175*
					(0.0096)	(0.0092)	(0.0090)	(0.0091)
ΔOpenness					0.0041	0.0028	0.0028	0.0027
					(0.0062)	(0.0058)	(0.0059)	(0.0058)
ΔNet-of-CIT					0.2108***	0.2238***	0.2085***	0.2085***
					(0.0335)	(0.0334)	(0.0342)	(0.0341)
ΔNet-of-VAT					0.1991***	0.1667***	0.1919***	0.1850***
					(0.0532)	(0.0559)	(0.0573)	(0.0553)
ΔGov. Deficit to GDP					0.0022***	0.0021***	0.0021***	0.0021***
					(0.0005)	(0.0005)	(0.0005)	(0.0005)
Industry–Year–GDP Quart. FE	YES	YES	YES	YES	YES	YES	YES	YES
Observations	1,823,311	1,823,311	1,823,311	1,823,311	1,823,311	1,823,311	1,823,311	1,823,311
Adj. R-squared	0.0087	0.0088	0.0088	0.0088	0.0758	0.0758	0.0758	0.0758

Table 3: Increases and Decreases in Average PIT

This table presents the results from regressing dummy variables for increases and decreases in average PIT as percentages of various incomes on firms' capital investments. Different panels represent different cutoff points for increases and decreases (e.g., a change larger than 0.5% in Panel B). All control variables are defined in first differences, and controls are included in all columns. We include industry–year–GDP quartile FE in all the regressions. We report robust standard errors clustered at the country–industry level in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Dependent Variable	**ΔCapital Investment**			
Income Class	10k	30k	70k	100k
	(1)	(2)	(3)	(4)
Panel A: Increases and decreases > |0.0%|				
PIT increase	-0.0051**	-0.0098***	-0.0084***	-0.0078***
	(0.0022)	(0.0016)	(0.0015)	(0.0015)
PIT decrease	-0.0013	0.0038**	0.0032*	-0.0015
	(0.0010)	(0.0015)	(0.0017)	(0.0024)
Controls	YES	YES	YES	YES
Industry–Year–GDP Quart. FE	YES	YES	YES	YES
Observations	1,823,311	1,823,311	1,823,311	1,823,311
Adj. R-squared	0.0755	0.0757	0.0756	0.0758
Panel B: Increases and decreases > |0.5%|				
PIT increase	-0.0140***	-0.0080***	-0.0062**	-0.0073***
	(0.0024)	(0.0027)	(0.0026)	(0.0028)
PIT decrease	0.0033**	0.0058***	0.0071***	0.0057**
	(0.0015)	(0.0019)	(0.0025)	(0.0025)
Controls	YES	YES	YES	YES
Industry–Year–GDP Quart. FE	YES	YES	YES	YES
Observations	1,823,311	1,823,311	1,823,311	1,823,311
Adj. R-squared	0.0757	0.0756	0.0757	0.0757
Panel C: Increases and decreases > |1.0%|				
PIT increase	-0.0212***	-0.0080***	-0.0137***	-0.0073**
	(0.0045)	(0.0019)	(0.0022)	(0.0029)
PIT decrease	0.0014	0.0064***	0.0075**	0.0036
	(0.0024)	(0.0024)	(0.0037)	(0.0026)
Controls	YES	YES	YES	YES
Industry–Year–GDP Quart. FE	YES	YES	YES	YES
Observations	1,823,311	1,823,311	1,823,311	1,823,311
Adj. R-squared	0.0756	0.0757	0.0757	0.0755

Table 4: Capital Investment and Future PIT

This table presents the main regression results, including lead and lagged values for PIT. All the variables are defined in first differences. Controls from the main regression are included in all the regressions. We include industry–year–GDP quartile FE in all the regressions. We report robust standard errors clustered at the country–industry level in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Dependent Variable		**ΔCapital Investment**			
ΔNet-of-PIT	Income Class Response in	10k	30k	70k	100k
		(1)	(2)	(3)	(4)
Response already before the tax change	year $t + 2$	0.0935	-0.1068	0.0114	0.0337
		(0.0890)	(0.0861)	(0.0735)	(0.0689)
	year $t + 1$	0.0388	-0.0197	0.0588	0.0558
		(0.1019)	(0.0713)	(0.0588)	(0.0570)
Immediate Response	**year *t***	**0.4825*** **	**0.5384*** **	**0.4369*** **	**0.3816*** **
		(0.0985)	**(0.1002)**	**(0.0677)**	**(0.0582)**
Delayed Response	year $t - 1$	-0.0840	0.0772	0.0836*	0.1215***
		(0.1060)	(0.0684)	(0.0440)	(0.0385)
	year $t - 2$	0.1873**	-0.0581	-0.0662	-0.0299
		(0.0837)	(0.0766)	(0.0516)	(0.0418)
Controls		YES	YES	YES	YES
Ind.–Yr.–GDP Quart. FE		YES	YES	YES	YES
Observations		949,031	949,031	949,031	949,031
Adjusted R-squared		0.0762	0.0763	0.0763	0.0763
Adjusted within R-sq.		0.0692	0.0693	0.0693	0.0693

Table 5: Collapsed Country-Level Analysis of PIT and Gross Capital Investment

This table presents the results from regressing the average net-of-PIT percentages of various incomes on firms' capital investments aggregated at the country level (*Country Gross Capital Investment*). All variables are defined in first differences of the country–year means. We include country and year FE in all the regressions. We include the controls from our baseline regression as country–year means in all the columns. We report robust standard errors clustered at the country level in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Dependent Variable	**ΔCountry Gross Capital Investment**			
Income Class	10k	30k	70k	100k
	(1)	(2)	(3)	(4)
ΔNet-of-PIT	0.6341**	0.6140***	0.4915***	0.4072**
	(0.2385)	(0.1803)	(0.1645)	(0.1477)
Controls	YES	YES	YES	YES
Country FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Observations	313	313	313	313
Adjusted R-squared	0.5262	0.5239	0.5244	0.5227

Table 6: Robustness of the Main Regression Results, Excluding Bailed-Out Countries

This table presents our results, excluding countries that received EU aid in the sovereign debt crisis (Cyprus, 2011–2016; Greece, 2010–2018; Hungary, 2008–2010, Ireland, 2010–2013; Latvia, 2008–2011; Portugal, 2011–2014; Romania, 2009–2015; Spain, 2012–2013). The dependent variable remains *Capital Investment*. The variable of interest is *Net-of-PIT*. All the variables are measured as of year *t*. Controls and industry–year–GDP quartile FE are included in all the regressions. We report robust standard errors clustered at the country–industry level in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Dependent Variable	**Δ Capital Investment**			
Income Class	10k	30k	70k	100k
	(1)	(2)	(3)	(4)
ΔNet-of-PIT	0.2618***	0.4283***	0.3877***	0.3082***
	(0.0752)	(0.0967)	(0.1005)	(0.0838)
Controls	YES	YES	YES	YES
Industry–Year–GDP Quart. FE	YES	YES	YES	YES
Observations	1,687,633	1,687,633	1,687,633	1,687,633
Adjusted R-squared	0.0774	0.0774	0.0775	0.0774

Table 7: Robustness of the Main Regression Results for Neighboring Countries PIT

This table presents our results when we include only observations for firms that are located in a two-digit postal code bordering another sample country (*Domestic Country*) and regressing the PIT of the country that is located at the border on the two-digit postal code (*Neighbor Countr*y). We thus estimate the regression within postal codes that share a border with another sample country. The dependent variable remains *Capital Investment*. The variable of interest is *Net-of-PIT*. All variables are measured as of year *t*. Controls and industry–year–GDP quartile FE are included in all the regressions. We report robust standard errors clustered at the country–industry level in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Dependent Variable	**ΔCapital Investment**			
Income Class	10k	30k	70k	100k
	(1)	(2)	(3)	(4)
ΔNet-of-PIT	0.2565**	0.2030***	0.1915***	0.1608***
(*Domestic Country*)	(0.1064)	(0.0764)	(0.0556)	(0.0454)
ΔNet-of-PIT	-0.0950	-0.0164	0.0076	0.0147
(*Neighbor Country*)	(0.0692)	(0.0453)	(0.0332)	(0.0390)
Controls	YES	YES	YES	YES
Industry–Year–GDP Quart. FE	YES	YES	YES	YES
Observations	263,780	263,780	263,780	263,780
Adjusted R-squared	0.0904	0.0905	0.0905	0.0905

Table 8: Robustness of the Main Regression Results Using Country–Year Income Percentiles to Calculate Net-of- PIT

This table presents the results of estimating the baseline regression (Table 2) using country–year percentiles to calculate Net-of- PIT and SSC. The dependent variable is *Capital Investment*, the natural logarithm of fixed assets to lagged fixed assets. The primary independent variable is *Net-of-PIT*, one minus the average PIT, in percent, as the logarithm and first difference from the lagged values at various income levels. All variables are measured as of year *t*. Industry–year–GDP quartile FE and controls are included in all columns. We report robust standard errors clustered at the country–industry level in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Dependent Variable	**ΔCapital Investment**					
Income Percentile	10th	25th	50th	75th	90th	99th
	(1)	(2)	(3)	(4)	(5)	(6)
ΔNet-of-PIT	0.5212***	0.6239***	0.3936***	0.2737***	0.2193***	0.0529*
	(0.1098)	(0.1097)	(0.0992)	(0.0693)	(0.0636)	(0.0271)
Ind.–Yr.–GDP Quart FE	YES	YES	YES	YES	YES	YES
Controls	YES	YES	YES	YES	YES	YES
Observations	1,823,311	1,823,311	1,823,311	1,823,311	1,823,311	1,823,311
Adj. R-squared	0.0756	0.0757	0.0756	0.0755	0.0755	0.0755

Table 9: Cross-Sectional Tests

This table presents the cross-sectional results of estimating the baseline regression (Table 2) on our primary sample. The dependent variable is *Capital Investment*, the natural logarithm of fixed assets to lagged fixed assets. The primary independent variable is *Net-of-PIT*, one minus the average PIT, in percent, as the logarithm and first difference from the lagged values at various income levels. All variables are measured as of year *t*. Controls and industry–year–GDP quartile FE are included in all columns. In Panel A, Columns (1), (3), (5), and (7) (Columns (2), (4), (6), and (8)) present the results using a subsample of companies with operating profits to turnover below (above) the country–year median (Jacob et al. 2019). In Panel B, Columns (1), (3), (5), and (7) (Columns (2), (4), (6), and (8)) present the results using a subsample of companies with factor productivity below (above) the sample median (Bethmann et al. 2018). In Panel C, Columns (1), (3), (5), and (7) (Columns (2), (4), (6), and (8)) present the results using a subsample of companies that are located in a non-border (border) postal code area. In Panel D, Columns (1), (3), (5), and (7) (Columns (2), (4), (6), and (8)) present the results using a subsample of companies that are divided according to whether they exhibit strong (weak) relations between capital and labor. Panel E presents the results using a subsample of companies that are divided according to the size of the informal economy in their country. To test for significant differences across columns, we report the coefficient estimate of the interaction between *Net-of-PIT* and the respective *small/low/non-border/weaker* indicator variable from a regression including all observations. In this test, we interact the respective *small/low/non-border/weaker* indicator variables with all the controls and FE. We report robust standard errors clustered at the country–industry level in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Panel A: Breakdown by Operating Margin

Dependent Variable	**ΔCapital Investment**							
Income Class	10k		30k		70k		100k	
Split	Low	High	Low	High	Low	High	Low	High
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ΔNet-of-PIT$_t$	0.2622***	0.1663**	0.2200***	0.1569**	0.1794***	0.1020**	0.1456***	0.0655
	(0.0594)	(0.0745)	(0.0524)	(0.0677)	(0.0447)	(0.0518)	(0.0344)	(0.0405)
Small vs. Large Size	0.0959		0.0631		0.0775*		0.0802**	
(PIT) t-stat.	(1.36)		(1.11)		(1.91)		(2.21)	
Controls & FE	YES	YES	YES	YES	YES	YES	YES	YES
Observations	911,580	911,731	911,580	911,731	911,580	911,731	911,580	911,731
Adjusted R^2	0.073	0.078	0.073	0.078	0.073	0.078	0.073	0.078

Panel B: Breakdown by Total Factor Productivity

Dependent Variable	**ΔCapital Investment**							
Income Class	10k		30k		70k		100k	
Split	Low	High	Low	High	Low	High	Low	High
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ΔNet-of-PIT$_t$	0.2760***	0.1290*	0.2077***	0.1690**	0.1629***	0.1160**	0.1240***	0.0838**
	(0.0556)	(0.0778)	(0.0429)	(0.0732)	(0.0401)	(0.0535)	(0.0288)	(0.0421)
Low vs. High Margin	0.1890***		0.0483		0.0567**		0.0452	
(PIT) t-stat.	(3.13)		(1.01)		(1.97)		(1.64)	
Controls & FE	YES	YES	YES	YES	YES	YES	YES	YES
Observations	907,125	907,274	907,125	907,274	907,125	907,274	907,125	907,274
Adjusted R^2	0.1062	0.0687	0.1062	0.0687	0.1062	0.0687	0.1062	0.0687

Panel C: Border versus Non-Border Firms								
Dependent Variable	**ΔCapital Investment**							
Income Class	10k		30k		70k		100k	
Split	Non-Border	Border	Non-Border	Border	Non-Border	Border	Non-Border	Border
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ΔNet-of-PIT	0.1988***	0.3012***	0.1643***	0.2316***	0.1214***	0.2045***	0.0885***	0.1696***
	(0.0543)	(0.1044)	(0.0464)	(0.0748)	(0.0398)	(0.0564)	(0.0297)	(0.0456)
Low vs. High Productivity	-0.1024		-0.0673		-0.0831**		-0.0810**	
(PIT) t-stat.	(0.0774)		(0.0571)		(0.0373)		(0.0319)	
Controls & FE	YES	YES	YES	YES	YES	YES	YES	YES
Observations	1,558,235	265,076	1,558,235	265,076	1,558,235	265,076	1,558,235	265,076
Adjusted R^2	0.0739	0.0899	0.0739	0.0899	0.0739	0.0899	0.0739	0.0899
Panel D: Breakdown by Relation between Capital and Labor at the Industry Level								
Dependent Variable	**ΔCapital Investment**							
Income Class	10k		30k		70k		100k	
Split	Stronger	Weaker	Stronger	Weaker	Stronger	Weaker	Stronger	Weaker
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ΔNet-of-PIT	0.4386***	0.2131***	0.5543***	0.1562***	0.4532***	0.0918***	0.3306***	0.0825***
	(0.1184)	(0.0549)	(0.1623)	(0.0327)	(0.1448)	(0.0256)	(0.1227)	(0.0237)
Border vs. Non-Border	-0.2255*		-0.3981**		-0.3614**		-0.2480**	
(PIT) t-stat.	(-1.73)		(-2.41)		(-2.46)		(-1.99)	
Controls & FE	YES	YES	YES	YES	YES	YES	YES	YES
Observations	452,457	1,370,854	452,457	1,370,854	452,457	1,370,854	452,457	1,370,854
Adjusted R2	0.102	0.069	0.102	0.069	0.102	0.069	0.102	0.069
Panel E: Breakdown by the Size of the Informal Sector in the Economy								
Dependent Variable	**ΔCapital Investment**							
Income Class	10k		30k		70k		100k	
Split	Small	Large	Small	Large	Small	Large	Small	Large
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ΔNet-of-PIT	0.6564***	0.0561	0.2989***	0.0863	0.6564***	0.0561	0.2989***	0.0863
	(0.1243)	(0.0812)	(0.0728)	(0.0618)	(0.1243)	(0.0812)	(0.0728)	(0.0618)
Border vs. Non-Border	0.6003***		0.2126**		0.3163***		0.3549***	
(PIT) t-stat.	(4.03)		(2.21)		(4.04)		(5.31)	
Controls & FE	YES	YES	YES	YES	YES	YES	YES	YES
Observations	540,583	1,282,728	540,583	1,282,728	540,583	1,282,728	540,583	1,282,728
Adjusted R^2	0.077	0.077	0.077	0.077	0.077	0.077	0.077	0.077

Table 10: PIT and Labor Input

This table presents the baseline results with an alternative dependent variable. The dependent variable is *Number of Employees*. The primary independent variable is *Net-of-PIT*, one minus average PIT as the logarithm and first difference from the lagged values at various income levels. All variables are measured as of year *t*. Controls are included in all columns and industry–year–GDP quartile FE are included in all the regressions. We report robust standard errors clustered at the country–industry level in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Dependent Variable	**ΔNumber of Employees**			
Income Class	10k	30k	70k	100k
	(1)	(2)	(3)	(4)
ΔNet-of-PIT	0.2299**	0.1887*	0.1256*	0.1126*
	(0.0993)	(0.1048)	(0.0688)	(0.0621)
Controls	YES	YES	YES	YES
Industry–Year–GDP Quart. FE	YES	YES	YES	YES
Observations	1,521,917	1,521,917	1,521,917	1,521,917
Adj. R-squared	0.0767	0.0767	0.0766	0.0767

Internet Appendix

The Role of Personal Income Taxes in Corporate Investment Decisions

Martin Jacob and Robert Vossebürger

A.1. SSC

Similar to PIT, we also collected data on SSC. Likewise, SSC should also reduce the labor supply and thus firm investment. However, it is ex ante unclear whether PIT or SSC have a stronger effect on firms' investment decisions. PIT and SSC generate different returns to employees. While PIT abstractly finance the government, without direct benefits to the employee, SSC are mostly directly linked to benefits, for example, in the form of healthcare or retirement payments.[1] Moreover, in most European countries, parts of the SSC are paid by the employers directly, making these payments less salient to workers. Therefore, it is possible that the effect on investment differs between PIT and SSC.

SSC, also known as payroll taxes, are compulsory payments to government institutions that entitle the employee to the receipt of predefined future social benefits and are levied on the employee's contractual gross wage. These contributions normally consist of payments for retirement, healthcare, unemployment, work safety, and/or training. Generally, they are shared by both the employer and the employee. Figure A.1 shows the average PIT and SSC values of our sample countries, Figure A.2 graphically shows the development of average PIT and SSC values over all countries for various income classes over time.[2] Generally, from 2006 to 2018, PIT rates are subject to a decline of about three to five percentage points, while SSC for all incomes, except 10,000 EUR,

[1] Ooghe et al. (2003) also find that the more pronounced the reciprocity between the contributions and benefits of SSC, the more the incidence lies with the employee.

[2] For an overview of average SSC, see Figure A.8 of the Online Appendix, and for the country-level development of SSC, see Figure A.7.

increase by two to three percentage points. For an income of 10,000 EUR, the SSC decreases by approximately three percentage points.

In our baseline regression (Table 2 of the main paper) and other regressions, we cannot document a positive and significant relation between SSC and investment. We attribute this to the aforementioned different natures of PIT and SSC. Therefore, we explain this null result by employees valuing the direct benefits of SSC, and, thus, they do not reduce their labor supply as when paying PIT.

A.2. Robustness to the Exclusion of Wages per Assets

Since the incidence of PIT and SSC lies partly with the firm, *Wages per Assets* (staff costs over total assets) could capture PIT and SSC, because they are reflected in the cost of labor. Moreover, this measure could inversely capture capital investments, since fixed assets are part of total assets. Taken together, this could influence our results. We therefore re-estimate the main regression without *Wages per Assets.* In Table A.12, we show that *Wages per Assets* do not influence our results. The net-of-average PIT coefficients are of similar magnitude (0.09–0.21, depending on the income class) as in our main regression and are all significant at the 1% level.

A.3. Robustness to the Inclusion of Alternative Controls and Dependent Variables

In Panel A of Table A.7, we use an alternative investment measure. We estimate our baseline regression, but use changes in *PP&E*, representing investment in tangible fixed assets, as the dependent variable. The results are comparable in magnitude to those of the baseline regression, in which we employed changes in fixed assets as the dependent variable.

In Panels B and C of Table A.7, we include additional control variables. While the inclusion of *Unemployment Rate* decreases the magnitude of the coefficients (Panel E), the inclusion of *Dividend Tax Rate* increases the effect slightly (Panel F). This result is reassuring, since our regression appears not to suffer from omitted variable bias.

References

De Vito, Antonio, Martin Jacob, and Guosong Xu (2020): Firms' internal networks and austerity spillover. *SSRN Electronic Journal*.

Ooghe, Erwin, Erik Schokkaert, and Jef Flechet (2003): The incidence of social security contributions: An empirical analysis. *Empirica*, 30, 81–106.

Figure A.1: Average Personal Income Tax Rates and SSC

This figure shows the average PIT and SSC across all income classes (10,000 EUR, 30,000 EUR, 70,000 EUR, 100,000 EUR) from 2006 to 2018.

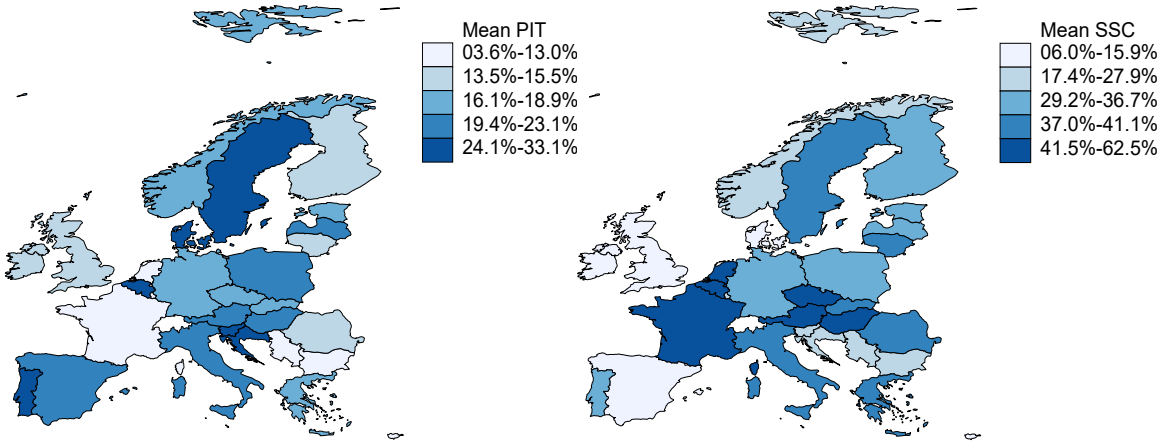


Figure A.2: Development of Average PIT over Time

This figure shows the development of average PIT over time.

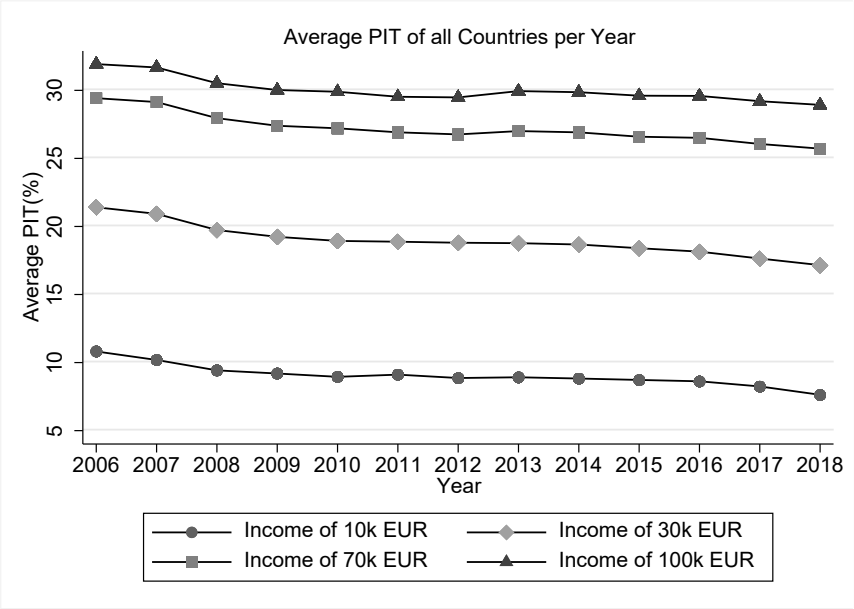
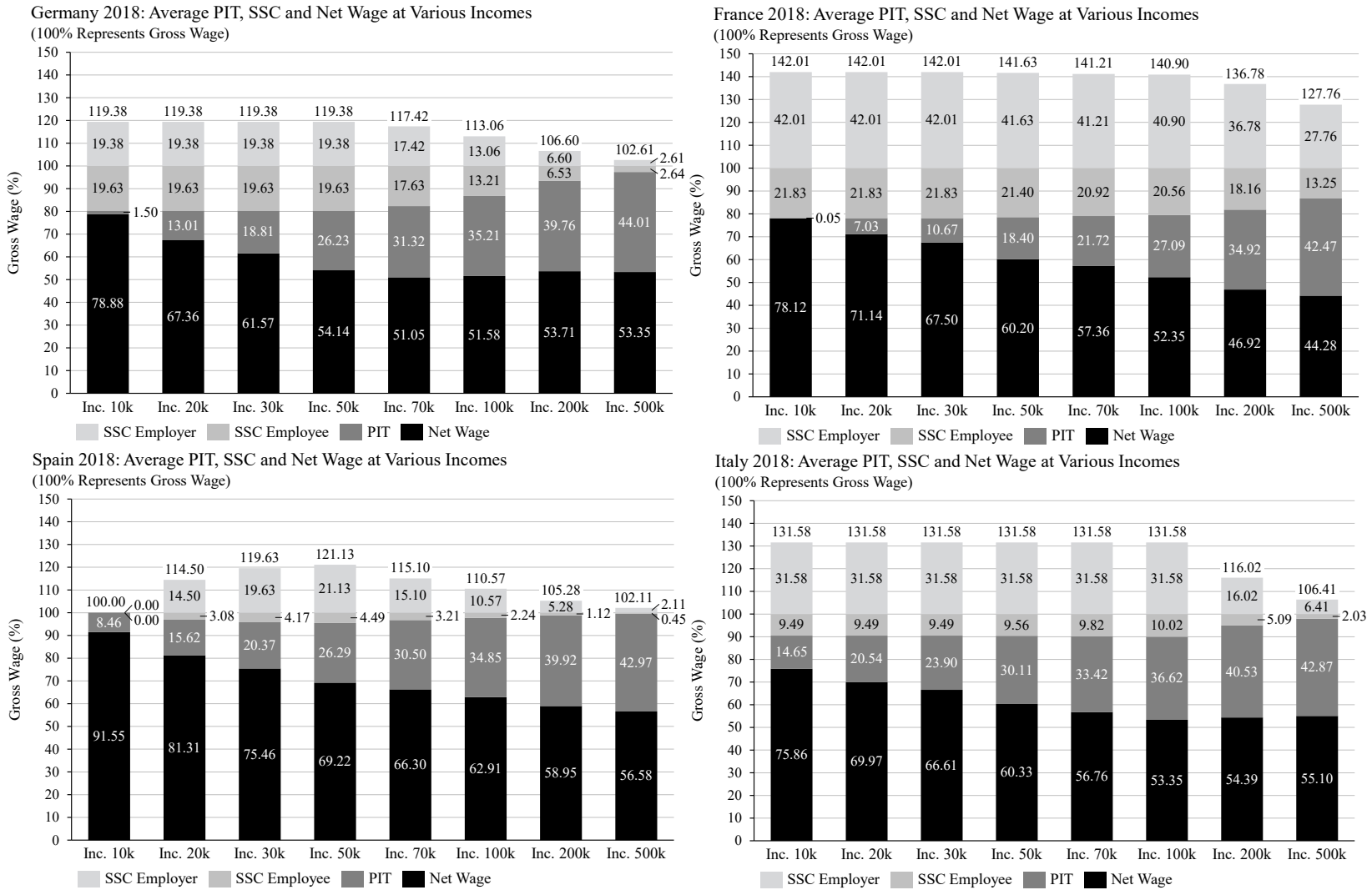
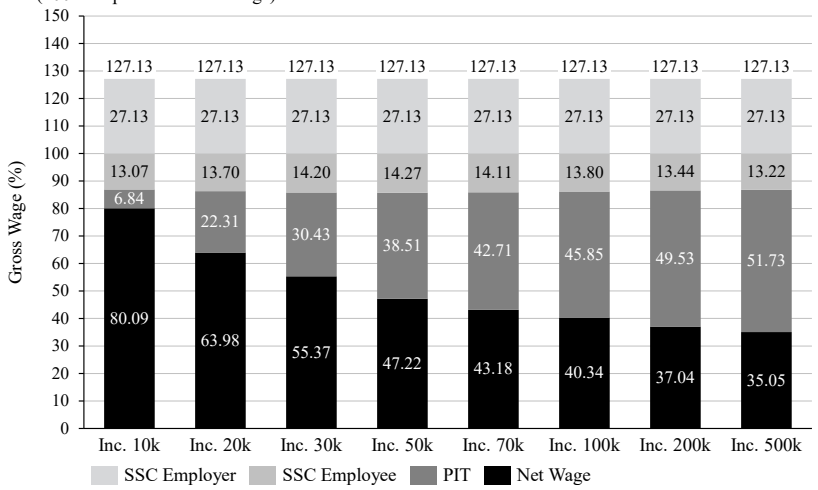


Figure A.3: Average PIT, SSC, and Net Wages at Various Incomes of Exemplary Countries

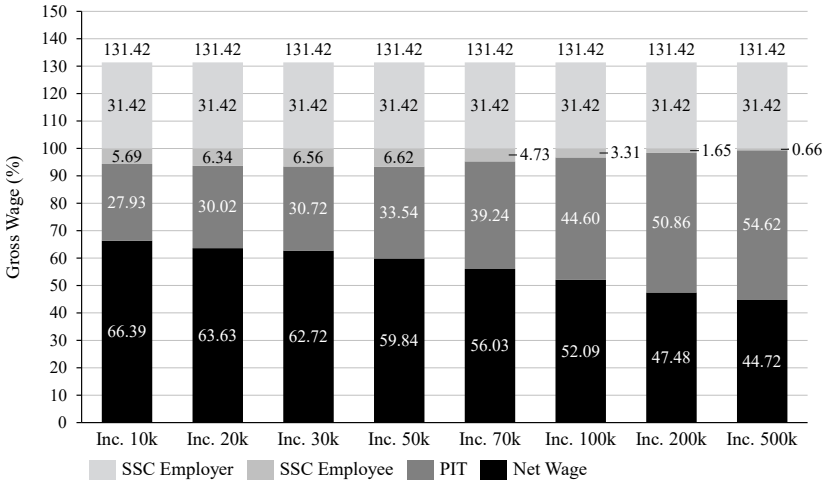
This figure shows marginal and average contributions over various incomes in selected sample countries.



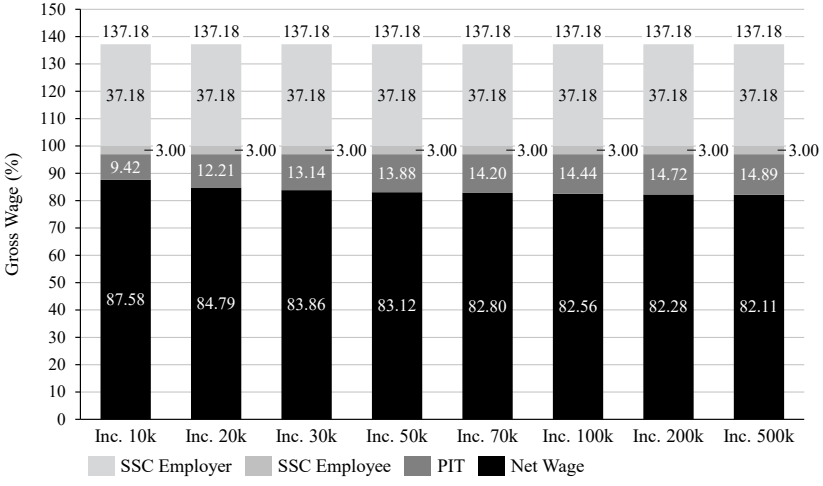
Belgium 2018: Average PIT, SSC and Net Wage at Various Incomes
(100% Represents Gross Wage)



Sweden 2018: Average PIT, SSC and Net Wage at Various Incomes
(100% Represents Gross Wage)



Lithuania 2018: Average PIT, SSC and Net Wage at Various Incomes
(100% Represents Gross Wage)



Great Britain 2018: Average PIT, SSC and Net Wage at Various Incomes
(100% Represents Gross Wage)

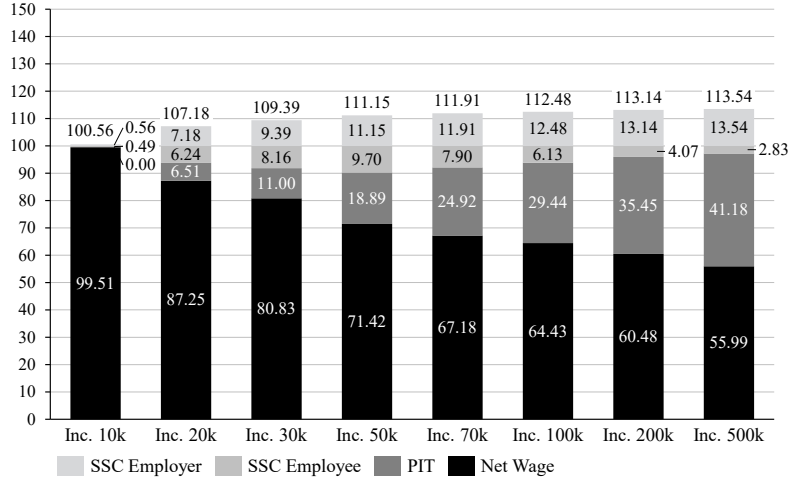


Figure A.4: Number of Changes in PIT and SSC

This figure shows the number of changes (if larger than 1%) to average PIT and SSC rates from 2006 to 2018.

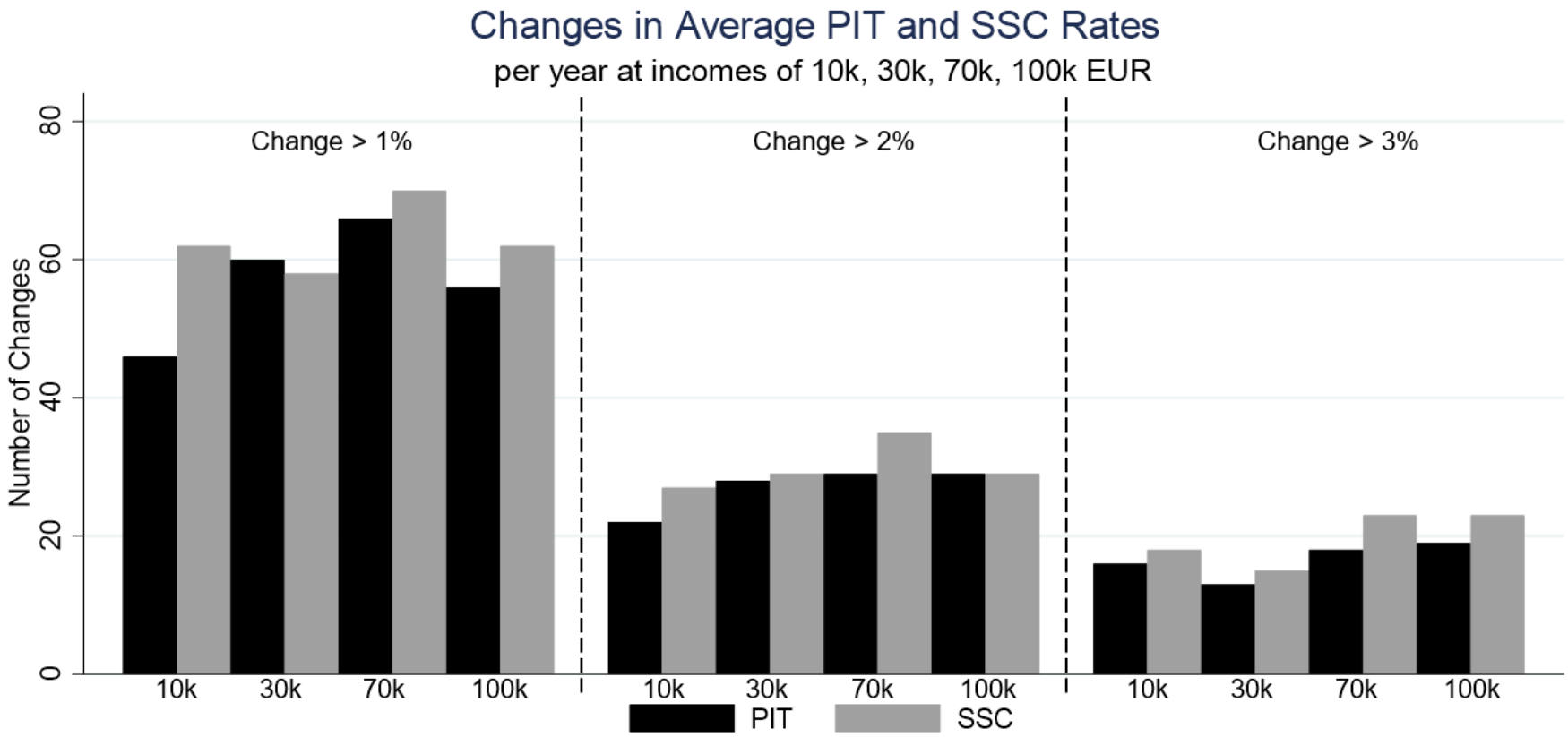
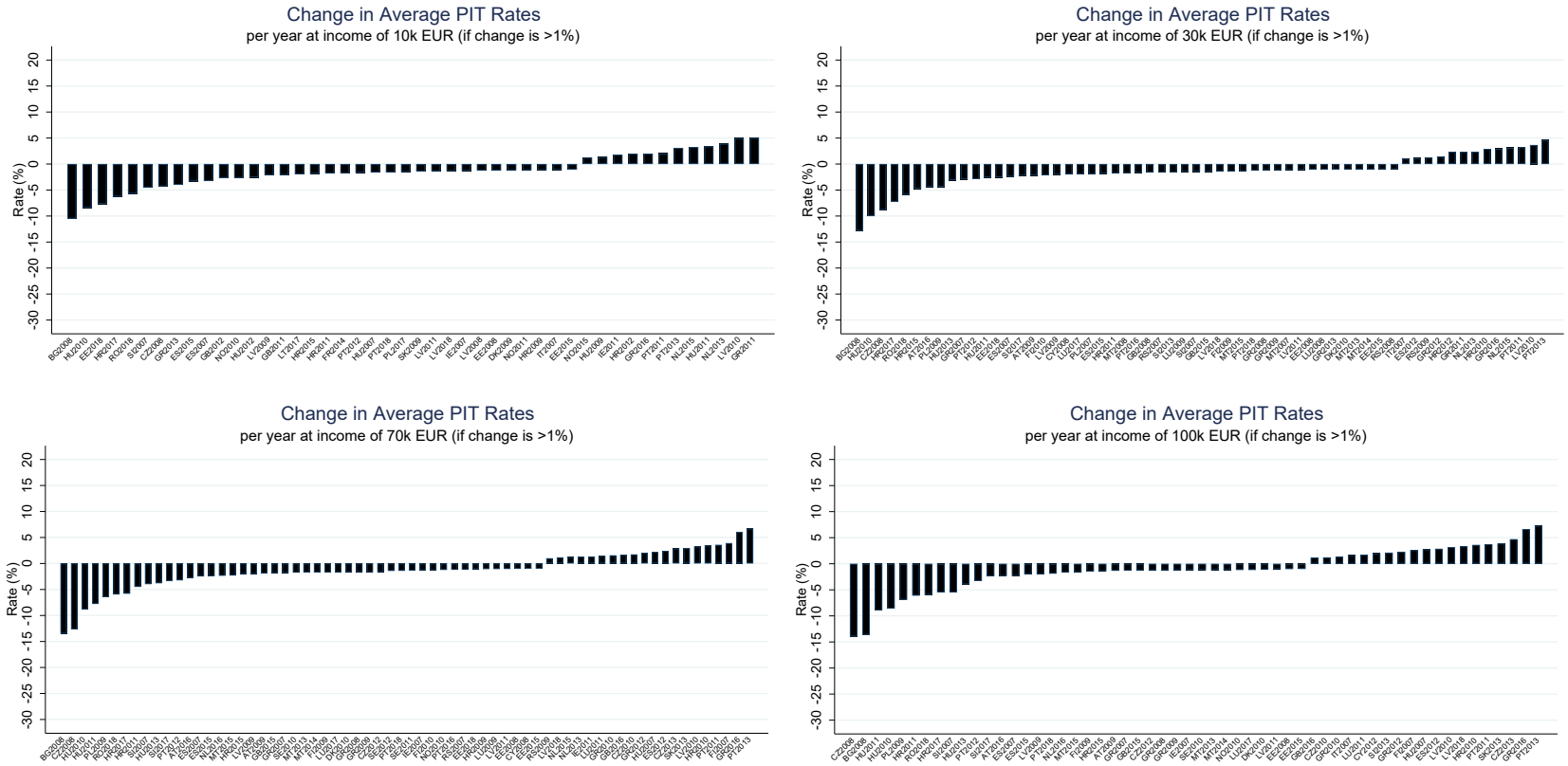
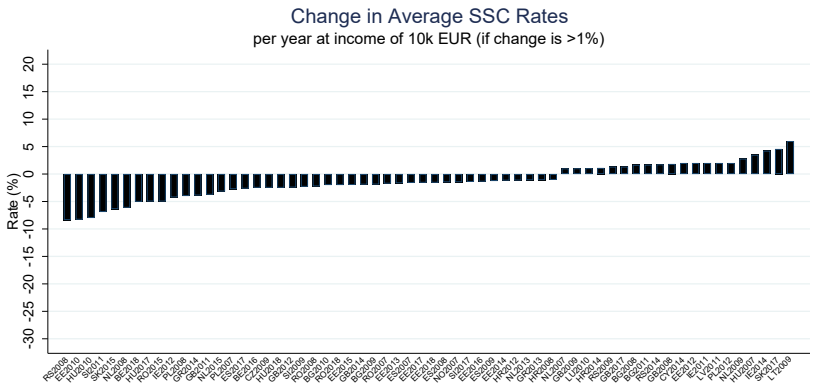
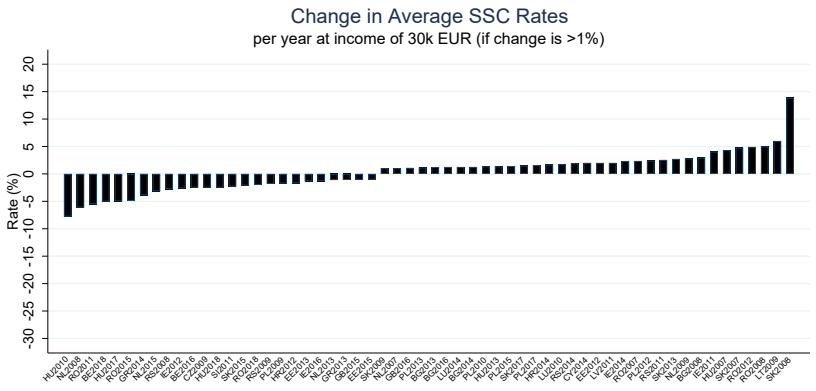


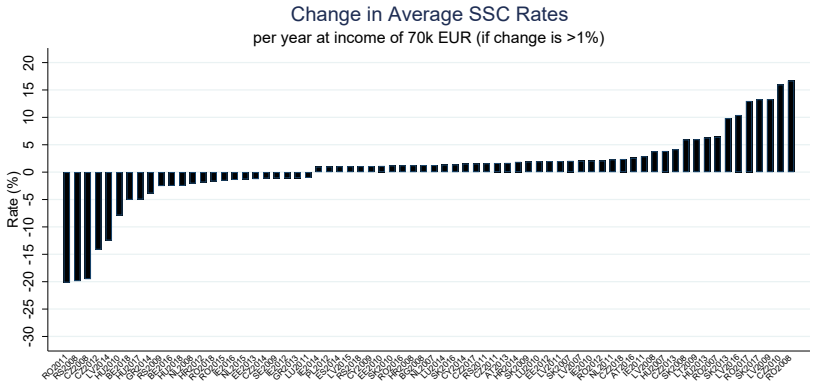
Figure A.5: Country–Year Changes in PIT and SSC

This figure shows the magnitude of changes (if larger than 1%) to the average PIT and SSC rates from 2006 to 2018.




Change in Average SSC Rates
per year at income of 10k EUR (if change is >1%)
Rate (%)
-30 -25 -20 -15 -10 -5 0 5 10 15 20


Change in Average SSC Rates
per year at income of 30k EUR (if change is >1%)
Rate (%)
-30 -25 -20 -15 -10 -5 0 5 10 15 20


Change in Average SSC Rates
per year at income of 70k EUR (if change is >1%)
Rate (%)
-30 -25 -20 -15 -10 -5 0 5 10 15 20

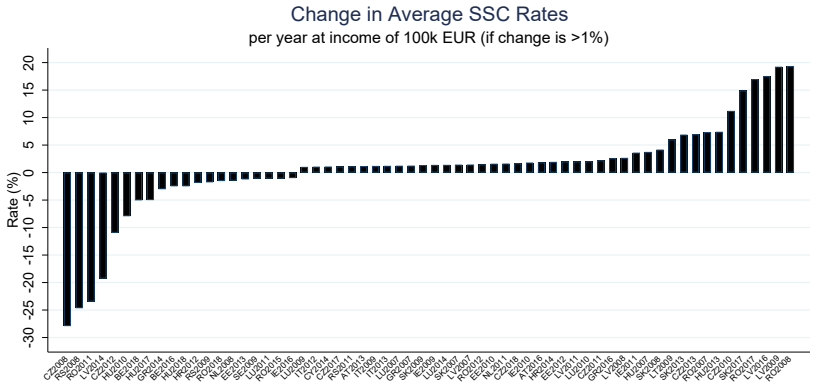

Change in Average SSC Rates
per year at income of 100k EUR (if change is >1%)
Rate (%)
-30 -25 -20 -15 -10 -5 0 5 10 15 20

Figure A.6: Number of PIT, CIT, and VAT Changes

This figure shows the number of net-of-tax changes for PIT, CIT, and VAT simultaneously

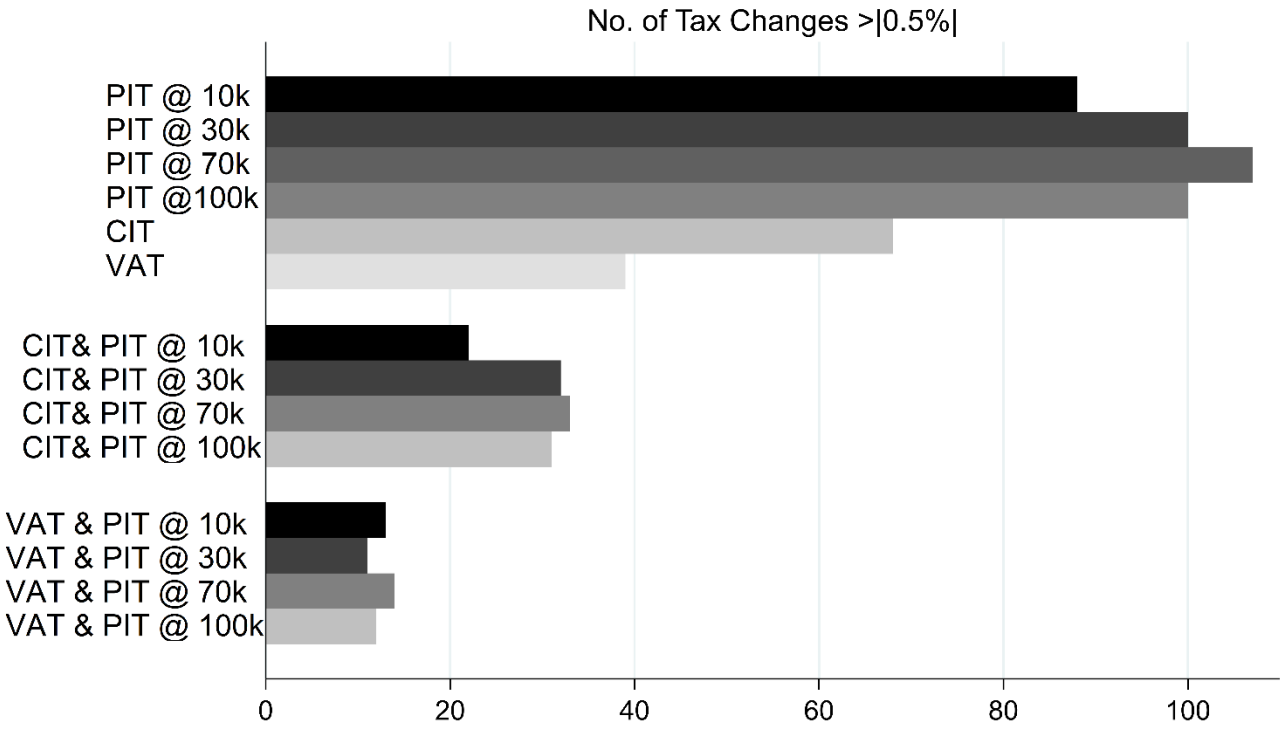


Figure A.7: Development of Average SSC over Time

This figure shows average values of SSC at various income levels averaged from 2006 to 2018.

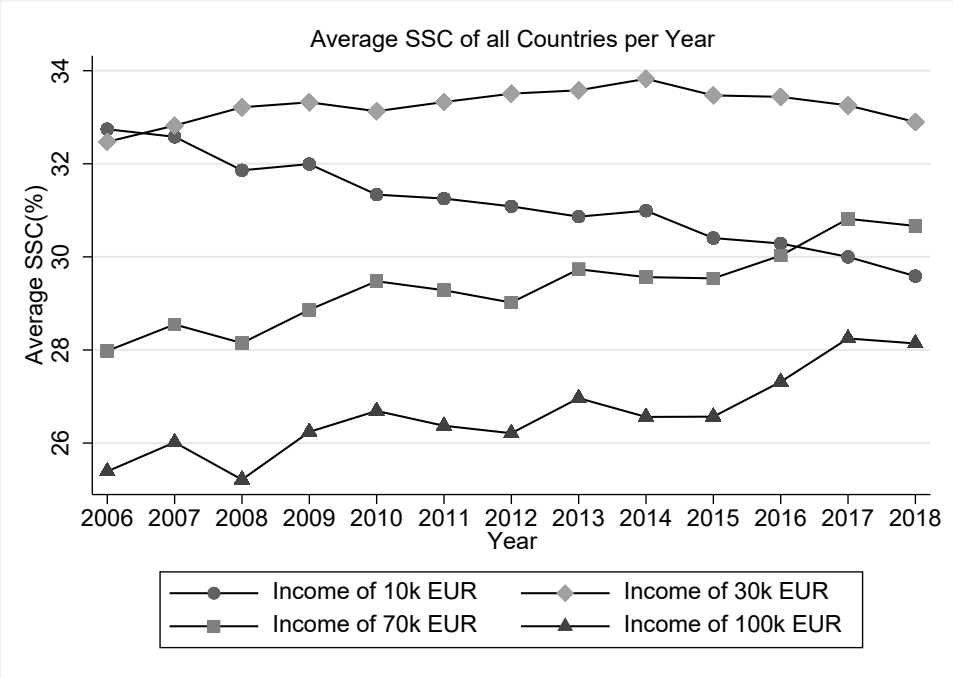


Figure A.8: Average PIT and SSC over Income Classes

This figure shows the average PIT and SSC amounts at various income levels averaged from 2006 to 2018.

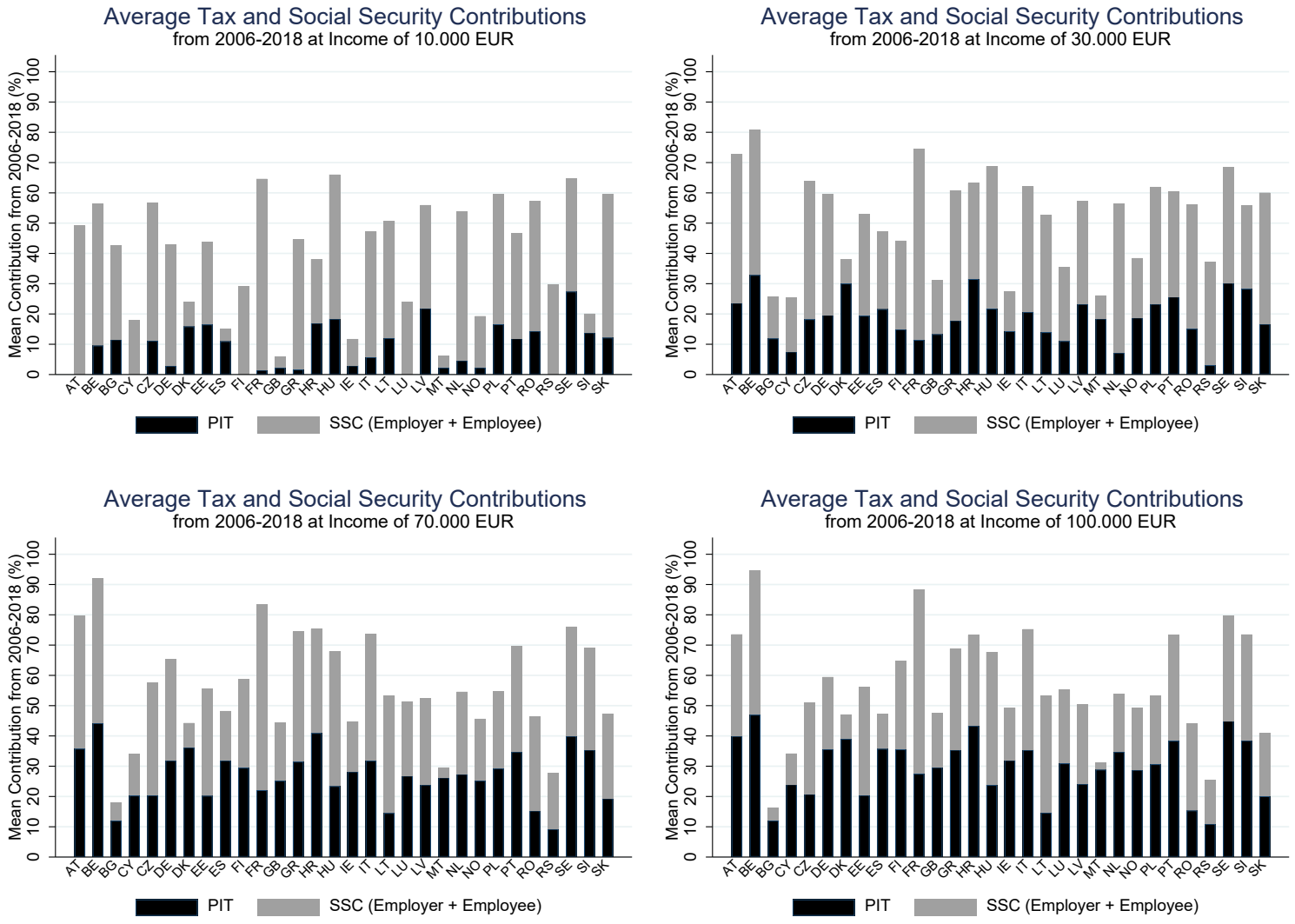


Table A.1: Assumptions for Data Collection per Country

This table shows the underlying assumptions when collecting the income tax and social security data.

Country	Assumptions
ALL (all countries)	We calculate the PIT and SSC for an unmarried non-state employee, living alone, who has no children. The basis (100%) is the contractual gross salary the employee receives. For SSC, we consider both employee and employer contributions, so employer labor costs amount to the contractual gross salary plus the employer SSC (>100% of the employee's gross salary). We consider standard allowances. Standard deductions are modeled as the first tax bracket. We generally do not consider the reduction of tax-free amounts with rising income classes. The tax deductibility of work-related expenses and SSC is generally neglected. The data for each country are consistently collected, i.e., they stem from one source. In case of a tax reform during the year, it is applied from the beginning of the next year, if not indicated otherwise.
AT (Austria)	For PIT, the standard work-related deduction of 132 EUR is not considered. Furthermore, we do not consider any other deduction (e.g., children, commuting). For SSC, we calculate the brackets including possible 13th and 14th salaries and we include payments for a severance pay fund, a family burden fund, community taxes, and the chamber of commerce.
BE (Belgium)	We assume PIT rates for white collar workers that work in a company with more than 20 employees. Moreover, in SSC, we include the Flemish Care insurance contribution, and we exclude the reduction of SSC for low-income earners (work bonus) and work accident insurance, because these are not applicable to all workers. The rates include a special SSC to finance the system, as well as a tax shift (i.e., cross-financing of SSC with taxes) from 2017 onward.
BG (Bulgaria)	We assume that the employee is born after 1960.
CY (Cyprus)	Cyprus introduced the euro in 2008. We assume a worker who earns more than the basic minimum insurable amount of 9068 EUR per year. Regarding PIT, we do not consider a special contributions tax (up to 3.5%), because of varying rates for certain professions. We exclude the special PIT contribution for defense, because it is only applicable to passive income. Regarding SSC, we include payments to the Redundancy Fund (1.2%), the Human Resource Development Fund (0.5%), and the Social Cohesion Fund (2%) in our calculations. We include payments made by the state to SSC (4–4-6%). We exclude, however, contributions to the Central Holiday Fund, since the rates are different for all individual employees, based on the length of their vacation time.
CZ (Czech Republic)	We take the PIT credit (24 840 CZK per year) into account. The solidarity surcharge tax as of 2013 is included in PIT. Moreover, we ignore the addition of employer SSC to employee taxable income for simplicity.
DE (Germany)	A standard PIT deduction of work-related expenses (1000 EUR since 2012) is not part of our calculations. A solidarity surcharge of 5.5% of income taxes is calculated as part of the PIT. SSC are based on the federal states that used to form West Germany until 1990. Marginal and average taxes are calculated through a formula provided by the Ministry of Finance (see § 32a of the Income Tax Code, or *Einkommensteuergesetz*) to ensure comparability with other countries.

DK (Denmark)	We include the labor market tax in PIT. We calculate PIT based on average municipality tax rates. Moreover, the personal tax credit is not included, since it decreases to zero with increasing income. Furthermore, Denmark applies a maximum tax rate that varies each year. We take this into account; however, the maximum value is not reached in every year. Since 2012 on, SSC are officially merged with PIT. In our calculations, however, we still identify SSC separately, because neither the height nor base varies from 2011 to 2012. If we merged SSC with PIT, we would observe a shock that does not reflect reality. We exclude fixed lump sum SSC, since these cannot be reflected in our calculation.
EE (Estonia)	Estonia introduced the euro in 2011. From 2018 onward, the standard deductible amount decreases with rising income; however, we assume the full amount for simplicity. With regard to 2009 changes in social security, the average yearly rate is considered. In 2012, a 2% pension insurance is added to SSC.
ES (Spain)	We assume a taxpayer under 65 years old. The standard PIT allowance is included in the calculations, and special tax credits are not. Furthermore, we do not take the deductibility of voluntary pension contributions into account. We apply the standard tax rate of autonomous regions, which is equal to the federal tax (i.e., the autonomous region does not exercise a special tax height). A standard deduction for work-related expenses is disregarded. Due to varying rates (up to 1.5%) across professions, accident insurance is not included. A general surcharge on income tax during the crisis years is included.
FI (Finland)	In Finland, we assume an employee younger than 53 years. The first PIT bracket includes a standard deduction of 620 EUR (from 2017 on, 750 EUR). Further, we disregard the tax credit, because it decreases to zero with increasing income. We apply the average municipality tax. Moreover, we do not take the tax allowance of the municipality tax into account, since it is negligibly small. We use the lower boundaries of the range of SSC, since no average is provided.
FR (France)	For France, we assume a non-executive employee who is working neither in Paris nor in a company with more than 20 employees. We disregard tax discounts only applicable to top income taxpayers. The SSC calculation includes special SSC (CRDS and CSG). We apply the average (2.3%) work-related accident insurance (NACE) and the lower bound of the professional training contribution. We disregard the reduction of employer SSC (Fillion Act), because of inconsistent data.
GB (Great Britain)	For Great Britain, we apply the PIT and SSC rates for England (Scotland, e.g., applies slightly different rates). Moreover, we do not take standard work-related expenses into account. To calculate the first SSC bracket, we multiply the weekly zero-contribution amount by 52. We neglect the partial reduction of the tax-free amount for high-income earners.
GR (Greece)	We assume that the underlying employee is older than 30 years. We disregard the reduction of PIT credits for large incomes. We include solidarity PIT imposed as part of the austerity measures of the European debt crisis. We include payments to the first and second pillars (compulsory SSC), but neglect payments to the third pillar (voluntary SSC).
HR (Croatia)	We include the municipality PIT of 18% of the capital city, Zagreb, due to the unavailability of average data. Moreover, we include the standard personal allowance in the calculations. We assume that employees contribute their SSC to the first and

	second pillars (compulsory). We neglect the option for people between ages 40 and 50 to opt out and to contribute to a voluntary private pension fund (third pillar), since the rates are generally equal. We take the crisis tax (introduced halfway through 2009) into account in 2010 only.
HU (Hungary)	We neglect the reduction of the tax credit of up to 200,000 HUF (approximately 500 EUR) if income is greater than 1,250,000 HUF.
IE (Ireland)	For Ireland, we assume an employee below the age of 66, with a weekly pay of more than 38 EUR. We do not include the noncumulative SSC allowance of 127 EUR, since this only applies if the employee does not opt for the standard SSC exemption. We include the Universal Social Charge, from 2011 onward, into the SSC calculations. We neglect that, in 2011, if annual earnings are below 4004 EUR, no SSC must be paid (with no reduction for incomes above 4,004 EUR). We neglect PRSI credits for SSC (credit granted to some employees based on the age and length of their contributions).
IT (Italy)	For regional PIT introduced in 2006, the lower rate of 0.9% (1.23% from 2017 on) is applied. For the municipality tax, the average value of 0.2% is applied throughout the sample. Furthermore, we neglect that the tax credit diminishes at certain income rates. For SSC, we assume an employee with no record of SSC before 1996; otherwise, the contributions are capped earlier.
LT (Lithuania)	The PIT standard deduction is reduced if income is greater than the 12 times the minimum wage, according to a formula provided by the Ministry of Finance. We include the full standard deduction in our calculations. A tax rate of 15% applies to wage income, interest, and rental income. SSC includes health insurance payments, which are subject to small changes for risky professions. We include the minimum health insurance contribution.
LU (Luxembourg)	We include the PIT standard deduction of 540 EUR in the first zero-tax bracket. Moreover, we include an unemployment surcharge of 2.5% of PIT payments in the calculation and subsume it under PIT. For SSC, we assume white-collar workers. For 2015 and 2016, we include the budget-balancing surcharge.
LV (Latvia)	We include a nontaxable amount into our PIT calculations, but no other deductions are considered. In 2018, the Latvian government introduced a formula to calculate non-taxable income. We use the lower bound of the formula. Moreover, we include the Solidarity Social Surcharge of 2016, which is partly paid by the employer, into SSC.
MT (Malta)	Malta introduced the euro in 2008. We assume a person who is born after 1962. We disregard lump-sum reductions in taxes between 40 EUR and 60 EUR. Furthermore, we do not include state contributions to SSC in our calculations.
NL (Netherlands)	We neglect the PIT credit and only include the first tax bracket. In the Netherlands, the rate of employee SSC depends on the employee's work-related risk. Average rates are included in our calculations. We neglect flat payments for health insurance but include income-dependent contributions. Moreover, we exclude the social security credit from the calculations.
NO (Norway)	For PIT, minimum amounts of basic allowance and standard allowance are considered. We include the absolute amount of 31,800 NOK and not the variable amount of 45% for the standard allowance. Special wage income is also included in taxable income. Moreover, we include the special surtax in the PIT rates. For SSC, we chose the average rate of 13% (according to the OECD).

PL (Poland)	We do not take the reduction of the PIT reducing amount into account, as it is calculated according to a formula provided by the Ministry of Finance. We do consider, however, the basic tax credit. In the SSC, the health insurance of 8-9% is included. However, we neglect the tax credit for the insurance. For work accident insurance the average rate according to OECD is chosen.
PT (Portugal)	We model the standard deduction as the first PIT bracket. We include additional PIT surcharges due to austerity measures.
RO (Romania)	For PIT, we neglect the reduction of the tax-free amount at higher incomes. SSC contributions decrease with rising income and depend on average wages. For the SSC classes, average wages from https://tradingeconomics.com/romania/wages are considered.
RS (Serbia)	No PIT are levied for incomes up to three times the national average salary plus 40% of the average salary (standard deduction). The average salary is obtained from the Statistical Office of the Republic of Serbia, at http://data.stat.gov.rs/Home/Result/2403040401?languageCode=en-US. The second tax bracket is limited to a deduction of nine times the national average salary plus 40% of the national average salary. SSC are paid on 35% of the average national salary and capped at five times the national average salary.
SE (Sweden)	We assume an employee born after 1952 but older than 26 years, due to special tax regimes for certain age groups. Regarding the municipality tax, we use the average rate provided by the OECD. The basic deduction varies with income. For simplicity, we take the lowest level of basic deduction into account. With regard to SSC, the first bracket is calculated as 42.3% of the basic amount. The basic amount is obtained from Statistics Sweden, at https://www.scb.se/en/finding-statistics/statistics-by-subject-area/prices-and-consumption/consumer-price-index/consumer-price-index-cpi/pong/tables-and-graphs/price-basic-amount/price-basic-amount. We neglect the 7% tax credit of SSC, for consistency with other countries. Moreover, SSC are calculated at the lowest compulsory amount.
SI (Slovenia)	Slovenia introduced the euro in 2007. We assume an employee younger than 60 years. The standard tax allowance decreases with rising income. We consider the full amount as the first tax bracket. We disregard SSC up to the minimum wage, since the exact rates vary and are generally low (<5%). The minimum wage is determined from data at https://countryeconomy.com/national-minimum-wage/slovenia.
SK (Slovak Republic)	The Slovak Republic introduced the euro in 2009. We disregard PIT credits for employees, children, and mortgage interest. Furthermore, we do not take into account special deductions for age, retirement savings, or children. The basic tax allowance decreases with rising income, and we include the full basic allowance in our calculations. Regarding SSC, we assume an employee working "on agreement" (i.e., including health insurance). We neglect an SSC allowance of 380 EUR per year per employee, since it decreases to zero with rising income.

Table A.2: Details on Selected Tax Reforms

	Magnitude and Direction of Reform		Planning Duration	Reasons
BG 2008 PIT+ SSC[1]	Introduction of a flat tax system for personal income taxation	Introduction of a flat tax system with a tax rate of 10% across all incomes. Prior to 2008, the tax rate was 20–24%. Therefore, the average tax reduction is estimated to be 7–14 percentage points, depending on the income class.	From 2000 to 2008, the tax was substantially reduced to a flat tax.	Changes were made to simplify the tax system, increase budget revenues, stimulate foreign investment, create new jobs, and reduce the administrative burden and costs.
CZ 2008 PIT+ SSC [2]	Reduction of tax brackets and tax rates and introduction of social security rates cap	Larger tax-free amounts decreased the average tax rates by 4–15 percentage points, depending on the income class. The cap in social security reduced average contributions from an income of approximately 50,000 EUR.	From 2004 until 2009, there were major changes in the tax and benefit systems.	Consistent with OECD recommendations, the tax system was made more transparent to promote economic growth. SSC were cut in 2009 to lower labor costs in reaction to the financial crisis. To balance the budget, PIT rates were increased.
ES 2012 PIT[3]	Introduction of additional tax brackets and tax rates for high-income earners	Introduction of two to three additional tax brackets that increase the top bracket taxation from 43% to 52%. Especially across incomes above 70,000 EUR, the average income tax increased by two to six percentage points.	Major tax changes as part of the 2011–2014 fiscal consolidation strategy.	The government under Prime Minister Rajoy increased taxation of the top income classes to balance the budget and to redistribute wealth from the highest to the lowest incomes. Due to smaller budget deficits, top income taxation was lowered in 2015.

[1] Source: http://www.minfin.bg/document/10885:1 https://www.econstor.eu/bitstream/10419/209683/1/taxation_growth_BG_accepted.pdf.

[2] Source: https://www.oecd-ilibrary.org/economics/further-advancing-pro-growth-tax-and-benefit-reform-in-the-czech-republic_5kmh5gmx8h9p-en;jsessionid=g8aSvf96aEL1t0tp-g77qJiP.ip-10-240-5-74 and https://www.oecd-ilibrary.org/docserver/5kmh5gmx8h9p-en.pdf?expires=1605034998&id=id&accname=guest&checksum=D149CE50CBE2144613A913D1D94B952A.

[3] Source: https://ec.europa.eu/info/sites/info/files/file_import/sp_spain_en_0.pdf https://www.bde.es/f/webbde/SES/Secciones/Publicaciones/PublicacionesSeriadas/DocumentosTrabajo/16/Fich/dt1620e.pdf.

FI 2013 PIT[4]	Introduction of additional tax brackets and tax rates for high-income earners	Introduction of an additional tax bracket that taxes incomes of 100,000 EUR by an additional 2%.	The Half-Way Reform was introduced by the Finnish Government as an overnight measure.	Increase of taxation for high incomes, called the solidarity tax, to balance the budget.
FR 2011 PIT[5]	Introduction of additional tax brackets and tax rates for high-income earners	Introduction of three additional income classes that increase the PIT for income earners of over 150,000 EUR by four to eight percentage points.	The changes in 2011 were numerous, with an outlook on 2012 and 2014, introduced shortly before Hollande entered office. They were not expected.	The left-wing government under President Hollande introduced an additional tax bracket to reduce the budget deficit to 3% of the GDP.
FR 2014 PIT[6]	Increase of tax allowance and tax rates	Increase of tax rates of lower income classes by nine to 11 percentage points and extension of tax-free amounts. Except for incomes below 10,000 EUR, the average tax remains constant.	In contrast to the 2011 changes, the 2014 changes were announced and part of a larger plan to balance the budget.	The tax brackets were adapted according to the price index evolution after two years of no amendments.
GB 2010 PIT[7]	Introduction of additional tax brackets and tax rates for high-income earners	Introduction of an additional tax bracket for incomes above 150,000 EUR that taxes them at 50% (45% from 2013 onward), compared to 40% before the reform.	The recession triggered a collapse in government revenues by 4.4% in 2008–2009 and 5.5% in 2009–2010. Hence, the changes appear not to have been anticipated.	The Labor government under Prime Minister Brown introduced additional tax brackets to raise revenue. Due to the impact of the financial crisis, the budget needed to be rebalanced.
GR 2010 PIT[8]	Introduction of additional tax brackets and tax rates for high-income earners	Introduction of five additional tax brackets and increase in the top tax rates by five percentage points. Reduction of tax rates for lower incomes by approximately 2%, on	The reform was announced over the Internet on December 18, 2009, and presented to parliament on December 11, 2009. It came into effect in March 2010.	The left-wing party under Prime Minister Papandreou raised taxes to comply with austerity measures. The low public

[4] Source: https://en.irefeurope.org/multi-pages/914/Finland.

[5] Source: Taxation Trends in the European Union, 2012 IREF Taxation Guide 2012.

[6] Source: https://www.latribune.fr/actualites/economie/france/20130605trib000768661/cet-impot-sur-le-revenu-qui-augmente-augmente..html.

[7] Source: https://www.telegraph.co.uk/news/politics/9740253/Two-thirds-of-millionaires-disappeared-from-official-statistics-to-avoid-50p-tax-rate.html and https://www.ifs.org.uk/uploads/mirrleesreview/design/ch4.pdf https://www.ifs.org.uk/uploads/publications/bns/BN_182.pdf.

[8] Source: https://www.rechtsanwalt-griechenland.de/blog/2010-tax-reforms-in-greece and https://www.eap.gr/images/stories/pdf/deo41_dp_series_17.pdf.

		average. In 2011 and 2012, further increases of the top tax rates.		revenues were disproportionate to government expenditures.
GR 2016 PIT[9]	Reduction of tax brackets and increase of tax rates	Reduction of two tax brackets and increased tax rates for incomes larger than 20,000 EUR by approximately ten percentage points. This results in increase in average taxation of two to nine percentage points across all income classes.	On May 8, 2016, a new law was adopted in an emergency voting session after Greece was pressured by the International Monetary Fund and the Eurogroup to pay back loans.	The left-wing Syriza party under Prime Minister Tsipras introduced Law 4389/2016, which imposed a special solidarity tax to balance the budget.
HR 2010 PIT[10]	Introduction of additional tax brackets and tax rates for high-income earners	Introduction of two additional income tax brackets that increase average taxation by approximately in five percentage points in 2010. These income tax brackets are abolished in 2011. On average this leads to an increase of taxation of three percentage points for incomes until 70,000 EUR and a stable taxation for incomes above that.	The 2009 budget needed to be revised several times; in April 2010, a new tax was introduced.	The middle-right government under Prime Minister Kosor introduced a crisis tax for the 2010 to reduce the budget deficit. In 2011, the government under Prime Minister Molanovic simplified the tax system to promote growth and investment. In 2013, the simplification increased, due to EU membership and EU regulations.
HR 2017 PIT[11]	Increase of tax-free allowance and reduction of top tax rates	Increase of the tax-free allowance by approximately 2,000 EUR and increase of the second tax bracket by approximately 7,000 EUR. Additionally, the top tax rate	The reform was introduced on January 1, 2017, and most laws entered into force in 2017.	The middle-right government under Prime Minister Plenkovic undertook the reform to achieve economic growth, increase employment, strengthen the competitiveness of the Croatian

[9] Source: http://taxsummaries.pwc.com/ID/Greece-Individual-Taxes-on-personal-income and https://www.dw.com/en/the-new-greek-reform-package-explained/a-19244453 https://greece.greekreporter.com/2019/06/28/greek-middle-class-hit-hardest-by-overtaxation.

[10] Source: https://www.ilo.org/wcmsp5/groups/public/@europe/@ro-geneva/@sro-budapest/documents/publication/wcms_167026.pdf, https://www.ilo.org/wcmsp5/groups/public/@europe/@ro-geneva/@sro-budapest/documents/publication/wcms_167026.pdf, and http://www.mvep.hr/files/file/dokumenti/130531-swd2013_croatia_en-final.pdf.

[11] Source: https://www.financierworldwide.com/will-major-croatian-tax-reform-boost-investments-and-reduce-outflow-of-workers.

		decreased by approximately five percentage points.		economy, encourage demographic renewal, and keep highly educated people in Croatia.
HU 2013 PIT+ SSC [12]	Introduction of a flat tax system	Introduction of a flat tax system that reduced the PIT from 32% in 2010, to 20% in 2012, to 16% in 2013. For incomes larger than 30,000 EUR, this reduced the PIT by three to four percentage points. The flat social security system increased the average contributions by two to nine percentage points for incomes larger than 30,000 EUR.	Reform was largely anticipated and conducted over the course of three years.	The middle-right government under President Orban introduced a flat tax PIT and SSC system to increase employment and competitiveness, reduce administrative burdens, and reduce the fiscal deficit.
IT 2012 PIT[13]	Introduction of additional tax brackets and tax rates for high-income earners	Introduction of a top tax bracket that imposes an additional tax of three percentage points on incomes larger than 300,000 EUR.	The tax was introduced in the summer of 2011 and applied the first time in 2012. The additional tax brackets remained in force until 2016.	The Berlusconi/Monti government introduced a solidarity tax to reduce high public debt through more revenues. The law was designed to be abolished in 2016.
LV 2018 PIT[14]	Introduction of a progressive tax system	Introduction of three tax brackets that increase the top tax rate by approximately eight percentage points. On average this decreases taxes by about one percentage points for incomes smaller than 70,000 EUR and increases taxes of incomes larger than that by one to eight percentage points.	The reform was passed on July 28, 2017, for changes that came into effect in 2018.	The government under President Vejonis diverted from a flat tax system to reduce the tax wedge (especially for low-wage earners) and to stimulate the economy.

[12] Source: https://mpra.ub.uni-muenchen.de/61890/1/MPRA_paper_61890.pdf, IREF Taxation Guide 2012.

[13] Source: https://www.translatetheweb.com/?from=it&to=de&ref=SERP&dl=de&rr=UC&a=https%3a%2f%2fwww.ilmessaggero.it%2feconomia%2feconomia_e_finanza%2fcontributo_solidarieta_meno_tasse_per_redditi_oltre_trecentomila_euro-2508103.html.

[14] Source: http://www.baltic-course.com/eng/analytics/?doc=131717 https://en.wikipedia.org/wiki/President_of_Latvia.

NL 2013 PIT+ SSC[15]	Harmonization of the income base for taxes and SSC	Increase of tax rates by three percentage points and decrease of SSC by three percentage points for incomes below 33,000 EUR.	Parts of a larger reform of the tax and benefit system from 2009 until 2013.	To facilitate administrative processes, the income bases for tax and social security were harmonized. This reform was budget neutral (fewer social security payments but increased tax payments).
PL 2009 PIT[16]	Reduction of tax brackets and tax rates for high incomes	Reduction of one tax bracket and decrease of top income tax rates by eight percentage points. This results in a decrease of average tax rates by two to eight percentage points across all income classes.	Parts of larger tax reforms between 2007 and 2001. Hence, the changes were likely to be anticipated.	High public debt led the government under President Kaczynski and President Tusk to facilitate the tax system to promote economic growth.
PT 2010 PIT[17]	Introduction of additional tax brackets and tax rates for high-income earners	Introduction of an additional tax bracket that taxes income larger than 150,000 EUR with additional three percentage points. Additionally, in 2011, tax rates across all brackets are increased by four to five percentage points.	Introduction of a solidarity tax under a new government, unlikely to have been anticipated.	The government under President Silver introduced a solidarity tax to maintain tax revenue during the economic crisis and to decrease the budget deficit to meet EU criteria.
SI 2013 PIT[18]	Introduction of additional tax brackets and tax rates for high-income earners	Introduction of an additional tax bracket that taxes incomes larger than 70,000 EUR with 50% instead of 41%, while other rates stay constant.	Introduction of a solidarity tax under a new government, unlikely to have been anticipated.	After 2013, the central-left government under Prime Minister Bratusek changed various taxes (CIT, PIT, VAT) to reduce public deficits and promote growth.

[15] Source: OECD Taxing Wages, 2013.
[16] Source: http://www.bankandcredit.nbp.pl › 2012/03 › bik_03_2012_01_art and https://www.oecd.org/poland/49655054.pdf.
[17] IREF, Taxation in Europe, 2011.
[18] Source: https://www.business.unsw.edu.au/research-site/publications-site/ejournaloftaxresearch-site/Documents/05_KlunStambuk_Tax%20experts%20opinion%20on%20the%20tax%20system%20in%20Slovenia.pdf.

SK 2013 PIT[19]	Introduction of additional tax brackets and tax rates for high-income earners	Introduction of an additional tax bracket that increases taxation from 19% to 25% from an income of approximately 35,000 EUR. This increases average taxation by two to six percentage points in incomes above that.	Introduction of a solidarity tax under a new government, unlikely to have been anticipated.	The left-wing government under Prime Minister Fico aimed to reduce the budget deficit by increasing taxes for high earners.

[19] Source: http://visegradrevue.eu/tax-reforms-in-slovakia-a-story-of-never-ending-experiments.

Table A.3: Regression Results Estimating Average PIT Based on Mean Country–Industry Year–Wages

This table presents the main results using lagged wages per employee to calculate Net-of-PIT. The dependent variable is *Capital Investment*, the change of the natural logarithm of fixed assets, in comparison to the prior year's fixed assets. The primary independent variable is *Net-of-PIT*, one minus the average PIT, as the logarithm and first difference from the lagged values at lagged wages per employee level. All variables are measured as of year *t*. Controls are included in all columns, with industry–year–GDP quartile FE in all the regressions. We report robust standard errors clustered at the country–industry level in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Dependent Variable	**ΔCapital Investment**				
Income Class	Mean Wage per Employee per Firm	Mean Cntry.-Ind.-Year Wage per Employee	P25 Cntry.-Ind.-Year r Wage per Employee	P50 Cntry.-Ind.-Year Wage per Employee	P75 Cntry.-Ind.-Year Wage per Employee
	(1)	(2)	(3)	(4)	(5)
Δ Net-of-PIT	0.2800***	0.3297***	0.3368***	0.3604***	0.3472***
	(0.0744)	(0.0874)	(0.0900)	(0.0934)	(0.0963)
Industry–Year–GDP Quart. FE	YES	YES	YES	YES	YES
Observations	1,823,311	1,795,699	1,795,699	1,795,699	1,795,699
Adj. R-squared	0.0756	0.0736	0.0736	0.0736	0.0737

Table A.4: Correlation between Average PIT and SSC

This figure shows the correlation between the marginal tax and social security rates across income classes, from 10,000 EUR to 500,000 EUR.

		[1]	[2]	[3]	[4]
Average PIT at income of 10k EUR	[1]	1.00			
Average PIT at income of 30k EUR	[2]	0.62	1.00		
Average PIT at income of 70k EUR	[3]	0.18	0.80	1.00	
Average PIT at income of 100k EUR	[4]	0.08	0.69	0.98	1.00

		[1]	[2]	[3]	[4]
Average SSC at income of 10k EUR	[1]	1.00			
Average SSC at income of 30k EUR	[2]	0.89	1.00		
Average SSC at income of 70k EUR	[3]	0.71	0.86	1.00	
Average SSC at income of 100k EUR	[4]	0.61	0.75	0.97	1.00

Table A.5: Correlations of PIT, CIT, and VAT Changes

This table shows the correlations between changes in PIT, CIT, and VAT.

PIT Changes and Other Tax Changes									
		Tax Increases of at Least 0.5%				Tax Cuts of at Least 0.5%			
Income Class		10k	30k	70k	100k	10k	30k	70k	100k
Number of PIT Changes of at Least 0.5%		**20**	**19**	**30**	**31**	**68**	**81**	**77**	**69**
Coinciding with:	Corporate Tax Increase	2	3	5	6	6	6	4	4
	Corporate Tax Decrease	2	1	5	5	12	22	19	16
	Consumption Tax Increase	4	4	7	7	7	6	5	4
	Consumption Tax Decrease	1	0	1	0	1	1	1	1
Coinciding with no change in corporate or consumption tax		**13**	**13**	**13**	**16**	**45**	**48**	**49**	**45**

Table A.6: Sample Composition

This table summarizes the number of observations per country in our sample from 2006 to 2018.

Country	Observations	Country	Observations
AT (Austria)	3,676	IT (Italy)	698,031
BE (Belgium)	13,802	LU (Luxembourg)	1,248
BG (Bulgaria)	44,042	LV (Latvia)	390
CZ (Czech Republic)	53,092	MT (Malta)	60
DE (Germany)	33,420	NL (Netherlands)	446
DK (Denmark)	1,665	NO (Norway)	63,090
EE (Estonia)	11,972	PL (Poland)	36,686
ES (Spain)	337,158	PT (Portugal)	135,586
FI (Finland)	35,921	RO (Romania)	13,301
FR (France)	218,627	RS (Serbia)	17,646
GB (Great Britain)	38,967	SE (Sweden)	6,662
HR (Croatia)	2,661	SI (Slovenia)	16,927
HU (Hungary)	2,370	SK (Slovak Republic)	33,879
IE (Ireland)	1,986		
		Total	**1,823,311**

Table A.7: Baseline Regression with Alternative Dependent Variables and Controls

This table presents the main results including additional controls or alternative dependent variables. The dependent variables are the change in *PP&E* in Panel A and *Capital Investment* in Panels B and C. The primary independent variable is *Net-of-PIT*, one minus the average PIT, as the log and first difference from the lagged values at various income levels. All variables are measured as of year *t*. Controls are included in all columns, and industry–year–GDP quartile FE are included in all the regressions. We report robust standard errors clustered at the country–industry level in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)	(4)
Income Class	10k	30k	70k	100k
Panel A: Alternative Dependent Variable Δ PP&E				
Δ Net-of-PIT	0.3083***	0.2911***	0.2177***	0.1729***
	(0.0631)	(0.0741)	(0.0537)	(0.0447)
Controls	YES	YES	YES	YES
Industry–Year–GDP Quart. FE	YES	YES	YES	YES
Observations	1,510,331	1,510,331	1,510,331	1,510,331
Adj. R-squared	0.0738	0.0738	0.0739	0.0739
Panel B: Including the Unemployment Rate as a Control				
Δ Net-of-PIT	0.1321**	0.1367***	0.1030**	0.0750**
	(0.0589)	(0.0485)	(0.0405)	(0.0297)
Δ Unemployment Rate	-0.0048***	-0.0047***	-0.0047***	-0.0047***
	(0.0005)	(0.0005)	(0.0005)	(0.0005)
Controls	YES	YES	YES	YES
Industry–Year–GDP Quart. FE	YES	YES	YES	YES
Observations	1,823,311	1,823,311	1,823,311	1,823,311
Adj. R-squared	0.0760	0.0760	0.0760	0.0760
Panel C: Including the Dividend Tax Rate as a Control				
Δ Net-of-PIT	0.3253***	0.2595***	0.1908***	0.1440***
	(0.0566)	(0.0513)	(0.0405)	(0.0297)
Δ Dividend Tax Rate	-0.1009***	-0.0981***	-0.1002***	-0.0923***
	(0.0175)	(0.0165)	(0.0168)	(0.0170)
Controls	YES	YES	YES	YES
Industry–Year–GDP Quart. FE	YES	YES	YES	YES
Observations	1,823,311	1,823,311	1,823,311	1,823,311
Adj. R-squared	0.0759	0.0759	0.0759	0.0759

Table A.8: Country–GDP Clusters (Growth and per Capita)

This figure shows the clusters of the country average combinations of GDP growth and GDP per capita over the sample period from 2006 to 2018.

	Cluster 1	**Cluster 2**	**Cluster 3**	**Cluster 4**
2006 to	CY	BE	AT	IE
2018	ES	BG	CZ	LU
	GR	DK	DE	MT
	HR	FI	EE	NO
	HU	FR	LT	PL
	IT	GB	LV	SE
	PT	SI	NL	SK
	RS		RO	

Table A.9: Alternative Choices of Control Variables and Fixed Effects

This table presents the main regression results with alternative controls or FE structures. All the variables are defined in first differences. Controls from the main regression are included in all the regressions of Panel B. We include industry–year–GDP quartile FE in all the regressions of Panel A. We report robust standard errors clustered at the country–industry level in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Panel A: Alterations in the Choice of Control Variables

Dependent Variable	**Δ Capital Investment**				**Δ Capital Investment**			
Income Class	10k	30k	70k	100k	10k	30k	70k	100k
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Δ Net-of-PIT	0.2001***	0.1859***	0.1349***	0.1005***	0.2596***	0.2257***	0.1687***	0.1315***
	(0.0624)	(0.0535)	(0.0426)	(0.0315)	(0.0502)	(0.0659)	(0.0517)	(0.0409)
Controls	All Country Controls from Baseline				All Firm Controls from Baseline			
FE	Ind.–Year–GDP Quart.				Ind.–Year–GDP Quart.			
Observations	1,823,311	1,823,311	1,823,311	1,823,311	1,823,311	1,823,311	1,823,311	1,823,311
Adjusted R-squared	0.0092	0.0092	0.0092	0.0092	0.0751	0.0751	0.0751	0.0751

Panel B: Alterations in the Choice of FE Structure

Dependent Variable	**Δ Capital Investment**				**Δ Capital Investment**			
Income Class	10k	30k	70k	100k	10k	30k	70k	100k
	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Δ Net-of-PIT	0.3221***	0.2697***	0.2349***	0.2007***	0.3642***	0.2663***	0.2427***	0.2029***
	(0.0892)	(0.0607)	(0.0538)	(0.0431)	(0.0804)	(0.0574)	(0.0543)	(0.0438)
Controls	All Controls from Baseline				All Controls from Baseline			
FE	Industry				Country			
Observations	1,823,311	1,823,311	1,823,311	1,823,311	1,823,311	1,823,311	1,823,311	1,823,311
Adjusted R-squared	0.0708	0.0709	0.0709	0.0709	0.0698	0.0698	0.0699	0.0699
	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)
Δ Net-of-PIT	0.2265***	0.1621**	0.1666***	0.1395***	0.3474***	0.2790***	0.2475***	0.2016***
	(0.0790)	(0.0628)	(0.0514)	(0.0415)	(0.0908)	(0.0793)	(0.0677)	(0.0539)
Controls	All Controls from Baseline				All Controls from Baseline			
FE	Year				Firm			
Observations	1,823,311	1,823,311	1,823,311	1,823,311	1,798,368	1,798,368	1,798,368	1,798,368
Adjusted R-squared	0.0703	0.0703	0.0703	0.0703	0.1012	0.1012	0.1013	0.1013
	(25)	(26)	(27)	(28)	(29)	(30)	(31)	(32)
Δ Net-of-PIT	0.3655***	0.2671***	0.2438***	0.2034***	0.2232***	0.1532**	0.1616***	0.1356***
	(0.0805)	(0.0573)	(0.0544)	(0.0438)	(0.0715)	(0.0606)	(0.0511)	(0.0420)
Controls	All Controls from Baseline				All Controls from Baseline			
FE	Country Industry				Industry Year			
Observations	1,823,311	1,823,311	1,823,311	1,823,311	1,823,311	1,823,311	1,823,311	1,823,311
Adjusted R-squared	0.0715	0.0715	0.0716	0.0715	0.0722	0.0722	0.0722	0.0722

Table A.10: EU Bailout Countries

This table shows the countries that received EU state aid during the sovereign debt crisis. The data are from Knight and Steward (2016).

Bailout Program	Bailout Period	Excluded Country–Years	Excluded Observations	Total Observations
Cyprus I Cyprus II	Dec 2011–Dec 2012 May 2013–Mar 2016	CY2011–2016	606	940
Greece I+II Greece III	May 2010–Jun 2015 Aug 2015–Aug 2018	GR2010–2018	43,859	59,393
Hungary*	Nov 2008–Oct 2010	HU2008–2010	778	3,750
Ireland	Nov 2010–Dec2013	IE2010–2013	3,085	9,594
Latvia*	Dec 2008–Dec 2011	LV2008–2011	4,785	20,428
Portugal	May 2011–Jun 2014	PT2011–2014	84,349	228,387
Romania I* Romania II* Romania III*	May 2009–Jun 2011 Mar 2011–Jun 2013 Oct 2013–Sep 2015	RO2009–2015	21,027	28,759
Spain	Jul 2012–Dec 2013	2012–2013	93,462	535,638
*Not all funds fully used.			251,951	886,889

Table A.11: Baseline Regression, Excluding Austerity Measures

This table presents the main results from De Vito et al. (2020), excluding austerity country–years. The dependent variable is *Capital Investment*. The primary independent variable is *Net-of-PIT*, one minus the average PIT, as the logarithm and first difference from the lagged values at various income levels. All variables are measured as of year *t*. Controls are included in all columns, and industry–year–GDP quartile FE are included in all the regressions. We report robust standard errors clustered at the country–industry level in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Panel A: Excluding Tax Increases in Austerity Country–Years				
Dependent Variable	**Δ Capital Investment**			
Income Class	10k	30k	70k	100k
	(1)	(2)	(3)	(4)
Δ Net-of-PIT	0.2322***	0.3227***	0.3104***	0.2315***
	(0.0770)	(0.0793)	(0.0826)	(0.0691)
Controls	YES	YES	YES	YES
Industry–Year–GDP Quart. FE	YES	YES	YES	YES
Observations	1,413,862	1,413,862	1,413,862	1,413,862
Adjusted R-squared	0.0813	0.0814	0.0814	0.0814
Panel B: Excluding Expenditure Cuts in Austerity Country–Years				
Dependent Variable	**Δ Capital Investment**			
Income Class	10k	30k	70k	100k
	(1)	(2)	(3)	(4)
Δ Net-of-PIT	0.3990***	0.4374***	0.3012***	0.2198***
	(0.0752)	(0.0783)	(0.0599)	(0.0454)
Controls	YES	YES	YES	YES
Industry–Year–GDP Quart. FE	YES	YES	YES	YES
Observations	1,490,949	1,490,949	1,490,949	1,490,949
Adjusted R-squared	0.0784	0.0785	0.0785	0.0784
Panel C: Excluding Tax Increases and Expenditures and Austerity Country–Years				
Dependent Variable	**Δ Capital Investment**			
Income Class	10k	30k	70k	100k
	(1)	(2)	(3)	(4)
Δ Net-of-PIT	0.3596***	0.4619***	0.3761***	0.2546***
	(0.0761)	(0.0969)	(0.0968)	(0.0817)
Controls	YES	YES	YES	YES
Industry–Year–GDP Quart. FE	YES	YES	YES	YES
Observations	1,081,504	1,081,504	1,081,504	1,081,504
Adjusted R-squared	0.0855	0.0856	0.0856	0.0855

Table A.12: Baseline Regression, Excluding Wages per Assets

This table presents the main results, excluding the control variable *Wages per Assets*. The dependent variable is *Capital Investment*, the change of the natural logarithm of fixed assets in comparison to the prior year's fixed assets. The primary independent variable is *Net-of-PIT*, one minus the average PIT, as the logarithm and first difference from the lagged values at various income levels. All variables are measured as of year *t*. Controls are included in all columns, and industry–year–GDP quartile FE are included in all the regressions. We report robust standard errors clustered at the country–industry level in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Dependent Variable	**Δ Capital Investment**			
Income Class	10k	30k	70k	100k
	(5)	(6)	(7)	(8)
Δ Net-of-PIT	0.2216***	0.1836***	0.1299***	0.0945***
	(0.0590)	(0.0522)	(0.0414)	(0.0301)
Δ Net-of-SSC	0.0230	-0.1620*	-0.0404	-0.0189
	(0.0495)	(0.0930)	(0.0287)	(0.0310)
Δ Leverage	0.3314***	0.3313***	0.3313***	0.3313***
	(0.0279)	(0.0279)	(0.0279)	(0.0279)
Δ Return on Assets	0.0070	0.0070	0.0070	0.0070
	(0.0107)	(0.0107)	(0.0107)	(0.0107)
Δ Sales	0.0411***	0.0411***	0.0411***	0.0411***
	(0.0043)	(0.0043)	(0.0043)	(0.0043)
Δ GDP per Capita	0.0668**	0.0712**	0.0674**	0.0732**
	(0.0316)	(0.0331)	(0.0336)	(0.0331)
Δ GDP Growth	0.0011**	0.0011**	0.0013**	0.0013**
	(0.0005)	(0.0005)	(0.0006)	(0.0006)
Δ Governance	0.0145	0.0130	0.0126	0.0124
	(0.0100)	(0.0097)	(0.0095)	(0.0096)
Δ Openness	0.0002	-0.0013	-0.0014	-0.0016
	(0.0065)	(0.0060)	(0.0061)	(0.0061)
Δ Net-of-CIT	0.2053***	0.2190***	0.2036***	0.2040***
	(0.0334)	(0.0333)	(0.0341)	(0.0341)
Δ Net-of-VAT	0.1819***	0.1478***	0.1737***	0.1686***
	(0.0540)	(0.0565)	(0.0577)	(0.0560)
Δ Gov. Deficit to GDP	0.0022***	0.0021***	0.0021***	0.0021***
	(0.0005)	(0.0005)	(0.0005)	(0.0005)
Industry–Year–GDP Quart. FE	YES	YES	YES	YES
Observations	1,823,311	1,823,311	1,823,311	1,823,311
Adj. R-squared	0.0356	0.0357	0.0357	0.0356

Table A.13: Additional Cross-Sectional Tests

This table presents the cross-sectional results of estimating the baseline regression (Table 2) on our primary sample. The dependent variable is *Capital Investment*, the natural logarithm of fixed assets to lagged fixed assets. The primary independent variable is *Net-of-PIT*, one minus the average PIT, in percent, as the logarithm and first difference from the lagged values at various income levels. All variables are measured as of year *t*. Controls and industry–year–GDP quartile FE are included in all columns. In Panel A, Columns (1), (3), (5), and (7) (Columns (2), (4), (6), and (8)) present the results using a subsample of companies in a country with a shadow economy size below (above) the sample median. We report robust standard errors clustered at the country–industry level in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Panel A: Breakdown by Size of the Shadow Economy (% of GDP)

Dependent Variable	**Δ Capital Investment**							
Income Class	10k		30k		70k		100k	
Split	Small	Large	Small	Large	Small	Large	Small	Large
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Δ Net-of-PIT$_t$	0.6734***	0.0284	0.3091*	-0.1401*	0.7477***	-0.1092	0.6165***	0.0110
	(0.1879)	(0.1262)	(0.1574)	(0.0837)	(0.1777)	(0.0791)	(0.1620)	(0.0755)
Small vs. Large	0.6450***		0.4492**		0.8569***		0.6055***	
(PIT) t-stat	(0.2257)		(0.1818)		(0.1963)		(0.1792)	
Controls & FE	YES	YES	YES	YES	YES	YES	YES	YES
Observations	897,982	907,683	897,982	907,683	897,982	907,683	897,982	907,683
Adjusted R^2	0.0875	0.0683	0.0874	0.0683	0.0878	0.0683	0.0876	0.0683

Table A.14: Descriptive Statistics of First-Difference Variables

This table presents descriptive statistics of the first differences of our main variables for 1,823,311 observations from 2006 to 2018. Panel A reports the results for the PIT variables, and Panel B for the firm- and country-level variables.

Variable	Mean	St. Dev.	P 25	P 50	P 75
Panel A: PIT Variables					
Δ Net-of-PIT 10k	0.0014	0.0077	0.0000	0.0000	0.0005
Δ Net-of-PIT 30k	0.0009	0.0081	0.0000	0.0000	0.0008
Δ Net-of-PIT 70k	0.0004	0.0110	0.0000	0.0000	0.0004
Δ Net-of-PIT 100k	-0.0001	0.0117	0.0000	0.0000	0.0002
Δ Net-of-PIT 10th	0.0004	0.0074	0.0000	0.0000	0.0000
Δ Net-of-PIT 25th	0.0001	0.0078	-0.0029	-0.0007	0.0018
Δ Net-of-PIT 50th	-0.0002	0.0074	-0.0031	-0.0008	0.0003
Δ Net-of-PIT 75th	-0.0003	0.0076	-0.0024	-0.0008	0.0018
Δ Net-of-PIT 90th	-0.0009	0.0080	-0.0031	-0.0012	0.0018
Δ Net-of-PIT 99th	-0.0011	0.0098	-0.0031	-0.0017	0.0018
Panel B: Firm and Country Variables					
Δ Firm Capital Inv.	0.0156	0.2378	-0.0766	-0.0193	0.0569
Δ Country Gross Cap. Inv.	22.6826	1.2047	21.9801	23.1166	23.6555
Δ Net-of-SSC 10k	0.0016	0.0079	0.0000	0.0000	0.0020
Δ Net-of-SSC 30k	0.0003	0.0054	0.0000	0.0000	0.0011
Δ Net-of-SSC 70k	-0.0014	0.0169	-0.0020	0.0000	0.0002
Δ Net-of-SSC 100k	-0.0028	0.0174	-0.0054	-0.0014	0.0000
Δ Net-of-SSC 10th	0.0005	0.0135	0.0000	0.0000	0.0000
Δ Net-of-SSC 25th	0.0010	0.0131	0.0000	0.0000	0.0002
Δ Net-of-SSC 50th	0.0009	0.0110	0.0000	0.0000	0.0010
Δ Net-of-SSC 75th	0.0006	0.0084	0.0000	0.0000	0.0012
Δ Net-of-SSC 90th	0.0005	0.0067	0.0000	0.0000	0.0013
Δ Net-of-SSC 99th	0.0000	0.0100	-0.0009	0.0000	0.0004
Δ Wages per Assets	0.0003	0.0771	-0.0157	0.0004	0.0180
Δ Leverage	-0.0055	0.0976	-0.0270	0.0000	0.0014
Δ Return on Assets	-0.0016	0.0795	-0.0215	-0.0001	0.0188
Δ Sales	112388	5192860	-103314	6294	181775
Δ GDP per Capita	70	892	-271	336	554
Δ GDP Growth	0.1361	2.5360	-1.0128	0.1136	1.0909
Δ Governance	-0.0121	0.0782	-0.0727	-0.0228	0.0398
Δ Openness	0.0186	0.0640	0.0029	0.0120	0.0242
Δ Net-of-CIT	0.0009	0.0152	0.0000	0.0000	0.0000
Δ Net-of-VAT	-0.0021	0.0064	0.0000	0.0000	0.0000
Δ Gov. Deficit to GDP	0.1691	1.8723	-0.1000	0.3000	0.9000
Δ Debt Crisis Bailout	-0.0022	0.2350	0.0000	0.0000	0.0000
Δ Firm Size	164540	3852730	-83654	4168	165401
Δ Firm Margin	-0.0062	0.5253	-0.0300	-0.0006	0.0265