Corporate Income Taxation and Firm Efficiency*

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PRELIMINARY AND INCOMPLETE

Abstract

This study tests empirically the hypothesis that corporate income taxes are neutral for firm efficiency. We exploit the fact that the tax definition of cost does not overlap fully with an accounting definition of cost and develop an instrument for taxation which relies on exogenous variation in this overlap. Our sample consists of firm-level data for roughly 20 million firms from over 40 countries over the period of two decades. We show that OLS estimates are strongly biased, yielding a positive correlation between taxation and output/efficiency. Accounting for the endogeneity via instrumenting yields robust negative estimates of the effects of taxation on firm output and efficiency. The results do not depend of firm characteristics, but are heterogeneous across countries: strong negative effects in some countries are accompanied by negligible or zero effects in others.

Key words: corporate income taxation, firm efficiency, firm-level

JEL Codes: H21, H33, D22

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1 Introduction

Our study tests if corporate income taxation is neutral to firm efficiency. The literature dating back to Modigliani and Miller (1958) analyzes the role of corporate income (CI) taxation in firm optimization decisions. In a nutshell, CI taxation should be neutral to firm optimum: with optimal decision in gross terms, the firm will be also in optimum even if profits are subjected to taxation, or $\arg\max_Y\{\Pi(Y)\} = \arg\max_Y\{(1-\tau)\Pi(Y)\}$ for arbitrary values of $\tau \in (0,1)$, where $\Pi(Y)$ denotes firm's profits across chosen output levels Y. If corporate income tax rate is expected to be stable over time, it has no bearing on firm investment (inter-temporal) decisions. Naturally, tax sheltering, offered by preferential tax treatment of debt interest relative to payoffs to equity owners, may introduce distortion to capital structure (Auerbach 1979, Fazzari et al. 1988) and capital reallocation between firms (Gourio and Miao 2010, Djankov et al. 2010), thus indirectly affecting the efficiency in an economy. Giroud and Rauh (2019) demonstrate that CI taxation affect the inputs composition. However, CI taxation is not believed to have a direct effect on firm efficiency, e.g. total factor productivity. Indeed, it appears that the majority of the interest in the literature has focused on the effects of CI taxation on investment and dividend decision, with little attention devoted to efficiency *per se*. Our study contributes to fill this gap.

Notably, if not all expenditure is CI tax deductible, it is possible that CI neutrality no longer holds, i.e. $\arg\max_Y\{\Pi(Y)\} \neq \arg\max_Y\{(1-\tau)\Pi(Y)\}$, because the relationship between Π and Y will depend on τ. In many countries, the legal definition of what constitutes a tax-deductible cost of operations departs from the accounting rules: some specific expenditures that can be subtracted from revenues to obtain the accounting measures of profits, cannot be subtracted from revenues to obtain tax base related to those profits (Donohoe and Knechel 2014). The obvious example concerns capital expenses and depreciation: the actual depreciation of equipment and necessary maintenance may be completely unrelated to the rules imposed by the tax code in a given country. Typically, the effect of financial operations on the bottom line is excluded from tax rules as well (Blaylock et al. 2017).[1] Specific examples in across the world include limits on representation cost, training cost, advertisement cost, certification cost and in some cases, even cost that would typically be considered cost of goods sold.[2] Non-deductibles include also membership dues/fees and fines.[3] Set up costs for new endeavors are only tax deductible if they generate the business turnover in a given fiscal year.[4] In many countries, property maintenance is tax deductible, so long as it has no aesthetic motives.[5]

[1] Indeed, depreciation and financial operations are far from being the only sources of divergence between accounting definition of cost and the definition relevant for taxes. For example, purchase of intermediate materials or consumables is not tax deductible until they are actually used in some revenue-generating production. Meanwhile, according to the accounting rules, any expenditure should reduce the bottom line in a given period (though not as a cost, if it does not generate revenue). In terms of magnitude, likely the largest source of discrepancy between booking and taxation cost rules concerns investment: under most tax codes, investment projects that do not yield a revenue in a given fiscal year are not a cost according to tax rules in most countries, yet they reduce the accounting bottom line.

[2] Under the US tax code, gifts to customers are tax deductible up to 25$ per person, expenditure above that threshold is an accounting cost, but cannot lower the tax base.

[3] Under Australian legislation the fees one pays to state-run organizations are tax-deductible (only those going to the self-governing business organizations are not).

[4] For example, Australia sets a minimum turnover threshold at AU$ 20 000. Moreover, many of the set-up costs are not deductible even if the turnover threshold is passed (they are actually labeled as "black hole expenditures", Sawyer 2005).

[5] A long discussion of these cases and the overlap between the accounting practices and tax code is provided by

These and other similar limitations were imposed sometimes in response to abuse of the ambiguity by the tax payers and sometimes preemptively which naturally brings about the matter of tax avoidance, sometimes referred to as CI tax aggressiveness, i.e. the extent to which tax rules are interpreted in favor (high tax deductibility). While the the delineation between tax avoidance and tax evasion typically resorts to the legality (Slemrod and Yitzhaki 2002, Sandmo 2005), the delineation between tax deductible costs and costs that cannot be accounted in tax statements relies on firm ability (Koester et al. 2016), specific technology and country characteristics (such as tax morale, tax enforcement, etc., see for example Torgler and Schneider 2009).[6] Book-tax (non)conformity is hence likely to differ across technologies (due to the nature of some costs) and across countries (due to differences in legislation).

Since more efficient firms may achieve higher profits and thus pay more taxes, τ and $\arg\max_Y \Pi(Y)$ are endogenous. We document that heterogeneity in technology driven book-tax conformity. We show that depending on the measurement of the tax burden, firm-level variation can contribute roughly 40-85% of the total observed variation. Notably, measures such as the value of taxes paid as well as the efffective tax rate (ETR, smoothened over time) display a high contribution of sector level to total variation, 64% and 46%, respectively. This implies that the technology specific variation in book-tax conformity may indeed provide a suitable source of variation exogenous to individual firms.

Given this obervation, we propose an instrument to estimate effects of CI tax on output and TFP. We use relative measures of book-tax conformity across technologies and countries to provide plausibly exogenous variation in CI taxation. To make this variation exogenous to the way tax rules are implemented in a given country, the instrument uses the variation within a given sector from all the countries except the one, in which a given firm operates. We show that this instrument has satisfactory statistical properties and is sufficiently sensitive to defy the null result.

We provide three novel results. First, the estimates of the causal effect of taxes on output growth and TFP are negative and robust to a number of statistical methods and sample definitions. Indeed, the endogeneity bias is large, effectively changing the sign of the inference. The plausibly causal estimates proposed in this study show that from a firm perspective, CI taxes are an efficiency costs: could firms retain 10% of the CI taxes, the TFP would be roughly 0.4% higher, *ceteris paribus*. Second, we demonstrate substantial heterogeneity of this effect across countries: in some of the European countries the CI taxes appear neutral, in others the negative effect prevails. Third, we show that the plausibly causal effect of CI taxes is not driven by firm's experience in dealing with tax issues: there appears to be no heterogeneity across firm's

Blaylock et al. (2017). The long and likely not exhaustive lists of exceptions in selected advanced economies are typically procured in annual review reports by global leading tax consultancy companies. The detailed treatment of issues such as the taxation of dividends and capital gains, withholding taxes, loss offset provisions, the group taxation regime, the double tax treaty network, thin capitalization rules, controlled foreign company rules, and the existence of a special holding regime on top of the statutory tax rates were incorporated by Keller and Schanz (2013).

[6] Indeed, the discrepancy between the books and the CI tax statements – also known as book-tax conformity or a tax base effects – is often exploited in economic research (Desai and Dharmapala 2009, Blaylock et al. 2017, to name just a few). The discrepancy between books and CI tax statements also leads to differences between statutory and effective tax rates, as often explored for policy purposes (Wilson 2009, Koethenbuerger and Stimmelmayr 2016, Serrato and Zidar 2017). Given the discrepancy, not entire difference between books and tax statements should be dubbed as tax avoidance: often the difference may stem from the specific vehicles, such as carry forward mechanisms and other arrangements.

age. In sum, our results point towards the pronounced policy relevance of the CI tax eligibility of business-related expenses.

Our study innovates relative to the literature along two dimensions. First, we provide an answer to a question that was somehow marginalized in the literature: what is the direct effect of CI taxes on the production decision of a firm. While earlier literature has demonstrated that the indirect effects are non-negligible (via capital structure of firms and hence the user cost of capital, the very access to capital, the reallocation of capital between firms, and investment), the direct effects of CI taxes on output level were not previously evaluated, despite the plausibility of the causal link between the two. Indeed, majority of the studies focus on dividend taxation[7] or on distortions / possible efficiency gains related to overall structure of taxation in the economy.[8] Second, we propose a novel instrument and demonstrate its properties in identifying the exogenous variation in CI taxation. While our proposed method is data intensive, it is not specific to a type of CI tax regime or reform, which advocates its usefulness in future research. Third, we also innovate in terms of data. We improve on the procedure proposed by Kalemli-Ozcan et al. (2015), by merging together many subsequent waves of the Amadeus data. This allows us to recover a substantially higher share of financial records for each firm. Hence, while we use consolidated data, as previous research, our sample covers a higher share of the analyzed economies.

The paper is structured as follows. The next section lays down the motivation. In section 3 we discuss in detail the data. Section 4 provides the rationale for the identification strategy. The results are reported in section 5. The policy implications of our study are reported in the concluding section.

2 Motivation

Consider the following case. In industry A, technology is characterized by a short investment cycle and almost immediately revenue is generated. Hence, it is highly likely that within a fiscal year revenue is generated from each new endeavor. Moreover, the investment nature is such that a small fraction of investment expenditure is classified as capital goods (and therefore depreciated gradually over multiple years), whereas a large fraction of investment expenditure can be legally classified as cost of goods sold (and therefore is immediately and fully tax deductible, so called short-lived assets). Now consider an industry B, in which technology is characterized by lengthy investment projects, spanning several fiscal years. Moreover, the bulk of the investment expenditure is born in terms of capital goods, hence tax deductible at a slow rate of a few percent per year. Such comparison of the two industries reveals that the relationship between the statutory and effective CI tax to be paid by two random firms in each of those industries is likely to differ systematically.[9]

In exploiting the within industry and between industry heterogeneity in book-tax conformity one encounters an obvious obstacle: while some data sources provide information on how much

[7] E.g. Poterba and Summers (1983), Chetty and Saez (2005), Gourio and Miao (2010), Yagan (2015), Alstadsæter et al. (2017)

[8] E.g. Fullerton et al. (1983), Judd (1987), Krusell et al. (1996), Erosa and Gervais (2002), Conesa et al. (2009)

[9] Analogous discussion, in reference to 2018 CI tax cuts in the US, can be found in a blog posts exchange by Stephen Williamson, John Cochrane, Francois Gourio and Greg Mankiw.

taxes a firm has paid, it is unknown how much it should have paid. There is evidence that some firms demonstrate higher ability to evade taxes than others.[10] Indeed, firms may optimize tax burden in a variety of ways. Badertscher et al. (2015) discuss the so-called conforming tax avoidance, in which firms reduce income tax liabilities in ways that reduce also the book incomes (as opposed to nonconforming tax avoidance, which reduces tax liabilities in separation from the book incomes). One could thus expect that firms more able to optimize taxes are more likely to have also other managerial abilities, making taxes paid and firm-level efficiency subject to endogeneity (due to the unobservable managerial skill). Typically, causal studies on taxation rely on evidence from tax audits (e.g. Breusch et al. 2005, Wilson 2009, Hanlon and Slemrod 2009, Hoopes et al. 2012, Badertscher et al. 2013)[12] or on experiments (controlled policy interventions or quasi-natural experiments, e.g. Slemrod et al. 2001, Feldman and Slemrod 2007, Kleven et al. 2011, Blaylock et al. 2017, admittedly, the experimental evidence is more frequently available for individual taxpayers than in the case of firms).[13] Studies exploit also the concordance between data reported in tax statements and in credit loan applications (e.g. Artavanis et al. 2016).[14]

One encounters also problems in the very measurement of taxation. Two most frequently used measures are book-tax difference (BTD) and effective tax rate (ETR). Both focus on actual payment to the tax authorities. While the two are closely related, as they are obtained from virtually the same data, they are are not flawless (Hanlon and Heitzman 2010, Alm 2012, among others), which encouraged simulation approach (recently e.g. Dechow et al. 2012, De Simone et al. 2017) and alternative measures. Notably, Henry and Sansing (2014) demonstrate how censoring of the observations, implicit in many studies, biases both these measures, as negative and close to zero pre-tax profits are problematic. They propose to scale tax obligations by assets rather than the pre-tax profits. Note that our data is not subject to implicit censoring in the sense discussed by Henry and Sansing (2014).[15]

Given the endogeneity challenge and the measurement challenge, our identification strategy relies on the fact that sector-specific technology limits the scope in which firms may benefit from optimization vehicles embedded in the legislation. Namely, firms in industry A from the earlier example will experience lower taxation burden than firms from industry B, regardless of

[10]Foreign owned entities may resort to shuffling operations between several tax regimes across different countries (e.g. Maffini and Mokkas 2011, Weyzig 2014, Koethenbuerger and Stimmelmayr 2016),[11] not to mention optimizing over the capital structures (e.g. Wilson 2009, Pfaffermayr et al. 2013). Feld et al. (2013) provide a meta-analysis of capital structure and tax avoidance. A broader overview of the accomplishments in the field is provided by Alm (2012). In addition to tax sheltering via corporate debt, firms may also use political connections (Kim and Zhang 2016), skill (e.g McGuire et al. 2012, Koester et al. 2016), not to mention morale (Alm and Torgler 2011, Huseynov and Klamm 2012, Bame-Aldred et al. 2013) – to choose the optimal tax burden, even within the legal limits. Admittedly, separating skill from morale may be impossible, for example Hanlon et al. (2012) find that firms with bigger book-tax difference tend to spend more on tax auditing services. This was concurred by Donohoe and Knechel (2014), who show that this is due to providing bundling of audit and advising. Empirical evidence demonstrates the links between competition and tax liabilities (e.g Cai and Liu 2009) as well as links to R&D activity (a recent meta-regression by Belz et al. 2017). The conformity between books and tax forms may also be relevant for access to capital (e.g. Artavanis et al. 2016, Bonsall et al. 2017).

[12]Sometimes self-reported tax evasion is used, for example Tedds (2010) provides an analysis based on self-reported percentage of income not revealed to the tax authorities from a World Bank firm-level survey.

[13]There is also a growing body of literature exploiting the tariff data for inference about taxation (e.g. Mishra et al. 2008, Ferrantino et al. 2012, Liu 2013).

[14]Literature discusses also the phenomenon of the so-called under-leveraging or under-sheltering (eg. Jacob and Müller 2017).

[15]Our method accounts fully for negative profits. Since in the data we use financial data is reported in fractions of 1000's of USD (converted at the exchange rate from the last trading day of a given year), zero profits are actually rare.

the firm-level managerial skill. Or, phrased alternatively, whatever the CI taxation in a given country and a given year, across countries firms from industry A will face lower tax cost than firms from industry B. We thus propose a novel instrument: sector, country and time specific deviation from the average effective CI tax. Our identification strategy exploits the fact that in some sectors technology allows firms to report higher fraction of expenditure as tax-deductibles. In response to the criticism towards measurement of the tax evasion, we use information about taxes paid rather than taxes scaled by pre-tax profits (Dechow et al. 2012, Henry and Sansing 2014, De Simone et al. 2017).

Our paper exploits rich and unique firm-level data for over forty European countries over two decades. This unique panel covers in principle over 130 million firms, although admittedly the coverage of the financial data is substantially smaller. Thanks to the richness of this data, we may finely define technologies (3 digit NACE). Given wide time span and selection of countries, our data is rich in variation in the nominal tax rates, as well as a variety of tax deductible reforms, which asymmetrically affected the tax base across industries and countries.

3 Data

We use firm-level data from Amadeus provided by Bureau van Dijk. We combine subsequent editions of Amadeus, obtaining nominal data coverage spanning the years from 1992 to 2013, as each edition of Amadeus data has up to 10 years of firms' history. Effective median duration of a firm-level panel for most countries amounts to about 4 to 6 years, but when combined, subsequent editions of Amadeus yield firm-level panels of up to 22 years. After combining the subsequent editions, the database covers more than 130 million firm-year observations from 44 countries. This sample is large by the standards of taxation literature.[16]

Amadeus data come from national information providers and are based on administrative records or registry courts (depending on the country legislation). Due to differences in national legislation as well as differences between the national information providers, the coverage of the economy is not the same across years and countries in our sample. In particular, the availability of the accounting information is highly heterogeneous (see Kalemli-Ozcan et al. 2015, for a detailed treatment). In fact, following step-wise data preparation procedure proposed by Kalemli-Ozcan et al. (2015) for one given edition of Amadeus data, one obtains the sample with roughly 4% of the original size. The reduction is particularly harmful to the length of the firm history, whereas following the history of each firm is particularly important for meaningful inference (Auerbach 2006). Such large reduction in the sample size ushers the risk of systematic data gaps and thus biased estimates.

We improve on the previously used data preparation procedures in three ways. First, we strive to construct long panels. We combine subsequent editions of Amadeus: 2002, 2003, 2004, 2008, and 2014, merging data with the use of unique firm identifiers. This way we may fill the missing information on firm history: if information for a given year for a given firm is missing in

[16] Recently, Zwick and Mahon (2017) analyze a sample of 120 thousand companies, earlier literature typically analyzed Compustat data i.e. sample restricted to listed companies. Altshuler et al. (2009) work with registry data covering about 100-140 thousand firms, while a majority of the tax audit and experimental studies use much smaller samples.

one edition of Amadeus, it may be replaced with the data from another edition of Amadeus.[17] This way we are able to fill about 24.5% of the missing data points.

Second, we observe the coverage of the Amadeus data and the sudden changes in Amadeus data coverage at country and sector level. To establish a measure of the Amadeus coverage we compare the total employment in a given sector in a given country in a given year to data from World Input and Output Database. We tag all those firms, which come from a sector with a coverage short of 10% in a given country (we also tag the data from the countries or years that are not covered by WIOD, as for them we cannot establish the reliability measures). We also drop those firms, whose sector and country coverage relative to WIOD has experienced a sudden change. For example, a change in national information provider could substantially reduce or increase the number of firms covered in a given country and a given sector, which hazards the continuity of firm history.[18] To mitigate the consequences of such sample changes on our estimations we tag those cases of sudden changes which imply a change in coverage by more than 10 percentage points in a given year. This step of our procedure does not drop the data, but the non-tagged data our preferred specification, which we dub as 'trusted data'.

Third, we impute the missing information in firm history, as we are particularly interested to recover all the firm-level information for the cases where CI taxes paid are reported, but some firm-level information is missing. This step is different from step 1 in that we do not fill in the gaps in one wave of Amadeus data by relevant information available in other wave of the Amadeus data, rather, once all the data that could be recovered from primary sources are filled, we *impute* the missing observation using the multiple imputation techniques. This way we maximize the use of the CI tax data reported and minimize the risk of non-random sample selection. The imputation procedure is implemented only for firms and periods with reported taxes, but discontinuous firm histories in other variables. This implies we only impute data points within the history of the firm (i.e. we do not impute data in the end, nor in the beginning of the firm history) and only few missing variables. We first determine the set of firms for which tax data is available. Following White et al. (2011) we then utilize multivariate imputation using chained equations (MICE) with fully conditional specifications (FCS).[19] In a nutshell, the procedure selects the variable with the lowest number of missing observation and computes dynamics (the chain component of the imputation procedure) to fill in the missing values, utilizing the available information for other relevant economic variables (the conditional specifications component of the imputation procedure). Note that imputations are only performed for 'trusted data' sectors and years.

We impute missing data point if at least seven out of a total of fourteen variables are available for a given firm in a given year. The fourteen variables include measures of sales, employment profits (before and/or after tax), assets, and revenues.[20] The dynamics are computed at 3-digit

[17] If two different values are available in the other editions of Amadeus, we replace the missing information for a given year with the data from the edition with the nearest year to the missing observation.

[18] For this reason, firm survival analyses with Amadeus data are questionable: a firm could disappear from Amadeus rather than actually go bankrupt.

[19] This procedure was originally proposed by Van Buuren et al. (1999). Subsequent studies, such as Van Buuren (2007), Lee and Carlin (2010) show its superiority relative to alternative imputation procedures.

[20] We use the following Amadeus variables: added value, total assets, fixed assets, EBITDA, profit/loss before tax, number of employees, shareholders funds, working capital, sales, operating revenue turnover, interest paid, costs of goods sold, cost of employees, and depreciation.

NACE level (separately for each country). For example, if we observe sales in a firm i in country c in sector s in year 1997 and then in 1999, we impute the sales level for this firm in 1998 using the forward looking dynamics computed for sector s in country c between 1997 and 1998, conditional on other variables available for this firm for 1998.[21]

For imputation validity, one needs to responsibly select the so-called variable threshold and the burn-in period threshold as well as the number of imputations. As discussed above, our variable threshold is seven out of fourteen, i.e. we do not impute firm-level data points if more than 50% of variables for a given year is missing for this firm. The burn-in period, refers to the number of iterations necessary for a chain to converge to a stationary distribution (Buuren and Groothuis-Oudshoorn 2011) and the number of imputations should be determined based on the fraction of missing information (Rubin 1976). Also, the larger the sample, the smaller number of imputations is required (Van Buuren et al. 1999). In our sample, the highest fraction of missing information concerns EBITDA variable, with roughly 20% data points missing. Given the observed frequencies, and following the guidance of White et al. (2011), we implement twenty imputations. Typically, the quality of the imputation is measured by the so-called relative efficiency statistic, which reports how much more efficiency could be gained if an infinite number of imputations was obtained, instead of the number of imputations specified by the the burn-in threshold. In the case of our imputations, the relative efficiency statistic reaches roughly 0.002%, which is satisfactory. In Appendix B we report the full account of the imputation procedure and quality diagnostics.

Overall, we are able to recover roughly 5.64 million data points through imputation and increase the average length of the panel from 3.8 years to 4.2 years. The imputation increases the number of firm-year observations to be used from 10.8 million to 11.3 million.[22] Given that imputation is an area of controversy in empirical research, for comparison, we provide estimations for the data with and without imputations. We describe in detail in Appendix A the evolution of the data coverage.

3.1 Stylized facts

The data support the idea that technology/industry drives the CI taxation liabilities. As revealed by a variance decomposition, for every single measure of taxation, sector identification has a larger contribution than country, see Table 1. Note, that in all of the analyzed countries, the statutory CI tax rate is universal across industries, while the nominal CI tax rates differ substantially across countries, with a discrepancy of as much as nearly 20 percentage points (or a 100%, see Clausing 2007). Naturally, firm level heterogeneity typically explains a dominant

[21] We also use backward looking dynamics, the results are the same, the detailed logs are available upon request. Note that our procedure is not susceptible to large firms outliers. First, when computing the sector-country chain dynamics, we use an unweighted average. Consequently, large firms, which have typically relatively lower dynamics, have disproportionately lower bearing on the imputed values. This procedure is consistent with the fact that typically large firms have fewer missing observations than smaller firms (Kalemli-Ozcan et al. 2015). Second, the sectoral dynamics are computed for 98% of the sample, i.e. without the extreme 1% of the distribution on either end. We only use sector-country-year cells that have at least 4 firms after this censoring.

[22] We have to drop about 7.4 mln data points (or 4.5% of the original sample), due to unavailable sector information. This account includes also the cases in which less than 4 firms exist within a sector for a given country. We impose this restriction because the intra-sector averages and dispersion measures are important for our causal identification as well as for the imputations. By excluding sectors where only few firms were present, we limit the scope for the influential outliers to drive the results.

share in variation, but this is to be expected, given the earlier literature on firm-level skill and aggressiveness (e.g. Hanlon and Slemrod 2009, McGuire et al. 2012, Kim and Zhang 2016, Koester et al. 2016).

Table 1: Sources of variation in taxation measures

	All firms			Firms ineligible to CF		
Variable	Firm	Country	Sector	Firm	Country	Sector
BTD	17.8%	0.1%	0.4%	15.5%	0.1%	0.5%
BTD / Assets	7.3%	0.0%	0.1%	6.9%	0.0%	0.0%
BTD / PTI	65.3%	14.0%	17.1%	69.3%	14.4%	18.4%
BTD/ taxes paid	33.2%	0.7%	0.5%	31.2%	0.8%	0.5%
Taxes paid	73.8%	9.6%	63.9%	76.8%	9.5%	71.9%
Taxes paid / Assets	85.0%	5.2%	11.2%	88.0%	5.4%	6.6%
Taxes paid / Lagged assets	66.8%	5.7%	9.8%	68.6%	6.5%	10.6%
ETR (1Y)	62.9%	18.0%	20.2%	68.5%	19.7%	21.6%
ETR (2Y)	41.1%	0.3%	45.6%	43.7%	1.3%	3.4%
CF incidence	69.6%	5.9%	11.1%			

Notes: 'trusted' sample used in subsequent estimations. ANOVA decompositions, we reports a fraction of total variance captured by a given given set of dummies (e.g. country dummies for the column denoted 'Country'). BTD denotes book-tax difference (in levels, divided by assets, pre-tax income and outstanding tax obligation). ETR defined as an effective tax rate, i.e. taxes paid / profits, ETR (1Y) is a contemporaneous measure, ETR (2Y) is an unweighted moving average over two years for each firm, see equations (2) and (3) later in text.

In our sample, a surprisingly large fraction of firms pays zero corporate income taxes. This fraction on average exceeds 30% of firms in most countries in most years, whereas some firms report even negative taxes, i.e. receive a refund from the tax authorities. In fact, a relatively high fraction of firms experiences an episode of paying no taxes in a given year over their histories. In Table A4 in the Appendix we report the fraction of firms observed over a given horizon, who paid CI taxes in every single year of that horizon. For firms observed for 6 years, for example, roughly 24-30% of firms had an episode of paying literally no CI taxes in one of the years. Moreover, there are large differences across sectors in the incidence of paying taxes at all and its time patterns, as reported by Table A5.

The cause of zero-CI-tax-liabilities is the so-called carry-forward regulation (hereafter CF). In principle this regulation allows firms which report losses in a given year to discount these losses against profits in the subsequent years. Countries differ in details concerning the CF regulation, in some cases the number of years is limited, sometimes only certain fraction of loss can be use to offset the profits, etc. Given the high incidence of no taxation due to the CF regulation, there is a large potential for the disparity between the accounting and the tax values of profits, as the accounting values are contemporaneous, whereas the CI tax values of profits account for time smoothing of CI tax burden.

To mitigate the consequences of this strategic behavior on our estimates, we identify which firms are eligible to claim CF reductions in a given year and re-estimate specifications accounting separately for firms ineligible to this particular cause of tax base reduction. Our identification of the CF eligibility is based on the synthetic account of the country-level rules.[23]

Our results shed also light on the earlier debate related to the measurement of taxation. As

[23] The full coverage of the CF rules is reported annually in EY Worldwide Corporate Tax Guide. The relatively high incidence of CF in our European sample is similar to the findings for the US (e.g. Auerbach and Poterba 1987, Auerbach 2007, Altshuler et al. 2009). Indeed, the coverage by CI tax appears to have declined, while CF eligibility largely affects decision making of firms across the size and profitability spectrum Edgerton (2010), Dreßler and Overesch (2013).

discussed earlier, censoring of negative and zero taxation observations may substantially affect the inference. For example, the measure proposed by Henry and Sansing (2014) – taxes over assets – seems to be particularly strongly driven by CF. Notwithstanding, the measures in the literature differ substantially in the sources of variance. Roughly 20% of the ratio between the book-tax difference and the pre-tax income is accounted for by the country-level variation in the tax rates. However, if book-tax difference is scaled by firm size (assets), country heterogeneity in statutory tax rates explains nearly no variation. Indeed, book-tax difference scaled by assets has the largest idiosyncratic component among the analyzed measures.[24]

From the perspective of our study, perhaps the most relevant insight in Table 1 is related to the difference in the sources of variance in ETRs when compared to taxes paid. If taxation is measured by taxes paid (absolute measure) or by ETR (relative measure) the relevance of the sectoral dimension is especially pronounced (in particular, in the case of ETR (1Y), which smooths part of the idiosyncratic variation). In fact, the sector-specific variation in ETR (2Y) is more relevant than firm level variation, which appears to driven mostly by the CF eligibility. Meanwhile, for the taxes paid the CF eligibility is not able to explain away the relevance of the heterogeneity across sectors. Our reading of these results is as follows. First, firms eligible to CF display different source of tax heterogeneity than firms ineligible to CF. Second, this difference does not seem to be explained away by firm-level idiosyncratic shocks, because a large fraction of the CF incidence is actually firm-specific: many firms succeed to maintain CF eligibility over long horizons. Third, country-specific heterogeneity appears to matter the most for measures which are based on rates and much less for measures which are based on book-tax differential. We rely on these premises in deriving our identification strategy.

4 Identification strategy

The interest in this paper lies in identifying the effects of taxation on firm's efficiency and scale of operations. To this end, we take the following production function:

$$Y_{i,t} = \alpha_i(taxation_{i,t}, \cdot)K_{i,t}^{\beta_k^s} + L_{i,t}^{\beta_l^s} \tag{1}$$

where Y denotes output, K and L denote capital and labor input, respectively, and *taxation* denotes the burden of taxation for firm i at time t (the superscript s by the factor elasticities β_k and β_l allows for sector-specific production function coefficients, with s denoting sector). Since more efficient firms tend to have higher profits and pay more CI taxes, the OLS estimates of elasticity of output with respect to *taxation* are biased towards positive values. This positive correlation does not disappear once variables are scaled by assets or revenues. This endogeneity bias calls for an exogenous identification.

We build on the following intuition: the extent to which accounting costs are costs also according to tax rules is heterogeneous across technologies, which we proxy by finely defined industries. If a firm cannot reduce its tax base because some costs are not tax deductible, it pays tax on a relatively higher base, so it seems like the effective tax rate is higher, when compared to the accounting base. We exploit the part of the mismatch between the accounting rules and

[24] This interesting phenomenon offers an interesting avenue for further research.

tax rules that is technology/industry specific. If a given technology has above average ETR, the reasoning would be that its tax base is higher than the accounting base, and vice versa. These discrepancies are independent of firm optimization behavior under a plausible assumption that firms do not choose technologies/industries in order to optimize the tax burden. We exploit a variation that is exogenous to contemporaneous choices of firms, but is related to the key characteristics of their technology: sector-level variation in taxation. To make sure that the variation is exogenous to decisions of large firms, we use the extent of taxes paid within given sector from different countries as our primary source of variation. To make sure these measures do not depend on a country statutory tax rate, we take relative measures: deviation of a given industry from average ETR in a given set countries (standardized over these countries).

In order to obtain instruments, we compute effective tax rates for each firm i from sector s in country c at time t as the ratio between corporate income tax paid and the tax base, i.e. profit. In the cases when profit data was missing, it was recovered from the available data as a difference between revenues and cost. If missing, the revenues and the cost data were imputed, following the MICE FCS procedure described above and subsequently the profit was computed. The effective tax rate at firm level was then aggregated to 3 digit sector averages within each country for each year (instantaneous and smoothed by moving average). Note that the averages are not weighted by firm size, hence they are not susceptible to large firms. In order to mitigate the risk that the deviations are driven by extreme observations, we use only country-sector-year cells with at least 4 observations, once we eliminate 1% on each side of the taxation distribution.

Naturally, the average across sectors should be close to the national statutory tax rate. Our measure, therefore, focuses on the deviation of the sector average from the overall tax rate in a given country. To take into account that countries differ on average in tax rules, we use the country average tax rate, rather than statutory tax rate. The departure of the (averaged) effective tax rate in a given sector from the national average allows to capture the features of a given technology / sector to align the accounting costs with the tax deductibles.

Overall, we obtain two measures of the effective tax rate:

$$ETR(1Y)_{i,t} = taxation_{i,t}/\pi_{i,t} \tag{2}$$

$$ETR(2Y)_{i,t} = (taxation_{i,t} + taxaton_{i,t-1})/(\pi_{i,t} + \pi_{i,t-1}) \tag{3}$$

where π denotes profits before taxation. These two measures refer to alternative views of the firm optimizing behavior. The measure defined by $ETR(1Y)$ implicitly assumes firms focus on contemporaneous tax burden. The measure defined by $ETR(2Y)$ takes into account that firms may engage into tax optimization over several periods.[25]

Subsequently, we standardize the obtained ETRs to a $N(0,1)$ distribution within sector for each point in time across countries, i.e. we obtain a standardized (mean independent) measure of ETRs in a given sector in a given year. This measure tells how many cross-country standard deviations away from the average is given sector in a given year. Hence, the instrument has sector and time variation, but no firm-level variation. The averages are obtained from observations that report nonnegative taxation and are not eligible to carry forward redemption. When obtaining

[25] We analyzed also longer planning horizons, the results are essentially unaffected, detailed logs available upon request.

the instrument, we exclude data from a given country. Formally:

$$instrument_{c,s,t} = \left(ETR_{s,t} - \frac{\sum_{i \notin (c)} ETR_{s,t}}{\sum_{i \notin (c)} i}\right) / \sqrt{\frac{1}{\sum_{i \notin (c)} i} \sum_{i \notin (c)} \left(ETR_{s,t} - \frac{\sum_{i \notin (c)} ETR_{s,t}}{\sum_{i \notin (c)} i}\right)^2} \quad (4)$$

where the averages and standard deviations are computed separately for every sector s in every period t, and the instrument is obtained separately for each of the two ETR measures, as defined in equations (2)-(3). The instrument has also country level variation, because the $i \notin c$ operation makes the standardization different for every country, but since the sample has 44 countries, this effect may be minor. Note also that the deviation is standardized in a given year, hence cyclical effects at country or sector level are not a part of the instrument.

Note that both instruments are obtained based on the effective tax *rates*, not on CI taxation *levels*, whereas our model relates value added and CI taxation in (log) levels. This is fortunate, because such instrumentation eliminates any scale effects from the instrumented CI tax paid on TFP. We effectively tease out only the variation in CI tax burden related to technology (sector at 3-digit NACE level). Overall, we estimate a two-stage model, with the second stage equation analogous to equation (1):

$$\log \text{value added}_{i,t} = \alpha_i + \beta_k^s \log capital_{i,t} + \beta_l^s \log labor_{i,t} + \gamma \widehat{taxation}_{i,t} + u_t + u_i + \epsilon_{i,t}, \quad (5)$$

$$taxation_{i,t} = \delta \cdot instrument\{ETR(1Y); ETR(2Y)\}_{c,s,t} + \eta_t + \varepsilon_{i,t}, \quad (6)$$

with two instruments for the alternative ETR specifications and firm i defined within country c, sector s in period t. We estimate the model described in (5) as a two-stage least squares model in (log) levels and in first differences. Since the model has firm-level fixed effects and time fixed effects, they are also included automatically in the first stage. Note that firms hardly ever change sectors in our sample.

5 Results

The model is estimated on the 'trusted' sample, and on the sample with imputed data. All estimations have firm fixed effects, country and sector fixed effects and standard errors clustered at firm level. The value added equation is estimated in levels (logarithms) and in growth rates (first-differences). For robustness check, similar to e.g. Cen et al. (2017) we also repeat the analysis for the firms ineligible to carry forward deductions. Table 2 reports a synthetic summary of the estimated average coefficients depending on sample and model specification. Namely, we compare a specification which includes inputs (and hence the coefficient on taxation can be interpreted in terms of TFP) and specifications which have no firm-specific controls beyond fixed effects (and hence the coefficient on taxation can be interpreted in terms of output). Comparing OLS and IV estimates allows to gauge the size of the endogeneity bias, whereas the comparisons between all firms and a subsample of firms which cannot benefit from carry forward reveals the size of the average influence by firms which pay no taxes.

The specifications which do not control for inputs yield positive coefficients in OLS estimations. Specifications with inputs report positive coefficients in OLS, but negative coefficients in IV estimations. In the bottom row of Table 2 all the coefficients are large and persistently

Table 2: Coefficient on taxation across equations: a comparison of VA estimations

	OLS	IV					
	Firms in 'trusted' sectors			Firms in 'trusted' sectors ineligible to CF			
	FE	FE	FD	FE	FD	MI FE	MI FD
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
No inputs	0.26	0.29	-0.092	0.35	-0.078	0.32	-0.094
	(0.000)	(0.005)	(0.012)	(0.005)	(0.013)	(0.006)	(0.015)
Controlling for inputs	0.133	-0.043	-0.035	-0.056	-0.32	-0.053	-0.039
	(0.000)	(0.004)	(0.008)	(0.005)	(0.008)	(0.006)	(0.011)

Note: all estimates significant at $\alpha < 0.001$, log of value added in the left hand side. Results reported in both rows refer to the same sample, i.e. models without controls for inputs and with controls of K and L refer to the same samples. FE denotes fixed-effects panel, FD denotes first-difference panel regressions, IV denotes 2SLS in a respective version, standard errors in parentheses. All specifications include constant, country, and sector fixed effects. Specifications which control for inputs include also capital and labor in firm (in logs). All second stage variables expressed in logarithms. Specifications denoted by MI refer to imputed samples (and MI procedure in STATA to obtain estimates). 'All trusted' include all the available with the 'trusted' restriction. CF refers to carry forward eligibility.

negative, except for the OLS specification. This suggests that bias may indeed be large, but also that firm-specific trends in output and taxation are strongly correlated. Once we account for inputs, there is no substantial difference between the FE and FD estimator, as one would expect. Notably, firms which have no ability to exploit carry-forward in a given year are slightly less bitten by taxation, which hints that in fact firms resorting to carry-forward are those whose output and productivity suffers mostly due to taxation. Table A6 reports the full set of results for a wide variety of IV specifications, which shows that the identification strategy passes the diagnostic tests and further corroborates the estimates reported in Table 2. Table A7 extends the sample to the imputed observations and reports essentially the same estimates across the specifications.

The estimate of $\gamma \approx -0.04$ is equivalent to stating that on average ten percent larger CI tax liabilities reduce output by roughly 0.4 of a percent. This is consistent with the conjecture that CI taxes are not neutral, in fact they are detrimental to firm's performance. Ability to 'optimize' on that burden, as proxied by technology-specific overlap between accounting and tax definitions of deductibles, allows to boost firm's efficiency. Notably, the estimates become higher, if we exclude firms that are eligible to carry forward negative profits from the previous years and thus exploit lower effective taxation. This estimate is fairly large and it is also surprising in a sense that the microeconomic theory strongly favors the neutrality of profit taxation on the output choice.

We then analyze age of firm, country and sector as potential sources of policy-relevant heterogeneity. First, earlier research suggest that ability to optimize taxes is a skill that a firm needs to earn over time (and possibly experience from interacting with the tax authorities). Comparing the firms across the age brackets reveals that indeed there appears to be no strong effect of experience, Figure A1. In fact, the firms which function for three years or more are all characterized by similar elasticity of TFP with respect to CI taxation, and only very young firms display relatively low and rather weakly significant effect of CI taxation on TFP.

Second, literature suggests paramount role of sector specificity, which also underlies our identification strategy. Meanwhile, there appears to be a relatively large heterogeneity across 2-digit NACE sectors, as evidenced by Table A11. Intuitively, sectors such as mining or construction, where CI taxes are small part of the overall tax burden, are characterized by zero elasticity of TFP. Given that the excavation license or the tax on minerals are typically a multiple of what CI tax would amount to, such cases are not surprising. However, large negative effects in services (wholesale and retail trade and slightly less robust in the case of HoReCa) hint that in the case of those sectors the CI taxes may be relevant for the output decisions. Also in manufacturing there are sectors which are characterized by a negative effect of taxes on TFP: food processing and production, textiles, wood and paper as well as plastics are robust and negative. It also appears that in the industries with high value added potential, the effect of taxes on TFP is positive rather than negative. One potential explanation is the survival bias and relatively high concentration, but that is a matter for further research: due to varying and heterogenous coverage of the economy, Amadeus data are ill-suited to yield reliable measures of market concentration.

Finally, countries differ in nominal tax rates. If one takes ideas such as the Laffer curve at a face value, then for relatively low statutory tax rates, increase in taxation may coincide with higher level of production, reaching a tipping point and turning negative henceforth.[26] In Table A10 we report the heterogeneity across countries. The width of the confidence intervals may roughly proxy for the size of the sample in a given country, relative to others. The fact that some countries have a relatively small samples makes some of the estimates insignificant and implausible (for example the average estimate of the elasticity of roughly 100% for Poland or Romania). However, the majority of the country level estimates appears reliable and conforms with the intuition. Countries with a higher CI statutory tax rate, such as Germany, have a negative coefficient. By contrast, countries with low statutory CI taxes, such as Czechia or Finland, have on average a positive effect of CI taxes on output. Naturally, these results are not a proof for the existence of the Laffer curve, but the reasoning behind Laffer curve is useful in explaining these observed patterns.

The remarkable homogeneity of the obtained estimates along firm-specific characteristic such as age – and equally remarkable dispersion of the estimates across countries and sectors provide intuition behind the results reported for the overall sample. Clearly, not in all sectors and not in all countries CI taxation is detrimental to firm efficiency. The fact that the average elasticity amounts to -0.04% is misguiding in a sense that for many businesses the negative effect of CI taxation on output growth and TFP is actually much larger, meanwhile in other countries and industries it appears close to neutral. The fact that the tax rate on average reduces not only TFP but also output growth rate calls in question if the CI taxes are indeed neutral. With the growing complexity of the tax regimes and eligibility rules, firms may in fact be choosing low growth technologies, if the expected reduction in CI taxes is enough of an incentive. This distortion was so far only weakly understood and our results should be viewed as a suggestion that this dimension of CI tax research may be an avenue for fruitful and policy-relevant research.

6 Conclusions

Our objective in this study was to analyze the direct effects of corporate income taxes on firm efficiency. Microeconomic theory hints that corporate income taxes do not affect the optimization

[26]Indeed, OLS estimations suggest no such pattern, we report them in Table A8: a positive correlation between TFP and CI taxation displays no curvature.

problem of the firm directly. However, we provide a variety or arguments why the complexity of the real world corporate income tax rules may reduce the neutrality of profit taxes. In the case of some sectors / technologies, the rules for CI tax eligibility may render a large chunk of expenses non-deductible for tax purposes, making the actual effective CI tax rate materially different from the statutory tax rate. If that is the case, some firms pay much more taxes than they "should" simply because they cannot claim some of their costs adequately; this in turn reduces their growth ability and total factor productivity. By the same token, some firms in some technologies are privileged to pay relatively lower CI taxes, because a higher fraction of their actual costs is eligible under CI tax rules. We posit that this heterogeneity depends on technology which is fixed within narrowly defined sectors and we provide an instrument for the CI taxation which builds on this assumption.

This methodology is applied to uniquely vast data for millions of firms across nearly three decades spanning nearly 30 countries. Our identification strategy has country-by-sector-by-time variation and yet the IV diagnostics are satisfactory. An OLS coefficient yields a positive correlation between CI taxation and firm's output/efficiency, which is consistent with the expected endogeneity bias towards positive values (bigger and more profitable firms pay more CI taxes). Once we account for this endogeneity bias, the causal relationship is negative for TFP and output growth. It is also robust across methods and samples. Our IV strategy reveals a TFP roughly -0.4 percentage points lower for each 10% CI tax payments.

The analysis of heterogeneity reveals that a universal decline in CI taxation does not have to improve efficiency as firms in some of the sectors and countries behave in line with the tax neutrality assumption. Moreover, it appears that in some cases our instrument is less effective in providing exogenous variation as for some sectors and countries we still find positive estimates of taxation on TFP. In fact, in our reading of the results reported in this study, CI tax rates should not be adjusted before we know well which of the specific tax eligibility rules make some sectors and firms unfairly less exposed to taxation than others. This analysis would require a thorough understanding of the production technology and interaction between this technology and the specific tax rules.

One of the important insights from our study relates to the role of technology and potentially – the choice of technology. In our identification strategy we implicitly assume that the technology is homogeneous within narrowly defined sectors and travels easily between (European) countries. Since our analysis is a short-run partial equilibrium estimation, we cannot say much about the actual distortion resulting from the choice of technology in order to optimize the CI tax burden.

Like all empirical studies, ours is not without limitations. One important caveat to keep in mind is the quality of the data. We use imputation methods and classify the reliability of the Amadeus data, our results survive these robustness checks. Notably, study like ours cannot be meaningfully repeated using administrative data, as by construction they only tell the tax part of cost eligibility. Yet, working with firm census data, which comprises accounting rather than CI tax reports on balance sheets and profit-loss statements could provide additional insights on the effects of corporate income taxation on firm's output and efficiency.

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A Data coverage

Table A1: Data coverage relative to WIOD, by country

Country	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
AUSTRIA	0.3%	0.5%	0.5%	0.6%	0.8%	0.7%	0.3%	0.2%	0.1%	0.0%	0.4%	0.5%	0.5%	1.7%	3.8%	4.0%	4.0%	3.3%
BELGIUM	47.6%	42.0%	41.2%	41.7%	44.0%	45.2%	44.1%	21.6%	15.7%	12.8%	12.7%	12.1%	9.2%	9.7%	9.9%	10.7%	11.2%	11.2%
DENMARK	0.1%	10.2%	12.1%	13.7%	18.6%	20.3%	20.2%	16.8%	14.4%	17.0%	20.3%	10.4%	0.3%	0.0%	2.2%	4.2%	4.0%	3.6%
FINLAND	0.1%	8.2%	12.0%	14.8%	17.3%	19.5%	19.7%	19.6%	16.9%	17.6%	19.3%	20.2%	16.1%	14.7%	16.2%	17.0%	19.8%	19.9%
FRANCE	11.6%	11.7%	12.7%	14.6%	16.4%	18.4%	21.6%	21.6%	15.5%	15.9%	16.2%	16.6%	11.9%	11.0%	10.8%	11.4%	10.1%	7.9%
GERMANY	0.4%	0.4%	0.5%	0.5%	0.6%	0.6%	0.5%	0.6%	0.6%	0.8%	1.5%	2.4%	2.9%	4.2%	5.1%	5.4%	5.9%	5.2%
GREECE	0.0%	9.9%	10.6%	11.3%	12.0%	12.5%	12.7%	11.6%	9.7%	15.6%	17.1%	15.8%	7.6%	7.0%	8.4%	9.1%	8.9%	8.1%
HUNGARY		0.0%	0.0%	0.3%	0.5%	1.5%	2.5%	3.1%	2.1%	1.9%	7.4%	9.6%	9.5%	12.4%	16.7%	25.6%	25.7%	26.3%
IRELAND	0.5%	0.1%		0.0%	0.1%	0.3%	0.3%	0.0%			0.0%	0.3%	2.1%	5.9%	6.7%	6.5%	6.3%	5.9%
ITALY	5.1%	6.9%	9.8%	12.1%	12.9%	13.6%	15.4%	16.2%	14.0%	9.5%	10.8%	14.5%	11.1%	13.4%	12.7%	12.3%	19.8%	20.0%
LATVIA		0.3%	3.3%	12.0%	14.5%	15.4%	15.7%	16.7%	12.8%	9.8%	8.2%	7.6%	1.4%	0.6%	1.0%	0.8%	1.6%	2.0%
LITHUANIA		0.0%	2.8%	7.6%	10.5%	12.5%	14.4%	15.6%	16.0%	9.1%	4.3%	3.7%	0.1%					
NETHERL.	2.4%	2.5%	2.5%	2.9%	3.3%	3.4%	3.3%	2.9%	2.5%	2.3%	2.5%	1.8%	0.6%	0.4%	0.5%	0.6%	0.6%	0.6%
POLAND	0.0%	1.1%	4.1%	11.5%	20.0%	19.3%	13.9%	10.1%	10.2%	10.0%	9.7%	9.4%	7.9%	9.9%	13.7%	8.3%	6.2%	2.8%
PORTUGAL	2.6%	3.7%	4.0%	5.2%	3.2%	2.8%	2.4%	2.1%	1.3%	1.2%	0.8%	27.2%	29.2%	34.1%	35.2%	33.3%	33.1%	30.1%
ROMANIA		16.6%	20.8%	37.2%	36.3%	41.3%	45.5%	42.3%	20.1%	26.4%	29.9%	29.3%	20.3%	29.9%	24.8%	28.5%	30.2%	30.6%
SLOVAKIA	0.0%	0.0%	0.0%	0.7%	1.4%	2.6%	6.4%	7.0%	7.1%	10.7%	13.5%	16.8%	17.9%	22.0%	21.2%	22.9%	22.7%	0.0%
SLOVENIA				0.1%	1.2%	3.1%	3.3%	9.8%	10.0%	20.7%	21.4%	19.6%	19.7%	21.5%	20.5%	22.0%	33.0%	31.7%
SPAIN	9.8%	12.2%	13.6%	16.0%	19.6%	21.6%	23.2%	24.4%	22.7%	24.1%	24.8%	23.6%	20.1%	22.6%	23.6%	23.1%	21.8%	19.0%
SWEDEN			0.1%	10.6%	16.8%	21.5%	22.2%	20.2%	20.1%	21.5%	23.9%	16.3%	10.7%	17.8%	23.4%	24.4%	25.2%	16.5%
UK	8.2%	8.9%	9.2%	9.4%	9.5%	9.7%	9.7%	9.2%	7.2%	5.9%	5.6%	5.1%	4.4%	5.4%	6.1%	7.2%	7.4%	7.5%

Notes: data come from Amadeus editions 2002, 2003, 2004, 2008, and 2014. For some countries data are not available in WIOD, hence, they are not reported above. The full list of countries includes: AUSTRIA, BELGIUM, BOSNIA-HERZEGOVINA, BULGARIA, CROATIA, CYPRUS, CZECH REPUBLIC, DENMARK, FINLAND, FRANCE, GERMANY, GREECE, HUNGARY, ICELAND, IRELAND, ITALY, LATVIA, LIECHTENSTEIN, LITHUANIA, LUXEMBOURG, MACEDONIA, MALTA, MONTENEGRO, NETHERLANDS, NORWAY, POLAND, PORTUGAL, ROMANIA, RUSSIA, SERBIA, SLOVAKIA, SLOVENIA, SPAIN, SWEDEN, SWITZERLAND, UK, UKRAINE & YUGOSLAVIA (until this country was dissolved). Countries, for which data coverage could not be compared to WIOD are tagged the same as countries for which the comparison with WIOD reveals low coverage. Countries and sectors were tagged as 'trusted' before we narrowed the sample to firms for which taxation data is available for two consecutive periods.

Table A2: Data coverage relative to WIOD, by sector

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
A to B	2.8%	4.5%	6.1%	6.9%	10.0%	16.1%	39.4%	44.2%	39.2%	40.1%	38.5%	34.8%	21.5%	22.2%	22.8%	21.9%	20.5%	13.5%
C	9.2%	13.8%	16.8%	24.1%	28.1%	58.7%	57.1%	49.1%	31.6%	36.5%	35.4%	37.5%	25.5%	31.7%	33.6%	33.4%	33.6%	24.0%
D	13.5%	16.7%	18.6%	23.1%	27.6%	31.6%	33.6%	33.4%	26.3%	28.0%	29.6%	30.7%	22.3%	26.0%	27.7%	27.8%	28.7%	24.8%
E	10.0%	12.1%	16.6%	23.9%	33.9%	45.3%	44.5%	43.9%	39.2%	50.5%	53.5%	49.2%	32.1%	38.8%	39.2%	38.9%	37.7%	28.2%
F	6.7%	8.2%	8.9%	12.1%	15.2%	17.8%	20.5%	22.2%	19.8%	20.3%	21.2%	22.0%	16.5%	19.0%	20.0%	18.9%	18.7%	16.1%
G	8.0%	9.5%	10.8%	13.3%	15.8%	17.2%	18.6%	19.9%	16.6%	17.4%	18.3%	19.1%	14.2%	16.7%	17.1%	17.8%	17.7%	16.0%
H	4.2%	5.2%	5.8%	7.5%	8.9%	10.1%	11.8%	12.9%	10.7%	11.1%	11.6%	12.7%	10.2%	11.7%	12.2%	12.8%	14.1%	13.1%
I	4.9%	6.0%	7.0%	9.2%	11.3%	12.8%	13.6%	13.9%	12.1%	13.1%	13.7%	14.5%	11.2%	12.9%	13.6%	13.9%	14.6%	13.3%
J	1.1%	1.3%	1.5%	1.8%	2.2%	2.6%	2.8%	3.0%	2.4%	2.6%	2.8%	2.7%	1.9%	2.2%	2.6%	2.7%	2.7%	2.6%
K	6.8%	7.9%	9.1%	11.2%	13.1%	14.2%	15.8%	16.8%	14.7%	16.1%	16.9%	17.2%	12.8%	14.7%	16.5%	16.9%	17.1%	15.4%
L	0.1%	0.1%	0.0%	0.1%	0.1%	0.1%	0.1%	0.2%	0.2%	0.4%	0.4%	0.5%	1.0%	1.9%	2.3%	2.4%	2.5%	2.6%
M	0.3%	0.4%	0.4%	0.5%	0.7%	0.8%	1.0%	1.2%	1.1%	1.2%	1.3%	1.3%	1.2%	1.4%	1.5%	1.6%	1.6%	1.5%
N	1.2%	1.3%	1.5%	1.9%	2.2%	2.7%	3.1%	3.3%	3.0%	3.3%	3.7%	4.1%	4.1%	4.8%	5.3%	5.5%	6.0%	5.4%

Notes: data come from Amadeus editions 2002, 2003, 2004, 2008, and 2014. Sector aggregates across countries compared for the available countries (see note under Table A1. Other community, social and personal service activities (NACE sec. O) and activities of households (NACE sec. P) excluded. Countries and sectors were tagged as ‘trusted’ before we narrowed the sample to firms for which taxation data is available for two consecutive periods.

B Imputation

We combine 2002, 2003, 2004, 2008, and 2014 editions of the Amadeus data. We merge all the data following procedure proposed by Kalemli-Ozcan et al. (2015) and fill the missing information in the firms' history. If a firm reported no industry at any point in time, this particular entity has to be dropped from the sample. If industry was reported in some years, but not in all years, the gaps are filled using the data from the edition of Amadeus that was the nearest time-wise.

Coverage of data varies in Amadeus across time and across countries. We make sure to use only firms from sectors which report at least for firms in a given year in a given country (4-digit NACE coding). In the interest of representativeness, we impose an additional requirement on the data: employment coverage in Amadeus for a given country in a given year at 2-digit NACE level has to be in excess of 10% relative to WIOD data.

Having defined the sample, we compute year-on-year chain dynamics for the available financial data: total assets, value added, payroll (in Amadeus: cost of employees), EBITDA, operating revenue turnover, sales, number of employees (FT equivalent), working capital, shareholder funds (capital), fixed assets, depreciation, interest paid, material costs, and costs of goods sold. Fourteen variables are used to impute the missing data points. This is the most comprehensive list of variables that assures satisfactory data coverage. For these variables we use the following transformations to obtain dynamics:

$$\Delta X_t = X_t/X_{t-1} - 1 \qquad \text{if} \quad X_t > X_{t-1} \tag{A1}$$

$$\Delta X_t = -(X_{t-1}/X_t - 1) \qquad \text{if} \quad X_t < X_{t-1} \tag{A2}$$

$$\Delta X_t = 0 \qquad \text{if} \quad X_t = .|X_{t-1} = . \tag{A3}$$

Chain dynamics are not computed and hence data is not imputed in two cases. First, if for a given firm in a given year less than 7 out of 14 above listed variables is reported. Second, we also eliminate 1 percentile at each end of the variables distribution to limit the risk of influential outliers.

Imputations are obtained via multivariate imputation using chain equations (MICE) with fully conditional specifications (FCS, as proposed by Van Buuren et al. 1999). We repeat the imputation 20 times, hence obtaining 20 new data sets, where the choice of 20 follows from the guidelines proposed by White et al. (2011). We simultaneously utilize all dynamics with burn-in period of 20 iterations, corresponding to 20% of missing data points for EBITDA, as suggested by Rubin (1976). We impose fixed random seed.

Once imputations are concluded, we reverse the dynamics back to levels, that are subsequently used in the regressions. Although this procedure allows to fill every missing data point within the panel, we only impute the gaps between the observed values. We do not impute the first, nor the last observation within the panel. This is conservative in a sense that a firm could disappear or appear in a panel for reasons related to its operations rather than the sample design of Amadeus and we cannot distinguish between the sample design and e.g. births or bankruptcies. Table A3 reports descriptive statistics for the imputed samples.

Table A3: Descriptive statistics for the imputation quality

Variable	Data	# obs	Mean	Std.dev.	Skewness	Kurtosis	p5	Median	p95
CI taxation		22,555,040	49,480	699,157	2,807	11,069,224	- 3,000	8,000	198,000
	Variables used in regressions								
Total assets	S	33,454,960	1,932,495	11,236,979	75	12,634	23,000	376,000	7,465,000
	I	33,456,168	1,932,516	11,236,992	75	12,634	23,000	376,000	7,465,000
Value added	S	19,760,122	870,161	3,096,109	42	5,875	19,000	269,000	3,287,000
	I	20,626,564	865,008	4,280,947	321	730,595	18,000	265,000	3,259,223
Costs of employees	S	31,889,284	446,524	1,519,165	24	1,537	5,000	120,000	1,724,000
	I	31,932,836	446,095	1,518,606	24	1,538	5,000	120,000	1,722,000
	Firm-characteristic variables used to improve the precision of the imputations								
EBITDA	S	32,526,840	196,580	1,360,694	99	25,487	- 34,000	36,000	761,000
	I	32,715,864	195,996	1,433,310	259	679,641	- 34,000	36,000	758,000
ORT	S	32,336,994	2,381,827	16,843,604	276	116,693	34,000	517,000	9,570,000
	I	32,370,080	2,385,075	16,842,514	275	116,605	34,000	518,000	9,585,250
Sales	S	29,977,756	2,171,630	15,815,876	293	129,761	31,000	491,000	8,584,000
	I	30,010,296	2,172,217	15,810,947	293	129,784	31,000	491,000	8,587,000
# of employees	S	24,397,056	17	48	16	585	1	5	67
	I	25,935,192	17	47	16	600	1	5	65
Working capital	S	16,381,673	424,250	2,263,386	131	41,543	- 37,000	57,000	1,885,000
	I	17,120,144	443,509	2,780,771	275	301,358	- 37,000	57,000	1,938,861
Shareholder funds	S	15,978,691	219,474	2,128,040	73	8,330	3,000	18,000	712,000
	I	16,590,520	219,241	2,147,559	81	13,863	3,000	18,000	712,000
Fixed assets	S	32,930,120	812,147	7,485,107	76	10,369	3,000	85,000	2,757,000
	I	32,970,224	811,221	7,480,752	76	10,380	3,000	85,000	2,754,000
Depreciation	S	31,313,612	78,169	579,676	85	14,787	1,000	14,000	271,000
	I	31,494,402	77,844	579,674	86	15,244	1,000	14,000	270,000
Interest paid	S	20,069,544	49,784	321,662	87	15,253	1,000	9,000	187,000
	I	20,843,418	48,880	489,803	850	2,341,858	1,000	8,000	183,000
Material costs	S	25,499,696	1,255,188	13,022,924	375	189,832	4,000	179,000	5,185,000
	I	26,007,602	1,268,453	27,466,082	1,511	5,177,491	3,530	179,000	5,190,950
Costs of goods sold	S	3,618,931	2,806,956	24,435,496	208	59,594	8,000	350,000	12,723,000
	I	3,685,923	2,827,855	28,019,952	287	188,360	8,000	354,000	12,736,150

Notes: ORT denotes Operating Revenue Turnover, EBIDTA denotes earnings before interest, depreciation and taxes. We denote by "S" the descriptive statistics for the original sample and by "I" the descriptive statistics for the total sample: source and imputed data points. Whenever we report the statistics for the imputed sample `MI` option in STATA is used.

C Paying taxes

Table A4: Fraction of firms which paid CI tax at least ___ years in a row

Year	2 years	3 years	4 years	5 years	6 years
1994	83.8%				
1995	84.9%	78.1%			
1996	85.6%	79.8%	73.6%		
1997	86.7%	80.6%	75.5%	69.7%	
1998	87.9%	82.1%	76.8%	71.7%	66.6%
1999	88.4%	83.2%	78.3%	72.7%	68.6%
2000	88.5%	83.7%	79.1%	74.3%	69.7%
2001	88.4%	83.5%	79.5%	75.0%	70.7%
2002	87.1%	82.4%	78.2%	74.3%	70.3%
2003	86.6%	81.6%	77.5%	74.0%	70.3%
2004	86.8%	81.7%	77.5%	73.7%	70.1%
2005	87.7%	82.5%	77.5%	73.4%	70.2%
2006	87.7%	82.7%	77.8%	73.5%	69.8%
2007	87.4%	83.1%	78.6%	74.1%	70.0%
2008	87.4%	82.3%	78.1%	74.1%	70.1%
2009	87.0%	82.0%	77.3%	73.7%	70.0%
2010	87.4%	82.5%	77.5%	73.3%	70.1%
2011	88.1%	82.5%	78.1%	74.2%	70.1%
2012	87.6%	83.0%	78.1%	74.1%	70.4%
2013	88.4%	84.2%	80.3%	76.4%	72.6%

Note: data come from Amadeus editions 2002, 2003, 2004, 2008, and 2014. Statistics on the incidence of paying CI taxes are based on the total combined sample, with filling in the missing observation between the editions of Amadeus, but without imputations. Averages computed without firms reporting negative profits in the year prior to the first year of the observation window. Exact sample size depends on the year and on the time horizon in question: two consecutive data points are available for the entire analyzed sample, increasing the horizon gradually reduces the sample size.

Table A5: Fraction of firms which paid CI tax at least ___ years in a row by sector and year

% of firms	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
A: Agriculture, hunting and forestry																				
— 2 years	0.86	0.87	0.88	0.9	0.9	0.88	0.89	0.9	0.89	0.88	0.88	0.88	0.88	0.87	0.88	0.87	0.87	0.88	0.88	0.88
— 3 years		0.8	0.83	0.84	0.85	0.85	0.84	0.85	0.85	0.84	0.83	0.83	0.83	0.83	0.82	0.82	0.82	0.82	0.83	0.83
— 4 years			0.76	0.8	0.8	0.8	0.81	0.81	0.8	0.81	0.8	0.79	0.79	0.79	0.78	0.77	0.78	0.78	0.78	0.79
— 5 years				0.74	0.76	0.76	0.78	0.78	0.76	0.76	0.76	0.76	0.75	0.75	0.75	0.74	0.74	0.74	0.75	0.75
— 6 years					0.71	0.72	0.73	0.75	0.74	0.73	0.72	0.73	0.72	0.72	0.72	0.7	0.7	0.7	0.71	0.72
B: Fishing																				
— 2 years	0.81	0.86	0.87	0.91	0.9	0.89	0.89	0.87	0.86	0.82	0.82	0.85	0.82	0.86	0.82	0.83	0.84	0.79	0.76	0.64
— 3 years		0.76	0.83	0.85	0.86	0.86	0.85	0.82	0.82	0.78	0.76	0.79	0.76	0.8	0.77	0.8	0.77	0.78	0.71	0.42
— years			0.73	0.81	0.81	0.84	0.82	0.79	0.75	0.74	0.73	0.74	0.71	0.74	0.72	0.75	0.74	0.73	0.7	0.25
— years				0.71	0.77	0.79	0.8	0.76	0.72	0.66	0.7	0.71	0.66	0.69	0.65	0.69	0.68	0.7	0.65	0.25
— years					0.7	0.76	0.75	0.74	0.68	0.66	0.62	0.68	0.63	0.67	0.62	0.63	0.64	0.65	0.62	0.17
C: Mining and quarrying																				
— 2 years	0.79	0.8	0.8	0.81	0.83	0.86	0.87	0.88	0.88	0.87	0.84	0.81	0.8	0.81	0.82	0.78	0.79	0.83	0.8	0.79
— 3 years		0.72	0.74	0.72	0.76	0.8	0.82	0.85	0.83	0.82	0.78	0.77	0.74	0.73	0.75	0.73	0.74	0.75	0.76	0.59
— 4 years			0.67	0.67	0.68	0.74	0.75	0.8	0.8	0.77	0.73	0.72	0.72	0.68	0.66	0.66	0.69	0.7	0.68	0.59
— 5 years				0.61	0.63	0.65	0.7	0.75	0.76	0.74	0.69	0.68	0.67	0.66	0.61	0.61	0.63	0.66	0.63	0.62
— 6 years					0.57	0.61	0.62	0.69	0.71	0.71	0.66	0.64	0.63	0.62	0.59	0.56	0.58	0.6	0.59	0.57
DA: Manufacture of food products, beverages and tobacco																				
— 2 years	0.82	0.83	0.83	0.83	0.84	0.84	0.85	0.86	0.85	0.85	0.85	0.85	0.84	0.84	0.84	0.84	0.84	0.86	0.85	0.85
— 3 years		0.77	0.76	0.77	0.77	0.78	0.79	0.8	0.8	0.8	0.8	0.8	0.8	0.78	0.78	0.78	0.79	0.8	0.8	0.81
— 4 years			0.71	0.71	0.72	0.72	0.73	0.74	0.74	0.75	0.75	0.75	0.75	0.74	0.74	0.73	0.73	0.75	0.74	0.76
— 5 years				0.67	0.66	0.67	0.68	0.69	0.69	0.7	0.71	0.71	0.71	0.71	0.7	0.69	0.69	0.7	0.7	0.72
— 6 years					0.62	0.62	0.64	0.65	0.65	0.66	0.67	0.67	0.67	0.67	0.66	0.66	0.65	0.65	0.66	0.68
DB: Manufacture of textiles and textile products																				
— 2 years	0.82	0.83	0.84	0.87	0.87	0.87	0.87	0.85	0.84	0.83	0.84	0.85	0.85	0.84	0.83	0.82	0.82	0.86	0.85	0.88
— 3 years		0.75	0.78	0.8	0.82	0.82	0.82	0.8	0.79	0.78	0.78	0.79	0.79	0.79	0.77	0.77	0.77	0.78	0.8	0.85
— 4 years			0.7	0.74	0.76	0.78	0.77	0.76	0.74	0.74	0.73	0.74	0.74	0.74	0.73	0.72	0.72	0.74	0.73	0.82
— 5 years				0.67	0.7	0.72	0.73	0.72	0.7	0.69	0.69	0.69	0.69	0.7	0.68	0.68	0.68	0.7	0.69	0.74
— 6 years					0.63	0.67	0.68	0.68	0.66	0.65	0.65	0.65	0.65	0.65	0.64	0.63	0.64	0.66	0.66	0.69
DC: Manufacture of leather and leather products																				
— 2 years	0.83	0.8	0.8	0.82	0.82	0.86	0.84	0.87	0.85	0.77	0.82	0.89	0.9	0.85	0.77	0.75	0.86	0.87	0.83	1
— 3 years		0.71	0.75	0.71	0.75	0.79	0.81	0.79	0.79	0.73	0.71	0.79	0.85	0.83	0.74	0.69	0.75	0.75	0.83	1
— 4 years			0.68	0.66	0.66	0.71	0.74	0.75	0.72	0.69	0.67	0.69	0.76	0.77	0.71	0.65	0.69	0.69	0.73	1
— 5 years				0.62	0.62	0.64	0.68	0.67	0.68	0.62	0.64	0.64	0.66	0.74	0.67	0.62	0.65	0.66	0.67	1
— 6 years					0.58	0.6	0.62	0.63	0.61	0.59	0.61	0.62	0.61	0.59	0.67	0.58	0.62	0.62	0.63	1

% of firms	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
... continued																				
	DD: Manufacture of wood and wood products																			
— 2 years	0.83	0.85	0.86	0.87	0.87	0.87	0.88	0.87	0.85	0.86	0.87	0.85	0.85	0.85	0.87	0.87	0.84	0.83	0.83	0.87
— 3 years		0.78	0.79	0.81	0.82	0.82	0.83	0.82	0.8	0.81	0.8	0.81	0.8	0.79	0.81	0.81	0.79	0.78	0.77	0.82
— 4 years			0.73	0.75	0.77	0.77	0.78	0.78	0.76	0.77	0.75	0.76	0.77	0.74	0.76	0.76	0.75	0.74	0.72	0.78
— 5 years				0.7	0.7	0.72	0.74	0.74	0.72	0.73	0.72	0.71	0.71	0.72	0.72	0.72	0.7	0.71	0.69	0.74
— 6 years					0.65	0.66	0.7	0.7	0.68	0.69	0.68	0.67	0.67	0.68	0.7	0.69	0.67	0.66	0.66	0.72
	DE: Manufacture of pulp, paper and paper products; publishing and printing																			
— 2 years	0.84	0.85	0.84	0.85	0.86	0.87	0.87	0.85	0.84	0.84	0.85	0.85	0.85	0.85	0.83	0.84	0.85	0.86	0.85	0.84
— 3 years		0.78	0.79	0.79	0.8	0.81	0.81	0.81	0.78	0.78	0.79	0.8	0.8	0.8	0.78	0.78	0.79	0.8	0.8	0.8
— 4 years			0.72	0.74	0.74	0.75	0.76	0.76	0.74	0.73	0.73	0.74	0.75	0.74	0.74	0.73	0.74	0.75	0.75	0.76
— 5 years				0.68	0.7	0.69	0.71	0.72	0.7	0.69	0.69	0.69	0.7	0.7	0.68	0.69	0.7	0.7	0.7	0.72
— 6 years					0.65	0.66	0.66	0.66	0.66	0.65	0.65	0.65	0.65	0.65	0.65	0.64	0.66	0.66	0.66	0.68
	DF: Manufacture of coke, refined petroleum products and nuclear fuel																			
— 2 years	0.81	0.77	0.73	0.77	0.78	0.86	0.82	0.82	0.76	0.73	0.75	0.83	0.88	0.86	0.84	0.81	0.71	0.75	0.8	1
— 3 years		0.74	0.67	0.65	0.71	0.74	0.79	0.78	0.71	0.73	0.62	0.72	0.82	0.8	0.81	0.79	0.71	0.65	0.7	1
— 4 years			0.63	0.58	0.63	0.67	0.69	0.74	0.67	0.71	0.62	0.58	0.73	0.75	0.8	0.75	0.68	0.65	0.6	0.5
— 5 years				0.59	0.59	0.61	0.64	0.66	0.61	0.61	0.59	0.58	0.58	0.74	0.73	0.73	0.63	0.67	0.6	0
— 6 years					0.59	0.56	0.59	0.6	0.56	0.57	0.54	0.56	0.58	0.61	0.71	0.67	0.6	0.6	0.61	0
	DG: Manufacture of chemicals, chemical products and man-made fibres																			
— 2 years	0.84	0.86	0.86	0.85	0.86	0.85	0.85	0.85	0.84	0.85	0.85	0.85	0.85	0.83	0.81	0.8	0.8	0.81	0.82	0.84
— 3 years		0.78	0.8	0.81	0.8	0.81	0.8	0.8	0.78	0.79	0.8	0.81	0.8	0.78	0.76	0.75	0.74	0.74	0.75	0.73
— 4 years			0.74	0.76	0.76	0.76	0.77	0.76	0.73	0.75	0.74	0.77	0.77	0.75	0.71	0.7	0.69	0.69	0.69	0.71
— 5 years				0.7	0.71	0.73	0.72	0.73	0.69	0.71	0.7	0.71	0.73	0.71	0.69	0.66	0.65	0.64	0.64	0.69
— 6 years					0.66	0.68	0.68	0.69	0.66	0.66	0.66	0.68	0.68	0.68	0.66	0.64	0.62	0.61	0.6	0.63
	DH: Manufacture of rubber and plastic products																			
— 2 years	0.83	0.88	0.84	0.84	0.87	0.87	0.86	0.87	0.84	0.83	0.83	0.86	0.86	0.85	0.82	0.81	0.8	0.82	0.82	0.77
— 3 years		0.8	0.82	0.77	0.8	0.82	0.82	0.82	0.79	0.77	0.77	0.79	0.81	0.82	0.77	0.75	0.75	0.76	0.75	0.77
— 4 years			0.76	0.75	0.73	0.74	0.77	0.78	0.74	0.72	0.72	0.73	0.76	0.77	0.75	0.71	0.7	0.72	0.7	0.73
— 5 years				0.69	0.71	0.68	0.72	0.74	0.69	0.68	0.68	0.69	0.7	0.72	0.7	0.69	0.67	0.67	0.67	0.72
— 6 years					0.67	0.67	0.66	0.69	0.66	0.64	0.64	0.65	0.67	0.65	0.65	0.64	0.66	0.63	0.62	0.7
	DI: Manufacture of other non-metallic mineral products																			
— years	0.82	0.82	0.83	0.85	0.85	0.86	0.86	0.86	0.85	0.84	0.85	0.87	0.85	0.87	0.85	0.83	0.84	0.86	0.85	0.85
— 3 years		0.75	0.77	0.78	0.8	0.8	0.81	0.81	0.79	0.79	0.79	0.81	0.81	0.83	0.8	0.79	0.78	0.79	0.81	0.8
— 4 years			0.7	0.72	0.74	0.75	0.75	0.76	0.75	0.75	0.75	0.75	0.76	0.78	0.77	0.74	0.74	0.74	0.75	0.78
— 5 years				0.66	0.69	0.7	0.71	0.71	0.69	0.7	0.71	0.72	0.71	0.73	0.73	0.72	0.7	0.71	0.71	0.74
— 6 years					0.64	0.65	0.66	0.67	0.65	0.65	0.67	0.68	0.68	0.68	0.69	0.68	0.67	0.67	0.68	0.74
	DJ: Manufacture of basic metals and fabricated metal products																			

% of firms	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
... continued																				
— 2 years	0.81	0.84	0.86	0.86	0.88	0.88	0.88	0.88	0.86	0.84	0.84	0.86	0.86	0.86	0.86	0.84	0.82	0.85	0.85	0.87
— 3 years		0.75	0.78	0.81	0.82	0.83	0.84	0.83	0.81	0.79	0.78	0.8	0.8	0.81	0.81	0.79	0.78	0.78	0.79	0.82
— 4 years			0.71	0.74	0.77	0.78	0.79	0.8	0.77	0.75	0.74	0.74	0.75	0.76	0.77	0.74	0.73	0.74	0.73	0.77
— 5 years				0.68	0.71	0.73	0.74	0.75	0.74	0.72	0.71	0.7	0.7	0.71	0.71	0.71	0.69	0.7	0.69	0.73
— 6 years					0.65	0.68	0.7	0.7	0.7	0.68	0.67	0.67	0.66	0.67	0.67	0.66	0.66	0.66	0.65	0.69
	DK: Manufacture of machinery and equipment n.e.c.																			
—2 years	0.79	0.84	0.85	0.88	0.89	0.89	0.88	0.87	0.85	0.84	0.85	0.86	0.87	0.87	0.87	0.84	0.83	0.85	0.85	0.85
— 3 years		0.75	0.79	0.82	0.84	0.84	0.85	0.83	0.81	0.79	0.8	0.8	0.82	0.82	0.82	0.79	0.77	0.78	0.79	0.84
— 4 years			0.71	0.76	0.78	0.8	0.8	0.8	0.77	0.75	0.75	0.76	0.76	0.78	0.77	0.74	0.73	0.74	0.74	0.76
— 5 years				0.68	0.72	0.75	0.76	0.76	0.74	0.72	0.71	0.72	0.72	0.73	0.74	0.7	0.69	0.69	0.69	0.69
— 6 years					0.66	0.69	0.71	0.72	0.71	0.69	0.68	0.68	0.68	0.68	0.68	0.67	0.66	0.66	0.65	0.64
	DL: Manufacture of electrical and optical equipment																			
— 2 years	0.84	0.83	0.86	0.86	0.87	0.87	0.87	0.88	0.85	0.84	0.85	0.87	0.87	0.88	0.88	0.85	0.85	0.86	0.84	0.84
— 3 years		0.78	0.79	0.8	0.82	0.81	0.83	0.82	0.81	0.78	0.79	0.81	0.82	0.83	0.83	0.81	0.81	0.81	0.8	0.8
— 4 years			0.73	0.73	0.76	0.77	0.78	0.79	0.77	0.75	0.74	0.75	0.77	0.79	0.79	0.77	0.77	0.76	0.75	0.78
— 5 years				0.68	0.7	0.72	0.75	0.74	0.73	0.71	0.71	0.71	0.71	0.74	0.75	0.73	0.74	0.73	0.71	0.73
— 6 years					0.65	0.67	0.7	0.7	0.69	0.68	0.68	0.68	0.68	0.69	0.72	0.7	0.7	0.7	0.68	0.7
	DM: Manufacture of transport equipment																			
— 2 years	0.83	0.88	0.87	0.87	0.87	0.87	0.86	0.86	0.86	0.85	0.83	0.85	0.86	0.89	0.88	0.85	0.83	0.85	0.84	0.86
— 3 years		0.8	0.83	0.82	0.81	0.83	0.82	0.82	0.81	0.8	0.79	0.77	0.8	0.83	0.84	0.8	0.78	0.78	0.79	0.81
— 4 years			0.75	0.8	0.77	0.77	0.78	0.77	0.77	0.76	0.75	0.73	0.73	0.77	0.78	0.76	0.75	0.74	0.73	0.78
— 5 years				0.72	0.75	0.74	0.73	0.73	0.73	0.72	0.71	0.69	0.69	0.7	0.74	0.71	0.71	0.7	0.69	0.77
— 6 years					0.69	0.72	0.7	0.69	0.7	0.69	0.67	0.66	0.66	0.66	0.68	0.67	0.66	0.68	0.66	0.74
	DN: Manufacturing n.e.c.																			
— 2 years	0.86	0.86	0.85	0.85	0.88	0.89	0.88	0.87	0.87	0.86	0.86	0.87	0.88	0.88	0.86	0.84	0.85	0.87	0.86	0.85
— 3 years		0.8	0.8	0.8	0.82	0.83	0.84	0.82	0.81	0.81	0.81	0.82	0.82	0.83	0.82	0.8	0.79	0.81	0.81	0.8
— 4 years			0.75	0.75	0.76	0.77	0.79	0.79	0.77	0.76	0.76	0.77	0.77	0.78	0.78	0.76	0.75	0.76	0.75	0.76
— 5 years				0.71	0.72	0.72	0.74	0.74	0.74	0.72	0.72	0.72	0.73	0.73	0.74	0.72	0.72	0.72	0.71	0.71
— 6 years					0.68	0.68	0.69	0.7	0.7	0.7	0.68	0.68	0.68	0.69	0.7	0.69	0.69	0.69	0.67	0.66
	E: Electricity, gas and water supply																			
— 2 years	0.73	0.72	0.7	0.7	0.73	0.74	0.71	0.75	0.8	0.78	0.78	0.77	0.78	0.79	0.81	0.79	0.81	0.83	0.86	0.93
— 3 years		0.69	0.65	0.65	0.66	0.68	0.66	0.68	0.72	0.76	0.71	0.71	0.73	0.74	0.73	0.71	0.74	0.77	0.78	0.93
— 4 years			0.63	0.61	0.62	0.63	0.62	0.62	0.64	0.7	0.69	0.65	0.67	0.69	0.69	0.66	0.69	0.71	0.72	0.8
— 5 years				0.59	0.58	0.59	0.6	0.58	0.6	0.65	0.64	0.64	0.6	0.64	0.65	0.62	0.64	0.65	0.66	0.74
— 6 years					0.55	0.56	0.57	0.57	0.54	0.62	0.6	0.59	0.59	0.59	0.6	0.58	0.59	0.6	0.61	0.63
	F: Construction																			
— 2 years	0.83	0.84	0.84	0.86	0.88	0.88	0.88	0.88	0.87	0.86	0.87	0.88	0.88	0.88	0.88	0.87	0.87	0.88	0.87	0.87

% of firms	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
... continued																				
— 3 years		0.76	0.78	0.79	0.81	0.83	0.83	0.83	0.82	0.81	0.82	0.82	0.83	0.83	0.83	0.82	0.82	0.82	0.82	0.82
— 4 years			0.71	0.73	0.75	0.77	0.79	0.79	0.77	0.77	0.77	0.77	0.78	0.79	0.78	0.78	0.77	0.77	0.77	0.78
— 5 years				0.67	0.7	0.71	0.73	0.74	0.73	0.73	0.73	0.73	0.73	0.74	0.74	0.74	0.73	0.73	0.73	0.74
— 6 years					0.64	0.67	0.68	0.69	0.69	0.69	0.69	0.7	0.69	0.7	0.7	0.7	0.7	0.7	0.69	0.71
	G: Wholesale and retail trade; repair of motor vehicles, motorcycles and personal and household goods																			
— 2 years	0.84	0.85	0.86	0.87	0.88	0.89	0.89	0.89	0.88	0.87	0.87	0.88	0.88	0.88	0.88	0.87	0.88	0.88	0.87	0.88
— 3 years		0.78	0.8	0.81	0.83	0.84	0.84	0.84	0.83	0.82	0.82	0.83	0.83	0.84	0.83	0.82	0.83	0.83	0.83	0.84
— 4 years			0.74	0.76	0.77	0.79	0.8	0.8	0.79	0.78	0.78	0.78	0.78	0.79	0.79	0.78	0.78	0.78	0.78	0.8
— 5 years				0.7	0.72	0.73	0.75	0.76	0.75	0.75	0.74	0.74	0.74	0.75	0.75	0.74	0.74	0.75	0.74	0.76
— 6 years					0.67	0.69	0.7	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.72
	H: Hotels and restaurants																			
— 2 years	0.81	0.82	0.84	0.85	0.87	0.87	0.88	0.88	0.87	0.87	0.86	0.87	0.86	0.86	0.86	0.86	0.87	0.88	0.87	0.87
— 3 years		0.74	0.76	0.79	0.8	0.82	0.83	0.83	0.82	0.81	0.81	0.81	0.81	0.81	0.8	0.8	0.82	0.82	0.82	0.83
— 4 years			0.69	0.72	0.74	0.76	0.78	0.78	0.78	0.77	0.77	0.77	0.76	0.76	0.75	0.75	0.76	0.77	0.77	0.78
— 5 years				0.65	0.68	0.7	0.72	0.73	0.73	0.73	0.72	0.72	0.72	0.71	0.71	0.71	0.72	0.72	0.72	0.75
— 6 years					0.62	0.65	0.67	0.68	0.69	0.69	0.69	0.68	0.68	0.67	0.67	0.67	0.68	0.68	0.68	0.71
	I: Transport, storage and communication																			
— 2 years	0.83	0.84	0.83	0.84	0.86	0.86	0.86	0.86	0.84	0.84	0.84	0.85	0.85	0.86	0.84	0.83	0.84	0.86	0.85	0.87
— 3 years		0.77	0.77	0.77	0.78	0.8	0.8	0.8	0.78	0.78	0.78	0.79	0.8	0.8	0.8	0.78	0.78	0.79	0.8	0.82
— 4 years			0.71	0.72	0.73	0.74	0.75	0.75	0.73	0.73	0.73	0.73	0.74	0.75	0.75	0.74	0.73	0.74	0.74	0.77
— 5 years				0.67	0.68	0.68	0.69	0.71	0.69	0.68	0.68	0.68	0.69	0.7	0.7	0.69	0.69	0.69	0.69	0.72
— 6 years					0.64	0.64	0.64	0.65	0.65	0.64	0.64	0.64	0.64	0.65	0.65	0.65	0.65	0.66	0.65	0.68
	J: Financial intermediation																			
— 2 years	0.82	0.84	0.84	0.85	0.86	0.87	0.88	0.88	0.87	0.86	0.87	0.88	0.88	0.88	0.87	0.86	0.86	0.86	0.86	0.87
— 3 years		0.77	0.79	0.79	0.81	0.81	0.83	0.83	0.82	0.82	0.82	0.83	0.83	0.83	0.82	0.81	0.81	0.81	0.81	0.82
— 4 years			0.72	0.74	0.75	0.76	0.77	0.78	0.78	0.78	0.78	0.78	0.78	0.79	0.78	0.78	0.77	0.76	0.76	0.78
— 5 years				0.68	0.7	0.71	0.72	0.73	0.74	0.74	0.74	0.74	0.74	0.74	0.75	0.74	0.74	0.72	0.72	0.74
— 6 years					0.64	0.67	0.68	0.69	0.69	0.7	0.7	0.71	0.7	0.7	0.7	0.71	0.7	0.69	0.69	0.71
	K: Real estate, renting and business activities																			
— 2 years	0.85	0.86	0.87	0.88	0.89	0.89	0.89	0.89	0.87	0.87	0.87	0.88	0.88	0.87	0.87	0.87	0.87	0.88	0.88	0.89
— 3 years		0.8	0.82	0.82	0.83	0.84	0.85	0.84	0.83	0.82	0.82	0.83	0.83	0.83	0.82	0.82	0.82	0.82	0.83	0.85
— 4 years			0.76	0.78	0.79	0.8	0.8	0.81	0.79	0.78	0.78	0.78	0.78	0.79	0.78	0.77	0.77	0.78	0.78	0.81
— 5 years				0.72	0.74	0.75	0.76	0.76	0.76	0.75	0.75	0.74	0.74	0.74	0.74	0.74	0.73	0.74	0.74	0.77
— 6 years					0.69	0.71	0.72	0.73	0.72	0.72	0.71	0.71	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.73
	L: Public administration and defense; compulsory social security																			
— 2 years	0.74	0.69	0.73	0.64	0.62	0.62	0.7	0.73	0.76	0.75	0.75	0.72	0.77	0.86	0.85	0.85	0.86	0.87	0.87	0.85
— 3 years		0.7	0.66	0.67	0.6	0.57	0.63	0.62	0.74	0.71	0.7	0.64	0.71	0.81	0.79	0.8	0.8	0.82	0.82	0.8

% of firms	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
... continued																				
— 4 years			0.7	0.59	0.63	0.55	0.57	0.57	0.62	0.7	0.67	0.61	0.64	0.76	0.75	0.74	0.76	0.77	0.78	0.76
— 5 years				0.65	0.58	0.57	0.55	0.5	0.56	0.64	0.66	0.59	0.59	0.71	0.71	0.7	0.7	0.73	0.73	0.73
— 6 years					0.64	0.56	0.57	0.52	0.54	0.63	0.62	0.57	0.59	0.67	0.66	0.66	0.67	0.67	0.69	0.69
	M: Education																			
— 2 years	0.79	0.84	0.87	0.87	0.88	0.89	0.87	0.85	0.86	0.86	0.85	0.86	0.86	0.88	0.93	0.94	0.94	0.93	0.94	0.94
— 3 years		0.75	0.8	0.82	0.83	0.82	0.82	0.8	0.79	0.79	0.79	0.82	0.8	0.83	0.82	0.91	0.91	0.91	0.91	0.93
— 4 years			0.7	0.75	0.78	0.78	0.77	0.76	0.74	0.74	0.75	0.76	0.76	0.79	0.78	0.78	0.88	0.89	0.9	0.9
— 5 years				0.69	0.72	0.74	0.73	0.72	0.7	0.69	0.69	0.71	0.7	0.75	0.73	0.73	0.73	0.86	0.87	0.88
— 6 years					0.64	0.68	0.69	0.68	0.65	0.65	0.65	0.66	0.66	0.7	0.69	0.69	0.69	0.69	0.85	0.84
	N: Health and social work																			
— 2 years	0.85	0.84	0.86	0.88	0.87	0.89	0.9	0.9	0.89	0.9	0.91	0.91	0.91	0.91	0.92	0.93	0.93	0.92	0.92	0.93
— 3 years		0.8	0.79	0.81	0.83	0.83	0.85	0.86	0.85	0.85	0.86	0.87	0.88	0.88	0.87	0.89	0.9	0.89	0.89	0.89
— 4 years			0.76	0.75	0.77	0.79	0.8	0.81	0.81	0.82	0.82	0.83	0.84	0.84	0.84	0.84	0.86	0.86	0.87	0.87
— 5 years				0.72	0.72	0.73	0.76	0.77	0.76	0.78	0.78	0.79	0.79	0.81	0.81	0.81	0.81	0.83	0.84	0.85
— 6 years					0.68	0.69	0.71	0.73	0.72	0.73	0.75	0.76	0.76	0.77	0.78	0.78	0.79	0.78	0.81	0.82

Note: see Table A4 for sample description. We do not report the community service activities (O), household services (P) and extraterritorial activities (Q) due to small sample sizes.

D Results - robustness

Table A6: Elasticity of TFP with respect to taxation (IV)

	Sector specific intercept				Sector specific intercept and slopes			
	Trusted sample				Trusted sample		Available sample	
	All	No CF	All	No CF	All	No CF	All	No CF
	FE		FD		FE			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Second stage							
Taxation	**-0.043*****	**-0.056*****	**-0.035*****	**-0.032*****	**-0.046*****	**-0.060*****	**-0.027*****	**-0.038*****
	(0.004)	(0.005)	(0.008)	(0.009)	(0.004)	(0.005)	(0.002)	(0.003)
Capital	0.35***	0.37***	0.31***	0.32***				
	(0.002)	(0.003)	(0.006)	(0.006)				
Labor	0.56***	0.54***	0.56***	0.55***				
	(0.001)	(0.001)	(0.001)	(0.001)				
# firms	1,869,103	1,385,130	1,775,146	1,339,044	2,609,887	2,096,703	2,980,035	2,409,048
# obs	9,373,781	6,500,426	6,538,912	4,606,826	10,114,565	7,211,999	11,865,048	8,468,731
Avg. # obs per firm	5.0	4.7	3.7	3.4	3.9	3.4	4.0	3.5
R^2	0.75	0.71	0.40	0.42	0.92	0.91	0.93	0.92
	First stage							
IV on ETR (1Y)	0.014***	.015***	.0056***	.0063***	0.014***	0.015***	0.045***	0.040***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
IV on ETR (2Y)	0.0004***	.0003***	.0002***	0.0001***	0.0004***	0.0003***	0.0008***	.0007***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
R^2	0.12	0.13	0.05	0.06	0.55	0.57	0.55	0.58
	Diagnostics							
Underidentification								
Anderson $\chi^2(2)$	4967.31	3878.19	1112.37	973.27				
$p-value$ of LM	0.000	0.000	0.000	0.000				
Cragg-Donald $\chi^2(2)$	4970.60	3881.14	1112.56	973.48				
$p-value$ of LM	0.000	0.000	0.000	0.000				
Weak identification								
Cragg-Donald Wald F	2485.30	1940.57	556.28	486.74				
$p-value$ of Wald	0.000	0.000	0.000	0.000				
Anderson-Rubin $\chi^2(2)$	148.36	165.87	21.76	14.67				
$p-value$ of Wald	0.000	0.000	0.000	0.000				
Overidentification test								
Sargan statistic $\chi^2(1)$	1.438	1.577	0.011	0.009				
$p-value$	0.23	0.21	0.92	0.92				

Note: panel 2SLS regressions, standard errors in parentheses, constant included but not reported; country, year and sector fixed effects included, but not reported. All second stage variables expressed in logarithms. Specifications denoted by FE report estimations from firm-specific fixed effects panel 2SLS regressions. Specifications denoted by FD denote a first-difference panel estimator. Columns (1)-(6) report estimations for the ‘ trusted sample’, i.e. data available in all the combined editions of Amadeus data, subject to the restrictions described in the data section, with various functional forms for the production function. We also report the estimates for the full available information in Amadeus editions (i.e. without restriction on sector size and coverage), denoted by ‘All firms’. Specifications denoted by ‘No CF’ exclude those data points, where a given firm is eligible for a carry forward deduction in taxation. IV on ETR (1Y) and IV on ETR (2Y) expressed in standard deviations from the mean.

Table A7: Comparison of sample and imputed regressions (IV)

	FE		FD		MI FE		MI FD	
	All firms (1)	No CF (2)	All firms (3)	No CF (4)	All firms (5)	No CF (6)	All firms (7)	No CF (8)
	Second stage							
Taxation	**-0.043*** **	**-0.056*** **	**-0.035*** **	**-0.032*** **	**-0.038*** **	**-0.053*** **	**-0.040*** **	**-0.039*** **
	(0.004)	(0.005)	(0.008)	(0.009)	(0.005)	(0.006)	(0.010)	(0.011)
Capital	0.350***	0.371***	0.310***	0.318***	0.349***	0.369***	0.318***	0.327***
	(0.002)	(0.003)	(0.006)	(0.006)	(0.003)	(0.003)	(0.007)	(0.008)
Labor	0.560***	0.537***	0.556***	0.552***	0.555***	0.532***	0.539***	0.537***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)
R^2	0.745	0.708	0.396	0.424				
	First stage							
IV on ETR (1Y)	0.015***	.0154***	.0056***	.0063***				
	(0.000)	(0.000)	(0.000)	(0.000)				
IV on ETR (2Y)	0.0004***	.0003***	.0002***	.0001***				
	(0.000)	(0.000)	(0.000)	(0.000)				
capital	0.543***	.538***	.687***	.686***				
	(0.000)	(0.001)	(0.001)	(0.001)				
labor	0.117***	.112***	.126***	.144***				
	(0.000)	(0.001)	(0.001)	(0.001)				
R^2	0.118	0.125	0.055	0.060				
# firms	1,869,103	1,385,130	1,775,146	1,339,044	1,890,310	1,401,097	1,820,942	1,375,589
# observations	9,373,781	6,500,426	6,538,912	4,606,826	9,782,132	6,766,124	7,059,745	4,963,022
avg. # obs. per firm	5	4.7	4.7	4.4	5.2	4.8	3.9	3.6
	IV diagnostics							
Underidentification:								
Anderson $\chi(2)^2$	4967.3	3878.2	1112.4	973.3				
$p-value$ of LM	0.000	0.000	0.000	0.000				
Cragg-Donald $\chi(2)^2$	4970.6	3881.1	1112.6	973.5				
$p-value$ of Wald	0.000	0.000	0.000	0.000				
Weak identification:								
Cragg-Donald F	2485.30	1940.6	556.28	486.74				
$p-value$ of Wald	0.000	0.000	0.000	0.000				
Anderson-Rubin $\chi(2)^2$	148.36	165.87	21.76	14.67				
$p-value$ of Wald	0.000	0.000	0.000	0.000				
Overidentification:								
Sargan statistic $\chi(2)^2$	1.438	1.577	0.011	0.009				
$p-value$	0.230	0.209	0.917	0.924				

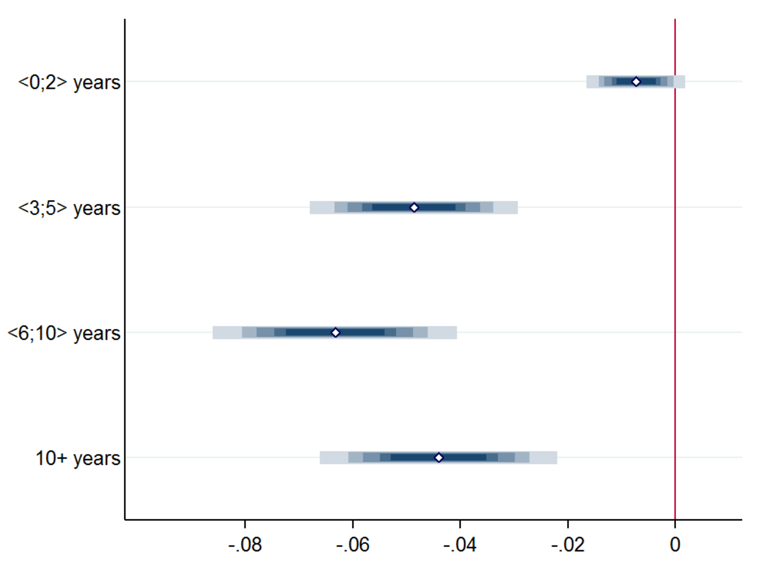
Note: panel 2SLS regressions, standard errors in parentheses, constant included but not reported; country and sector fixed effects included, but not reported. All second stage variables expressed in logarithms. Specifications denoted by FE report estimations from firm-specific fixed effects panel 2SLS regressions. Specifications denoted by FD denote a first-difference panel estimator. Imputation procedure in STATA (MI) does not produce the full output from the first stage regression when applied to 2SLS syntax. Columns (1)-(4) report estimations for the data available in all the combined editions of Amadeus data, subject to the restrictions described in the data section (the 'trusted sample'). Columns (5)-(8) report estimations for the whole sample including imputed missing observations. Specifications denoted 'All firms' report estimates for firms eligible to CF and include all the available data points. Specifications denoted by 'No CF' exclude those data points, where a given firm is eligible for a carry forward deduction in CI taxation. IV on ETR (1Y) and IV on ETR (2Y) expressed in standard deviations from the mean.

Table A8: Elasticity of production with respect to taxation (FE OLS)

	Full	Q1 T	Q2 T	Q3 T	Q4 T	P25 T	P50 T	P75 T
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
taxation	0.133***	0.107***	0.115***	0.135***	0.167***	0.119***	0.125***	0.147***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
		0.11 - 0.11	0.12 - 0.12	0.14 - 0.14	0.17 - 0.17	0.12 - 0.12	0.12 - 0.13	0.15 - 0.15
capital	0.255***	0.231***	0.254***	0.273***	0.274***	0.245***	0.263***	0.276***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)
labor	0.539***	0.602***	0.570***	0.524***	0.474***	0.577***	0.549***	0.504***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)
R-squared	0.851	0.879	0.872	0.852	0.812	0.873	0.865	0.841
# of obs.	10,163,735	2,611,118	2,029,964	2,630,036	2,892,617	1,086,596	2,012,137	2,196,414
# of firms	2,625,365	814,839	529,788	634,856	645,882	313,784	509,907	501,467
		Q1 VA	Q2 VA	Q3 VA	Q4 VA	P25 VA	P50 VA	P75 VA
		(2a)	(3a)	(4a)	(5a)	(6a)	(7a)	(8a)
taxation		0.205***	0.146***	0.123***	0.108***	0.167***	0.132***	0.117***
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
		0.20 - 0.21	0.15 - 0.15	0.12 - 0.12	0.11 - 0.11	0.17 - 0.17	0.13 - 0.13	0.12 - 0.12
capital		0.286***	0.249***	0.232***	0.231***	0.261***	0.240***	0.228***
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
labor		0.483***	0.544***	0.572***	0.564***	0.518***	0.562***	0.573***
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
R-squared		0.861	0.865	0.862	0.828	0.863	0.865	0.853
# of obs.		1,927,477	2,491,774	2,867,614	2,876,870	1,820,682	2,167,947	2,382,326
# of firms		660,251	652,751	656,461	655,902	526,093	524,682	523,986

Note: panel regressions with firm fixed effects reported, standard errors in parentheses, for taxation variable we also report 95% CI. All variables expressed in logarithms, constant included, not reported. Country and sector fixed effects included (not reported). Column (1) reports estimates for the full sample. Specifications denoted by Q (from 2 to 5 and from 2a to 5a) stratify sample of firms on the quartile of the taxation variable (columns denoted by T) and value added variable (columns denoted by VA). Specifications denoted by P (from 6 to 8 and from 6a to 8a) report estimates for subsample of a reported percentile $+/-$ 10% of the sample around the given percentile.

Figure A1: Age effects



Note: Estimates analogous to Table A9, obtained separately for each age group. Age measured when firm first enters Amadeus sample. The dark blue area refers to 95% confidence interval, gradually lighter shades refer to lower probability of type 2 error.

Table A9: Age specific effects of taxes on TFP

Firm age	The estimate of γ from equation (5) for each age group
<0;2>years	-0.007**
	(0.004)
<3;5>years	-0.049***
	(0.008)
<6;10>years	-0.063***
	(0.009)
10+ years	-0.044***
	(0.009)

Note: full set of results reported in other tables in this paper available upon request. Every parameter reported correspond to CI taxation estimate from column (1) in A7, with sample restricted to a particular firm age bracket. ***, ** denote significance at 0.1% and 0.5% respectively.

Table A10: Country specific effects of taxes on TFP

Country	The estimate of γ from equation (5) for each country
Austria	-0.030
	(0.027)
Belgium	0.027
	(0.123)
Bulgaria	-0.543***
	(0.066)
Czech	0.060***
	(0.007)
Denmark	-0.043
	(0.059)
Finland	0.127***
	(0.024)
France	-0.032***
	(0.001)
Germany	-0.156***
	(0.024)
Hungary	0.032**
	(0.014)
Ireland	-0.037
	(0.112)
Italy	0.106***
	(0.007)
Latvia	-1.298
	(1.469)
Luxembourg	-0.016
	(0.040)
Netherlands	0.275
	(0.241)
Poland	0.969**
	(0.454)
Portugal	-0.533***
	(0.029)
Romania	5.797***
	(1.268)
Slovakia	0.459***
	(0.041)
Slovenia	0.029***
	(0.010)
Spain	0.060***
	(0.002)
Sweden	0.437***
	(0.011)
UK	-0.259***
	(0.046)

Note: full set of results reported in other tables in this paper available upon request. Every parameter reported correspond to CI taxation estimate from column (1) in A7, with sample restricted to a particular country. ***, ** denote significance at 0.1% and 0.5% respectively.

Table A11: Sector specific effects of taxes on TFP

Sector	The estimate of γ from equation (5) for each sector
A: Agriculture	-0.058***
	(0.021)
C: Mining	-0.003
	(0.091)
DA: Manufacture of food products	-0.05***
	(0.009)
DB: Manufacture of textiles	-0.081**
	(0.034)
DC: Manufacture of leather	0.137***
	(0.019)
DD: Manufacture of wood	-0.038***
	(0.012)
DE: Manufacture of paper products	-0.052***
	(0.010)
DF: Manufacture of refined petroleum products	0.383***
	(0.074)
DG: Manufacture of chemicals	0.042
	(0.034)
DH: Manufacture of plastic products	-0.175***
	(0.024)
DI: Manufacture of other non-metallic products	0.016
	(0.011)
DJ: Manufacture of basic metals	0.034***
	(0.004)
DK: Manufacture of machinery and equipment n.e.c.	-0.011
	(0.047)
DL: Manufacture of electrical and optical equipment	-0.030
	(0.049)
DM: Manufacture of transport equipment	0.064***
	(0.015)
DN: Manufacturing n.e.c.	-0.343***
	(0.081)
E: Electricity gas and water supply	0.100***
	(0.020)
F: Construction	-0.009***
	(0.003)
G: Wholesale and retail trade	-0.058***
	(0.003)
H: Hotels and restaurants	-0.010
	(0.012)
I: Transport storage and communication	-0.002
	(0.017)

Note: full set of results reported in other tables in this paper available upon request. Every parameter reported corresponds to CI taxation estimate from column (1) in A7, with sample restricted to a particular sector. ***, ** denote significance at 0.1% and 0.5% respectively.