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How Do Value Added Taxes Affect Wages and Labor?*

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Abstract

We analyze how value added taxes (VATs) affect labor market outcomes (firms' employee costs, wages, hours worked, employment). While VATs are designed to tax consumption, they are levied at the firm level, which creates potential spillovers to labor markets. We hypothesize that VATs affect wages and employment through two channels: an inflation adjustment effect, where employees demand higher wages to compensate for VAT-induced price increases; and a profitability effect, where incomplete pass-through reduces firms' net sales and profits, putting downward pressure on wages and employment. We exploit variation in VAT rates, measuring labor market outcomes at the firm and country level. We find economically significant negative effects of VAT rates at the firm level on employee costs and at the country level on wages and employment. At the firm level, a one percentage point increase in the standard VAT rate corresponds to a 3.886% reduction in employee costs. At the country level, the same increase is associated with a 2.802% decline in average nominal wages. We find a 1.444% decline in employment at the country level following a one percentage point increase in the VAT rate. For working hours, the evidence is inconclusive and at most suggests a reduction. Heterogeneity analyses suggest that small firms and firms with high profit margins react stronger; among the employees, the age group 15-24 years is hit hardest. Our study provides the first systematic cross-country evidence on the labor market consequences of VATs.

JEL classification codes: D22; D24; H22; H25; M51

Keywords: VAT, Labor Supply, Labor Demand, Wages, VAT Incidence, Inflation, Wage Bargaining

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1. Introduction

Do Value Added Taxes (VATs) increase or decrease wages? How do they affect employment and firms' employee costs? The importance of these questions is driven by the economic relevance of VATs. Worldwide, VATs are a major or even the largest source of government revenue. In 2021, consumption taxes, including VATs, accounted for 21.4% of total tax revenues in OECD member countries, marking a significant increase from 13.4% in the mid-1970s (OECD, 2023). In 2023, VAT revenues in European Union countries exceeded corporate tax revenues by more than a factor of 2.2.[1] VATs are levied at the firm level, albeit being designed as a tax on consumption. The assumption that VATs are fully passed on to consumers is widespread among the public and policymakers: "VAT is ... borne by the final consumer, not by businesses"[2]. In line with theoretical research, previous studies have shown that consumers are burdened by VATs through higher prices (Benedek et al., 2020; Benzarti & Carloni, 2019; Benzarti et al., 2020; Besley & Rosen, 1999; Brusco & Velayudhan, 2025; Carbonnier, 2007).

However, empirical research has documented varying degrees of tax shifting, suggesting that firms may absorb part of the tax burden. There is mounting empirical evidence that VATs can negatively affect firms: VATs reduce corporate investment (Jacob et al., 2019), sales (Benzarti et al., 2020; Fuest et al., 2023; Kosonen, 2015; Thompson & Rohlin, 2012), profits (Loewe, 2024), and debt levels (Hundsdoerfer, 2022), highlighting the extent to which firms bear part of the VAT burden.[3] VATs have structural similarities with R-base cash flow taxes on excess profits, and the extent to which firms bear the burden of VATs has implications for corporate profitability. When firms cannot fully pass

[1] Eurostat Governance finance statistics, urlec.europa.eu/eurostat/databrowser/view/gov˙10a˙taxag.

[2] European Commission, `https://taxation-customs.ec.europa.eu/taxation/vat_en`; see also OECD (2017), p. 11: Businesses "should not, in principle, bear the burden of the tax"; Congressional Budget Office (2012).

[3] In addition, consumption taxes can affect firms' investment and financing decisions through its effect on the shareholders' consumption needs, (Jacob et al., 2025).

VAT increases on to consumers, they must adjust along internal margins. A natural but largely unexplored adjustment channel is labor. Despite extensive research on the impact of VATs on firms and consumers, little is known about its effects on employees. This study addresses this gap by examining whether and to what extent VATs affect firms' employee costs, wages, and employment, thereby expanding the existing literature on the economic incidence of VATs.

This paper examines the impact of VATs on wages and labor through two opposing mechanisms that operate on different margins. The first mechanism is an inflation adjustment effect that operates through wage-setting. As consumer prices tend to rise following a VAT increase, employees and trade unions may demand higher nominal wages to compensate for the VAT-induced increase in the cost of living. If such cost-of-living adjustments occur, nominal wages are expected to increase following a VAT hike, without necessarily affecting employment levels. The second mechanism is a profitability effect that operates through firms' labor demand and wage bargaining. Although VATs are theoretically pass-through taxes for firms, they nonetheless have significant economic implications for firm outcomes. Higher prices may reduce overall consumption (Thompson & Rohlin, 2012), resulting in lower sales volumes. At the same time, incomplete pass-through implies that firms absorb part of the VAT increase, which directly reduces net sales and profits (Loewe, 2024). In response, firms may adjust labor costs along two margins. First, if VATs reduce investment (Jacob et al., 2019) and capital and labor are complementary inputs, labor demand and thus employment may decline. Second, lower excess profits reduce the wage bargaining surplus, which can put downward pressure on wages.

Determining which of these opposing effects dominates is ultimately an empirical question. Note the economic consequences of these effects: If the inflation adjustment effect holds, firms may be hit twice by VATs – they lose net sales and face higher wages at the same time. On the other hand, if the profitability effect holds, employees may be hit

twice by VATs, as they would face higher prices and lower nominal wages and/or reduced employment.

Surprisingly, the employment effects of VATs remain largely underexplored in empirical research. As noted by de Mooij et al. (2025), *"very little is known about where the incidence of the tax falls when pass-through to consumer prices is incomplete"* (p. 24).[4] To our knowledge, no multinational study has examined the impact of the standard VAT rate on wages and employment at both the country and firm level.

To analyze the impact of VATs on wages and labor, we exploit variation in standard VAT rates across a panel of 27 European countries between 2006 and 2019. We focus on the standard rate, as it applies to the majority of products and services within a country. Our empirical approach is twofold. First, we analyze firm-level employee costs using unconsolidated Orbis accounts to capture firms' overall labor cost responses. Second, to disentangle wage and employment channels, we conduct country-level analyses using OECD and Eurostat data on wages, employment, and hours worked. We further examine implications for labor productivity and firms' factor allocation between labor and capital.

We find that VATs have an economically significant negative effect on labor in the EU. At the firm level, we find that VATs reduce employee costs. VATs reduce wages and employment. The effects are economically large: At the firm level, a one percentage point increase in the standard VAT rate corresponds to a 3.886% reduction in employee costs. At the country level, the same increase is associated with a 2.802% decline in average nominal wages. Employment at the country level appears to decline by about 1.444% following a one percentage point increase in the VAT rate. For working hours, the evidence is inconclusive and at most suggests a reduction. Furthermore, VAT reduce labor productivity and the labor intensity of production.

[4]In comparison, there is a notable literature on the incidence of corporate income taxation on labor (Giroud & Rauh, 2019; Ljungqvist & Smolyansky, 2018; Fuest et al., 2018; Knaisch & Pöschel, 2023), with mixed evidence. As the tax base of corporate income taxes and VATs differs, mainly because VATs do not tax the market return on capital, we do not think that the results of this literature can be directly applied to VATs.

VAT rates are not randomly determined, raising concerns about potential endogeneity. We address these concerns through a series of robustness tests applied consistently in both country- and firm-level analyzes. First, we refine our control groups by introducing country-group-by-year fixed effects that absorb common time-varying shocks within economically comparable groups of countries. Second, to directly address policy endogeneity, we restrict the analysis to VAT reforms that are plausibly exogenous to economic conditions, identified using the narrative approach of Vegh & Vuletin (2015) and Gunter et al. (2021). Robustness is further supported by replicating results with alternative labor market indicators, such as labor productivity, and by systematically exploring heterogeneity across countries and firms.

This study contributes to the literature on firm behavior in reaction to taxes by analyzing how VATs affect firms' employee costs and by separately identifying wage and employment responses to VAT changes. Although VATs are often perceived as consumption taxes with limited firm-level relevance, our findings suggest that they have meaningful implications for firms' labor-related decisions. Jacob et al. (2019) provide evidence that investment declines following an increase in the standard VAT rate, raising concerns about broader real effects. Given the close relationship between investment and labor inputs, our study extends this line of research by directly assessing the impact of VATs on wages and employment.

More broadly, we contribute to the literature on wage-setting and employment decisions by highlighting VATs as an important but largely overlooked determinant of labor market outcomes. The wage and labor responses to VAT changes deserve closer attention in policy debates, particularly regarding the design of consumption taxes and their potentially unintended labor market consequences.

Finally, our paper speaks directly to recent calls to broaden the scope of tax accounting research. In a comprehensive review, Lester & Olbert (2025) document that accounting research on firms' real responses to taxation has focused predominantly on

income-based taxes, while non-income taxes, such as consumption taxes, have received little attention, despite their importance for firms' operating costs and performance. Consistent with this assessment, Dyreng et al. (2025) argue that the literature has defined its scope too narrowly by focusing primarily on corporate income taxes. They call for expanding the field to study the broader set of taxes that firms remit and interact with and note that public economics provides a useful benchmark for the wider range of tax issues that can be examined. We respond to this call by studying VATs, an economically important but understudied non–income tax, and by developing hypotheses centered on firms' reactions to VAT changes. By analyzing how VATs affect wage-setting and employment decisions and measuring the resulting effects at both the firm and country levels, our study broadens the range of taxes and firm behaviors typically examined in tax accounting research.

2. Literature Review and Theory

2.1. VATs and Consumer Prices

In general, VATs are levied on all commercial activities on every step of the supply chain. Firms remit the VAT they collect and claim a tax credit for the VAT paid on their supplies (input VATs), so that only the value added is taxed. As consumers cannot claim input VATs on goods and services they purchase, only the consumption stage is effectively taxed. In this regard, VATs resemble general sales taxes.

VATs are structurally similar to R-base cash flow taxes (Auerbach, 2010). Both are destination based. Input VATs on investments are immediately credited. Firms have to pay VATs on sales without deducting depreciations. Financial transactions (credits, interest payments, equity payments) are not subject to VATs. Contrary to R-base cash flow taxes, VATs do not allow the deduction of labor cost but do not tax wages at the individual level. The border adjustment (zero-rating exports, taxing imports) is shared

by both taxes. Ghosh et al. (2026) show that a VAT reduces production distortions, compared to a tax on intermediate inputs.

The effect of VATs on consumer prices has been analyzed in several studies, often focusing on reduced VAT rates. For example, Kosonen (2015); Benzarti et al. (2020) analyze a VAT reduction for hairdressers in Finland. The incidence of VAT cuts for restaurants is well understood. Benzarti & Carloni (2019) find that French restaurant owners pocketed more than half of the VAT cut. Independent Swedish and Finnish restaurants pocketed nearly the full amount of a VAT reduction, while most chain restaurants passed the VAT reduction through to customers, at least in the short run (Harju et al., 2018). Based on special VAT rate cuts in France, Carbonnier (2007) estimates that between 57% (luxury cars) and 77% (housing repair services) were passed on to consumers. Benedek et al. (2020) provide one of the few analyses of changes in the standard VAT rate, finding a pass-through of about 80%.

2.2. Wages

Tax incidence refers to the extent to which the tax is economically borne by investors, employees, suppliers or consumers in the form of lower revenues, lower wages or higher prices, regardless of who is legally liable to pay the tax. It is the welfare loss that remains with taxpayers or other market participants after all pass-through operations (Harberger, 1962). In the canonical partial equilibrium model, the incidence of VATs depends on the elasticities of supply and demand. If either demand is perfectly inelastic (elastic) or supply is perfectly elastic (inelastic), consumers (producers) bear the entire tax burden.

VATs could induce a price-driven upward pressure on wages (inflation adjustment effect): As presented above, VATs increase consumer prices. To compensate for the higher cost of living, employees and trade unions may demand higher nominal wages. Duarte & Marques (2009) argue that shocks to consumer prices increase nominal wages, whereas in the long run real wages do not change. If this holds, we would expect (nominal) wages to

rise in response to a VAT increase.

On the other hand, VATs negatively affect the economic situation of firms (producers), which may result in downward pressure on wages. Few empirical studies have focused on the effects of VATs on the producer side. While French restaurant owners pocketed the majority of a VAT reduction, consumers, suppliers, and employees shared the remaining windfall profit, with limited employment effects (Benzarti & Carloni, 2019). Loewe (2024) presents evidence that VATs increase consumer prices and reduce firm sales and profits, consistent with an economically significant reduction in both consumer and producer surplus. As far as firms cannot fully pass through the burden of VATs and instead lose producer rents, this burden must fall on firm owners, suppliers, or employees. One determinant of the VAT incidence is the mobility of production factors. As employees are usually assumed to be less mobile than capital, we would expect labor to bear a significant part of the burden.

In addition, VAT incidence depends on the wage setting mechanism:

Labor market power: Many firms have market power on the labor market. In a monopsonistic labor market, firms pay low wages and capture most of the rents. A VAT induced shock to rents will affect wages only slightly or not at all, because wages cannot be reduced further. In such a case, firm owners bear the majority of the burden, and we would not expect wages to react strongly to VAT rate changes.

Rent sharing via collective bargaining: As firm owners, suppliers and employees compete over the rents generated by a firm, a reduction in rents to be split between firms and employees may affect wage bargaining. Collective bargaining at the firm or sector level may play a crucial role here, because the jurisdiction of VAT rate changes (the state) is usually as large as or larger than the jurisdiction of collective bargaining (e.g., a sector within a state). This mechanism predicts a negative wage effect.

Efficiency wage and fair wage theory: Another approach to explaining wage setting

mechanisms is efficiency wage theory, which predicts that firms may optimally pay above market-clearing wages to induce effort. One potential channel is shirking, where wage premiums act as a threat of unemployment to deter shirking (Shapiro & Stiglitz, 1984). The lower the firms' profitability per working hour, the lower the potential losses from shirking and the optimal wage premiums. Another potential channel is gift exchange (fair wage theory), where above-market wages establish perceived fairness and secure effort (Akerlof & Yellen, 1990). Negative shocks to firm profits may lower workers' perceived fair wage, so that firms may be able to cut wages (or suspend wage increases) without large effort losses. For both channels, the optimal wage premium depends on the gross profits (rents) earned by the firm. If VATs reduce these rents, these models predict lower wages.

Taken together, low mobility of labor, wage bargaining, and efficiency wage theory suggest that VATs may reduce nominal wages, in addition to their inflationary effect. We posit that VATs reduce producer rents (Loewe, 2024) and thereby reduce wages.

H1: VATs reduce nominal wages.

2.3. Employment

If firms bear part of the VAT burden, this can also affect employment. Three single-country studies in the area of VATs and employment use firm-level data: Benzarti & Carloni (2019) find limited effects of selective VAT cuts on wages and employment. Studying a VAT reform in China, Yang & Zhang (2020) show that VAT incentives implemented between 2004 and 2008 to stimulate firm investment increased capital investment while reducing employment. Treated firms experienced higher average wages but, due to growing capital intensity, a decline in the labor income share. Gao et al. (2021) examine the employment and wage effects of VAT rebates for exporters in China and find that adjusting VAT rebates has a positive impact on firm employment, but no statistically significant impact on firm wages. Simone & Olbert (2025) find that a reform shifting VAT liability on

digital B2C sales from the seller's country to the destination country reduced VAT avoidance but also led multinationals to cut employment in low-VAT countries. We are not aware of a multinational analysis of the impact of the standard VAT rate on employment and wages at the firm- and country-level.

Two mechanisms can help to understand the potential effects (Suárez Serrato & Zidar, 2016):

Rent sharing (see 2.2): VATs may reduce rents available to share. If firms shift a part of their VAT burden to employees via reduced rent shares, theory does not predict a lower employment, as the reduction of rents should not alter labor market participation of the affected employees. However, in a competitive labor market, reduced rents in one firm or sector may also affect equilibrium wages in other firms or industries. A reduction in wages via reduced rents could increase employment in other industries. As VATs can also be interpreted as a tax on labor that makes labor relatively more expensive, we do not expect this effect to dominate.

Labor-capital complementarity/substitutability (see Section 5): VATs can reduce the profitability of investments (Jacob et al., 2019). If firms need less labor to operate less fixed assets, then VATs will reduce both investment and employment (complementarity, see Jacob & Vossebürger (2022)). However, if firms replace machinery with labor, employment may rise after a VAT increase that reduces the attractiveness of investments (substitutability). Chirinko (2008); Oberfield & Raval (2021) estimate the elasticity of substitution between capital and labor in the range of 0.4-0.7, indicating complementarity between the factors. Skill heterogeneity matters: capital is more complementary with skilled than with unskilled labor, as it more easily substitutes for unskilled tasks (Krusell et al., 2000).

A literature in macroeconomics predicts positive employment effects for VATs. Beginning with Prescott (2004), there is a discussion in macroeconomics on the differential incidence of a VAT, compared to a payroll tax. Substituting social contributions with

VATs can be seen as mimicking a nominal currency devaluation ("fiscal devaluation"). In calibrated general equilibrium models, a revenue-neutral shift from payroll taxes to VATs increased employment (Farhi et al., 2013; de Mooij & Keen, 2012; Pestel & Sommer, 2017; Capéau et al., 2024). However, we do not think that this line of argument fits for our analysis, as we do not analyze differential incidence.

We see strong arguments for labor-capital complementarity. As there is evidence that VATs reduce investment (Jacob et al., 2019), we hypothesize that VATs reduce employment.

H2: VATs reduce employment.

3. Identification and Data

3.1. Identification

We exploit country-level variation in standard VAT rates to identify the effect of VATs on labor. Some variables are available only at the firm level (e.g., employment costs or factor mix), whereas others are collected on the country level (e.g., average wages). Therefore, we combine analyses at the firm and the country level.

Our basic estimation is a fixed effects regression model:

$$Y_{i,j,t} = \alpha_0 + \beta_1 \,\mathrm{VAT}_{j,t} + \gamma C_{j,t} + \rho X_{i,j,t} + \delta_i + \delta_t + \varepsilon_{i,j,t} \tag{1}$$

where i, j, and t index the unit, country, and year, respectively. At the firm level, unit i is the firm; at the country level unit i corresponds to the observational unit in the dataset (e.g. country-industry cell). The dependent variable $Y_{i,j,t}$ is a labor market outcome: employee costs (firm level), or wages, working hours, and employment (country level). The key independent variable is the standard VAT rate ($VAT_{j,t}$) in country j and year t. As country-level controls $C_{j,t}$, we include the country population (log), the GDP

growth rate, the corporate tax rate, the personal income tax rate, and the tax wedge (including payroll taxes and social security contributions). At the firm level, we include firm size, leverage and margin as control variables ($C_{j,t}$). However, because VATs may also affect these variables (e.g. Hundsdoerfer (2022) for leverage, Loewe (2024) for margins), we exclude them from the main specification to avoid overcontrol. We include unit fixed effects δ_i and year fixed effects δ_t. Because the treatment varies at the country level, we cluster standard errors at the country level.

In light of recent work on forbidden comparisons in two-way fixed effects (TWFE) regressions (Borusyak et al., 2024; de Chaisemartin & D'Haultfœuille, 2020; Baker et al., 2022), we estimate stacked regressions following Cengiz et al. (2019). We reorganize the sample so that the control group for each cohort consists only of observations from countries that did not experience a VAT change shortly (three years) before or after the treated country's reform. A treatment is defined as a change in a country's standard VAT rate. Each country experiencing a reform in year t enters the treatment group of cohort $k = t$ (e.g., cohort_2012). For each cohort, we retain observations from the window $[t-3; t+3]$, e.g. 2009-2015 for a 2012 reform. The control group for cohort k consists of all countries that did not change their VAT rate within $[t-3; t+3]$.

We then create pseudo identifiers for firms (firm-level analysis) or countries (country-level analysis) and use these pseudo identifier to define unit × cohort fixed effects, following Cengiz et al. (2019). Year fixed effects (or countrygroup × year fixed effects) are replaced by year × cohort (or countrygroup × year × cohort) fixed effects. This leads to the specification:

$$Y_{i,j,t,k} = \alpha_0 + \beta_1 \, \mathrm{VAT}_{j,t} + \gamma C_{j,t} + \rho X_{i,j,t} + \delta_i \times cohort_k + \delta_t \times cohort_k + \varepsilon_{i,j,t} \qquad (2)$$

In stacked regressions, untreated observations may serve as controls for multiple

cohorts, meaning they appear more than once in the dataset. Their associated errors are mechanically correlated across cohorts. To address this, we cluster standard errors at the country (and not at the country × cohort) level.

A key empirical challenge in studying VAT reforms is the potential endogeneity of policy changes, as VAT adjustments are typically driven by political, institutional, and economic factors rather than occurring randomly. Policymakers often increase VAT during downturns and reduce it in better economic times, reflecting deliberate responses to complex country conditions (Vegh & Vuletin, 2015). This non-randomness can confound the estimated relationship between VAT and firm-level employee costs and other labor market outcomes. To mitigate concerns of endogeneity, we employ two strategies: We build regional groups of countries, and we divide VAT rate changes into plausibly exogenous and plausibly endogenous changes.

First, we address the concern that countries may be differently hit by economic shocks (Ljungqvist & Smolyansky, 2018). We argue that economic shocks are more likely to have similar effects in regional country groups that share long-term economic development. We employ four distinct country groups: *Northern Europe* (Denmark, Estonia, Finland, Ireland, Lithuania, Latvia, and Sweden); *Central Europe* (Austria, Belgium, France, Germany, Luxembourg, and the Netherlands); *Southern Europe* (Cyprus, Spain, Greece, Italy, Malta, and Portugal); and *Eastern Europe* (Bulgaria, the Czech Republic, Hungary, Croatia, Poland, Romania, Slovenia, and Slovakia). In our regression model described in Equation (2), we replace year × cohort fixed effects with country-group × year × cohort fixed effects.

Our second strategy relies on VAT changes classified as exogenous. Following the narrative identification framework pioneered by Romer & Romer (2010), which distinguishes exogenous tax reforms from endogenous ones through comprehensive historical records such as congressional documents and presidential statements, Gunter et al. (2021) applied this methodology specifically to VAT reforms. Their classification leverages con-

temporaneous sources, including IMF reports, OECD Economic Surveys, and media coverage, to categorize VAT changes into five endogenous types (GDP procyclical, GDP countercyclical, offsets to other tax changes, offsets within VAT, and offsets to spending) and three exogenous types (long-run growth motives, inherited deficit-driven, and inherited debt-driven motives). Within the study period, we successfully classify 29 out of 41 VAT changes accordingly, identifying 13 as plausibly exogenous.[5] Technically, we replicate the regression in Equation (2) while interacting the independent variable, VAT, with two dummy variables: *Exog* and *Endo*.[6] The dummy *Exog* equals one if the VAT reform is classified as exogenous, while *Endo* equals one if the reform is classified as endogenous. This approach strengthens the credibility of our causal inference regarding VAT reforms and their labor market impacts.

3.2. Data

We compile firm-level financial statements and macro-level variables for the 27 EU member states over the period from 2006 to 2019. The year 2006 marks the beginning of our sample, because reliable firm-level data in the Orbis database is available only from that year onward, while 2019 constitutes the end year in order to avoid potential distortions arising from the onset of the COVID-19 pandemic. This strategy allows us to capture heterogeneities within firms operating in the same institutional environment as well as across populations at the country level.

We choose a European panel to ensure some geographical, economic and cultural proximity. We assume that economic development is more similar within Europe than at the global level, and that different economic shocks tend to affect certain regions differently (Ljungqvist & Smolyansky, 2018).

[5] A detailed overview of classified VAT reforms is provided in the Appendix, Table A3.

[6] In a first difference model without leads and lags, it would suffice to interact the VAT rate change with the indicators only in the year of change. As we employ a fixed effects (levels) model, we have to interact the VAT rate in the reform year (t) and in the six years around the reform with the indicators.

We obtain financial information from firms in 27 EU countries for the period 2006 to 2019 from Bvd Orbis via WRDS. Specifically, we use unconsolidated financial statements of listed and unlisted firms from BvD Orbis. The advantages of this dataset for our identification are that we can quite accurately localize the activity of an individual firm and that it includes private firms.

We exclude firms reporting total assets below €50,000 or zero sales from the sample. Additionally, firms lacking information on sales, number of employees, or employee costs are omitted. Observations with negative values for sales or employee costs, which are economically implausible, are removed. Firms operating in the financial, real estate, energy and water supply, and education sectors are also excluded. Missing values for debt are imputed as total assets minus shareholder funds. Firms with fewer than four firm-year observations are removed to ensure sufficient panel length for robust analysis. All continuous variables are winsorized at the 1% level by year to mitigate the influence of extreme outliers. Following this data cleaning process, four European countries (Greece, Ireland, Latvia, and Lithuania) are no longer represented in our Orbis dataset.[7] In total, the Orbis sample constitutes an unbalanced panel comprising 1,184,735 firms and 6,282,491 firm-year observations. Because we employ a stacked sample design, some firm-year observations appear multiple times while others (earlier treated observations) are excluded. As a result, these figures do not correspond to the number of observations used in the firm-level regression analyses.

Table 1 presents descriptive statistics of the Orbis firm dataset. The average European firm in our sample reports costs of employees of 1,362,528 Euro and average earnings before interest and taxes (EBIT) of 357,912 Euro. On average, firms generate turnover of 8,775,363 Euro.

We use the OECD database to obtain data on average wages in U.S. dollars for the

[7]For the income statement, the cost of sales format is mandatory in Greece, Latvia, and Lithuania, so that employee costs are not disclosed separately. The cost of sales format is not mandated by Irish company law, but most Irish companies report using the cost of sales format.

Table 1: Descriptive Statistics, Orbis Dataset

	(1) N	(2) Mean	(3) Median	(4) SD	(5) Min	(6) Max
Employee Costs	6,282,491	1,362,528	107,906	28,272,896	0	11,916,000,256
Factor Mix	5,604,970	10.84	10.62	1.76	1.80	24.81
EBIT	6,281,806	357,912	22,121	17,601,991	-18,631,000,064	10,471,000,064
Turnover	6,282,491	8,775,363	521,504	211,829,721	0	107,900,002,304
Size	6,282,491	13.38	13.05	1.74	10.82	25.90
Leverage	6,282,304	0.63	0.68	0.29	0.00	1.00
Profit Margin	6,248,117	0.02	0.04	0.32	-3.90	0.75

Note: The table shows descriptive statistics on firm variables for the period from 2006 to 2019 for 27 European countries. The definitions of the variables can be found in Table A1 in the appendix.

period 2006–2019. These data are available only for OECD member countries, covering 22 European economies. Table 2 presents the descriptive statistics for this sample.

From Eurostat, we compile labor market data for all 27 member states of the EU for the period 2006 to 2019, specifically covering working hours and employment. For robustness analyzes, we further employ additional indicators from Eurostat, namely employment per capita, hours worked per employee, hours worked per capita, labor productivity per hour worked, and labor productivity per employee. The descriptive statistics of these datasets are displayed in Tables 2, 3 and 4. In our country-level panel, the average European employee works 37.46 hours per week and earns an annual wage of USD 43,915 over the sample period. Greece has the highest average weekly working hours (41.19 hours), while Luxembourg reports the highest average annual wages (USD 71,663). Employment is highest in the public sector and social services in Germany, with an average of 524.77 thousand workers, and lowest in culture and other services in Malta, with 1.17 thousand workers.

The European Commission's annual report *'VAT Rates applied in the Member States of the European Union'* provides information on VAT rates for all European countries. From this source, we collect the standard VAT rates for the 27 European countries over our sample period.[8] Luxembourg had the lowest standard VAT rate at 15%, while Hungary had the highest at 27%. Austria, Belgium, Bulgaria, Denmark, Malta, and Sweden did not experience any changes in their standard VAT rates throughout the sample period. The largest VAT rate change occurred in Hungary, where the standard rate increased from 20% to 27%. As our dataset contains annual information, we use the first of July as the cut-off date for VAT changes during the year, and after this date we accrue changes to the next year.

To account for country-specific macroeconomic conditions, we further collect an-

[8]We check the VAT rates against the data in the Research School of International Taxation's (RSIT) International Tax Institutions (ITI) database (Wamser et al., 2024). See Appendix, Table A2 for a comprehensive overview of the VAT rates across the 27 European countries.

Table 2: Descriptive Statistics of Wages and Working Hours

	Average Wages		Hours Worked	
	Mean	SD	Mean	SD
Austria	62,821.86	1,112.90	36.49	4.90
Belgium	64,230.71	1,127.89	37.57	5.69
Bulgaria	-	-	40.45	1.48
Croatia	-	-	39.43	2.93
Cyprus	-	-	38.66	4.08
Czechia	30,006.86	2,747.71	40.12	2.80
Denmark	61,930.57	2,283.76	32.72	7.45
Estonia	26,463.21	3,185.25	38.01	3.19
Finland	49,587.64	824.33	35.10	5.19
France	50,332.71	1,986.49	36.46	5.35
Germany	55,540.36	3,015.32	34.63	5.83
Greece	31,796.86	3,578.53	41.08	4.54
Hungary	24,397.00	1,237.42	39.30	1.35
Ireland	50,325.79	2,483.37	35.25	5.47
Italy	46,464.21	656.91	36.35	4.90
Latvia	25,346.71	3,681.09	38.65	2.16
Lithuania	32,914.07	4,362.76	38.01	2.07
Luxembourg	71,663.36	2,100.78	37.41	5.40
Malta	-	-	39.02	4.05
Netherlands	65,607.50	1,432.85	30.17	7.76
Poland	29,324.64	3,336.28	39.37	2.99
Portugal	30,240.21	803.25	38.53	4.44
Romania	-	-	40.30	1.56
Slovak Republic	22,940.50	2,024.83	40.00	2.64
Slovenia	42,639.00	2,096.82	37.41	5.50
Spain	44,551.07	1,269.49	36.59	5.15
Sweden	47,012.21	2,582.34	35.44	5.02
TOTAL	43,915.32	15,179.92	37.44	5.21

Note: The table provides descriptive statistics by country for the period 2006–2019, including average wages (US Dollars, PPP converted) from OECD and weekly hours worked from Eurostat.

Table 3: Descriptive Statistics of Employment

	Employment per Industries						
	Construction & Real Estate	Culture & Other Services	Knowledge-Intensive & Business Services	Primary Sector and Utilities	Public Sector & Social Services	Trade, Transport & Tourism	Total
Austria	40.75	13.97	29.2	48.04	50.11	58.83	41.15
Belgium	43.02	13.17	38.53	44.47	73.07	56.07	45.53
Bulgaria	41.29	10.08	19.54	46.	42.49	51.12	37.06
Croatia	17.66	5.21	10.05	21.87	18.58	24.94	17.24
Cyprus	5.93	2.53	3.74	3.29	4.92	6.68	4.49
Czechia	45.8	11.4	27.99	58.89	51.04	61.35	44.
Denmark	22.16	10.11	21.66	24.49	47.32	33.99	27.6
Estonia	8.13	3.16	4.77	10.02	8.57	9.19	7.65
Finland	22.38	10.28	22.13	28.22	39.66	28.9	26.04
France	206.85	75.23	203.04	179.81	406.63	319.89	227.99
Germany	281.82	105.64	303.48	357.05	524.77	481.31	350.01
Greece	41.08	12.32	26.65	44.62	50.02	69.76	41.69
Hungary	40.65	14.99	27.41	57.6	55.85	55.86	44.49
Ireland	22.36	7.94	18.46	21.02	29.51	30.09	22.03
Italy	168.5	75.15	160.21	220.26	232.95	308.73	194.79
Latvia	11.82	4.66	6.47	12.54	12.34	15.28	11.02
Lithuania	17.84	5.71	10.21	22.71	20.2	23.48	17.77
Luxembourg	3.02	2.24	3.86	1.97	4.18	2.7	3.18
Malta	2.91	1.17	1.57	2.7	2.87	3.16	2.4
Netherlands	49.89	24.79	71.31	49.11	125.46	104.28	73.57
Poland	151.67	32.99	78.6	217.93	174.8	196.61	148.76
Portugal	58.23	25.53	31.67	67.92	65.87	67.15	53.81
Romania	116.51	21.79	40.56	188.96	82.25	105.11	103.69
Slovakia	30.47	6.59	14.56	38.41	31.37	32.72	27.01
Slovenia	7.75	2.89	6.26	15.55	11.57	11.87	10.01
Spain	154.77	73.08	133.85	130.16	207.86	298.12	163.23
Sweden	34.47	19.15	43.01	31.68	82.12	52.21	45.19
Total	69.3	28.07	55.17	85.28	98.24	95.76	74.29

Note: The table provides descriptive statistics of employment (in thousands of persons) from Eurostat by country and industry for the period 2006–2019.

Table 4: Descriptive Statistics of Additional Labor Market Indicators

	(1) N	(2) Mean	(3) Median	(4) SD	(5) Min	(6) Max
Total Employment per Capita	378	1.012	1.007	0.0522	0.867	1.198
Hours Worked per Employed person	378	1.010	1.004	0.0222	0.949	1.100
Hours Worked per Capita	378	1.023	1.012	0.0564	0.878	1.227
Nominal Unit Labor Cost based on Hours Worked	378	0.986	0.995	0.104	0.569	1.383
Nominal Unit Labor Cost based on Persons	378	0.986	0.995	0.105	0.570	1.379
Real Labor Productivity per Hour Worked	378	0.969	0.980	0.0799	0.669	1.198
Real Labor Productivity per Person	378	0.978	0.989	0.0751	0.687	1.224

Note: The table provides descriptive statistics of additional labor market indicators from Eurostat for the period 2006–2019. The data are index values with 2015 = 1.

nual GDP growth rates, unemployment rates, statutory corporate tax rates and personal income tax rates from the OECD database. We collect the tax wedge from ECFIN[9]. For countries not covered by the OECD, we complement the data with information from Eurostat, PwC publications and the World Bank database. We add country population numbers from Eurostat.

Table 5 presents descriptive statistics for the country variables of our sample. Across European countries, GDP grows at an average rate of 1.88% per year, the average inflation rate is 1.93% and the average unemployment rate is 8.78% over the sample period.

4. Empirical Analysis

4.1. Firm Level Analysis: Employee Costs

We start with the investigation of employee-related costs within firms. Our analysis primarily focuses on the cost-side effects of VAT increases on European firms. Notably, employee costs may reflect changes in wages, hours worked, hiring and firing decisions, as well as severance payments, so that they are a measure of the overall effects of VAT rate changes. We expect a clear pattern from BvD Orbis data, as the accounts from Orbis are unconsolidated, so that they do not contain consolidated foreign subsidiaries, and cover private firms. The firms in this sample are mostly domestic and are expected to be affected by a domestic VAT rate change.

Figure 1 plots the logarithm of employee costs against standard VAT rates, both demeaned by firm, thereby effectively controlling for firm fixed effects. We additionally control for year fixed effects[10]. The figure displays binned scatterplot averages, where observations are grouped into bins of the demeaned VAT rate and points represent within-

[9]For different reasons, the ECFin database has some gaps in the tax wedge for Bulgaria, Croatia and Cyprus. We backfill these datapoints with the next available country value (e.g. Cyprus 2014 for Cyprus 2013). We plan to use the EUROMOD simulation model to fill these gaps. As a robustness check, we also re-estimate all regressions without these controls and obtain similar results.

[10]Technically, both variables are residualized with respect to year indicators prior to plotting.

Table 5: Descriptive Statistics of Country Controls

	(1) N	(2) Mean	(3) Median	(4) SD	(5) Min	(6) Max
Value Added Tax	378	0.210	0.210	0.030	0.150	0.270
Population	378	16,357,467	8,429,991	21,546,311	404,999	83,019,213
GDP growth rate	378	0.02	0.02	0.04	-0.15	0.26
Inflation	378	0.02	0.02	0.02	-0.04	0.15
Unemployment rate	378	0.09	0.08	0.04	0.02	0.28
Corporate tax rate	378	0.23	0.22	0.07	0.09	0.38
Personal income tax rate	350	0.39	0.44	0.15	0.10	0.74

Note: The table provides descriptive statistics of country controls from the OECD database, Eurostat, PwC publications, and the World Bank database for the period 2006–2019.

bin means of log employee costs. A linear fit with a 95% confidence interval is added. The visual evidence presented in Figure 1 suggests a strong negative association between VAT rates and employee costs.

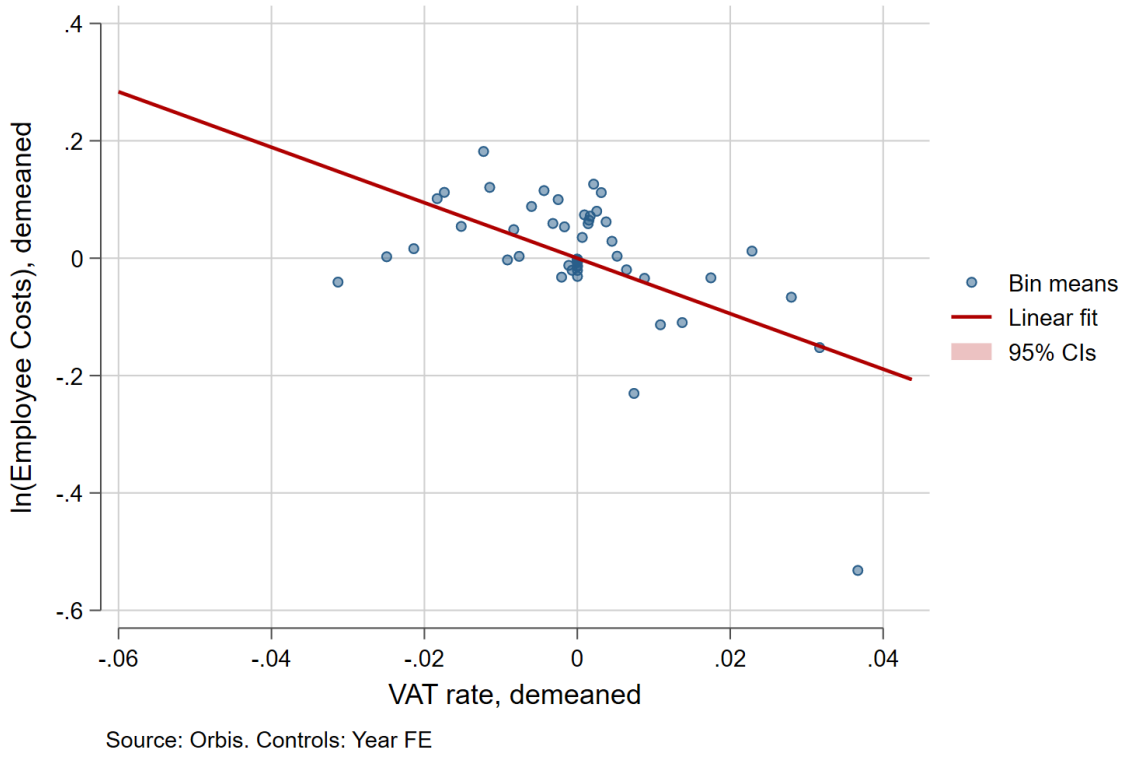


Figure 1: Association between ln(Employee Costs) and VAT (both demeaned by firm). The figure plots binned scatterplot averages, with observations grouped into equal-sized bins of VAT and points representing within-bin means.

To empirically assess the effect of VATs on firms' employee costs, we estimate this variant of the model described in Equation (2):

$$ln(Employee\ Costs)_{i,j,t} = \alpha_0 + \beta_1 \text{VAT}_{j,t} + \gamma C_{j,t} + \rho X_{i,j,t} + \delta_i \times cohort_k + \delta_t \times cohort_k + \varepsilon_{i,j,t} \quad (3)$$

where i, j, t, and k are a firm, country, time, and cohort index, respectively. The dependent variable is employee costs (item *staf* in BvD Orbis). The independent variable is the standard VAT rate ($VAT_{j,t}$) in country j and year t. At the country level, we control for the size of the population, GDP growth rate, the corporate and personal income tax

rate, and the tax wedge including payroll taxes and social security contributions[11] ($C_{j,t}$). As the VAT rate may affect many economic variables on country and firm level, we are careful to avoid overcontrol bias. For example, we obviously must not control for unemployment, neither at the firm nor at the country level. Therefore, we include firm level variables (firm size, leverage and margin, $X_{i,j,t}$) that are potentially affected by VATs only in specification (3). δ_i and δ_t are firm and year fixed effects. $cohort_k$ is the cohort (stack). We cluster standard errors at the country level. The results of these regressions are reported in Table 6.

As many firm-level variables may be affected by VAT rates, we omit firm-level control variables in column (1) to avoid potential overcontrol. In column (2), we add firm controls. Both specifications show a negative and statistically significant coefficient, indicating that an increase in the VAT rate strongly reduces employment-related costs. From an economic perspective, the results reported in column (2) imply that a one percentage point increase in VAT is associated with a reduction in employee costs by 3.886%.

To mitigate endogeneity concerns, we conduct two tests explained in Section 3.1:

First, we replace year × cohort fixed effects with country-group × year × cohort fixed effects to control for regional shocks. Table 6, column (3), shows an effect of -3.668. The stability of the coefficients under this specification suggests that our findings are not mainly driven by unobserved regional shocks.

Second, we employ the classification of VAT rate changes by Gunter et al. (2021) into exogenous and endogenous changes. We interact the VAT rate with the two indicator variables *Exog* (plausibly exogenous change) and *Endo* (plausibly endogenous change). In this specification, we lose the observations with VAT rate changes that were not classified by Gunter et al. (2021). Table 6, column (4), presents the results. We observe that the coefficient obtained using exogenous VAT reforms in specification (4) is absolutely smaller

[11]For different reasons, the ECFin database has some gaps in the tax wedge for Bulgaria, Croatia and Cyprus. We backfill these datapoints with the next available country value (e.g. Cyprus 2014 for Cyprus 2013). We plan to use the EUROMOD simulation model to fill these gaps.

Table 6: VAT and Employee Costs: Firm-Level Regression Results

	(1) ln(Empl Costs)	(2) ln(Empl Costs)	(3) ln(Empl Costs)	(4) ln(Empl Costs)
Endo×VAT				-2.996***
				(0.704)
Exog×VAT				**-2.626*** **
				(0.613)
VAT	**-3.886*** **	**-3.743*** **	**-3.668*** **	
	(0.333)	(0.433)	(0.361)	
Observations	7,686,349	7,686,349	7,686,349	2,763,003
Estimator	OLS	OLS	OLS	
Country Controls	YES	YES	YES	YES
Firm Controls	NO	YES	NO	NO
Firm FE	YES	YES	YES	YES
Year×Cohort FE	YES	YES	NO	YES
Ctrygrp×Yr×Cohort FE	NO	NO	YES	NO
Data	BVD ORBIS	BVD ORBIS	BVD ORBIS	BVD ORBIS
SE Clustering	COUNTRY	COUNTRY	COUNTRY	COUNTRY
Within R2	0.00506	0.116	0.00241	0.00409

Note: The table reports the main results of the stacked regression estimating the effect of VAT changes on the natural logarithm of firm-level employee costs. Column (1) includes country-level controls as well as firm fixed effects and year×cohort fixed effects. Column (2) augments the specification by adding firm-level controls, namely leverage and firm size. Column (3) replaces the year×cohort fixed effects with country-group×year×cohort fixed effects. Column (4) introduces an interaction specification in which VAT is interacted with the dummy variables *Endo* and *Exog*. The variable *Endo* equals one if a VAT reform is classified as endogenous, while *Exog* equals one if a reform is classified as exogenous, following the classification of Gunter et al. (2021). A detailed overview of this classification is provided in Table A3.

(-2.626%) than the coefficients in specifications (1)-(3), hinting at a potential endogeneity bias. However, the coefficient still shows a strong negative reaction of firm-level employee costs to VAT rates.

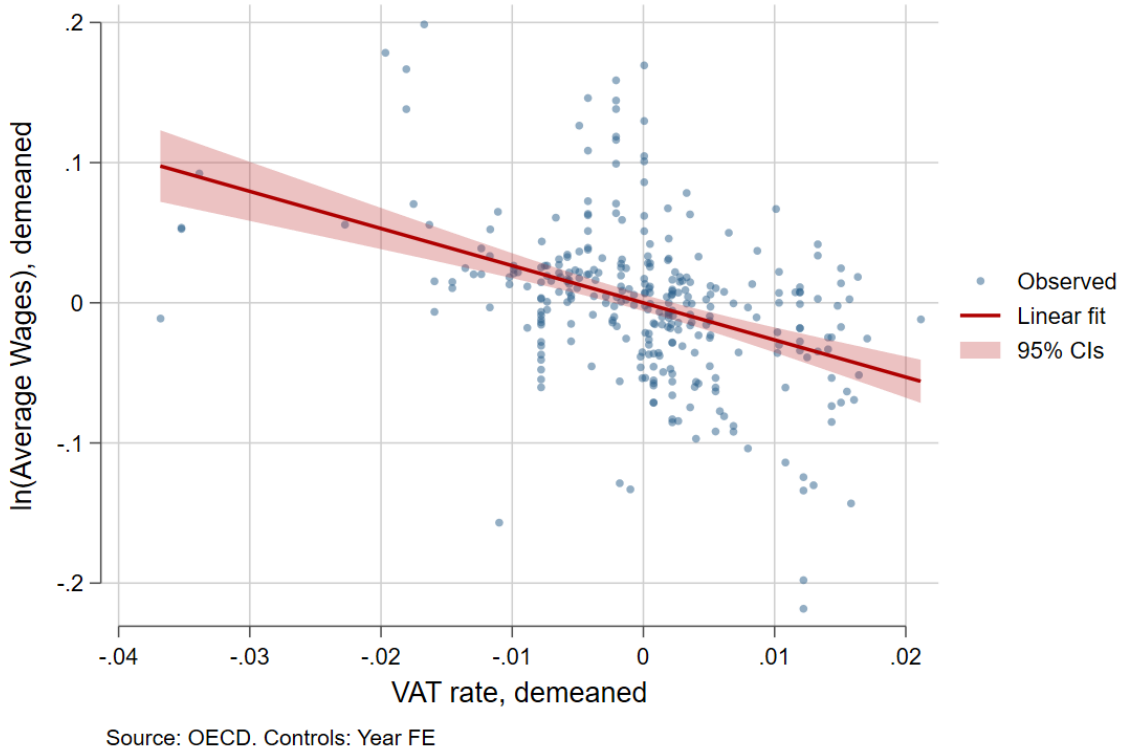
As the data in Orbis are in Euro, the change in employee costs could be driven by firm-level changes (wages, hours, employment) or VAT-induced currency adjustments. In an unreported analysis, we test whether currency adjustments are a key driver of the result. When we translate employee costs into local currency, the effects are slightly stronger. We conclude that the effects are mostly driven by firm-level developments.

An increase in VAT rates may well change the firms' incentives to conceal sales and evade taxes. However, as employee costs do not reduce the VAT base, VAT rates do not affect firms' incentives to pay employees officially or out of the records (in cash). Therefore, we do not think that tax evasion is a key driver of our results.

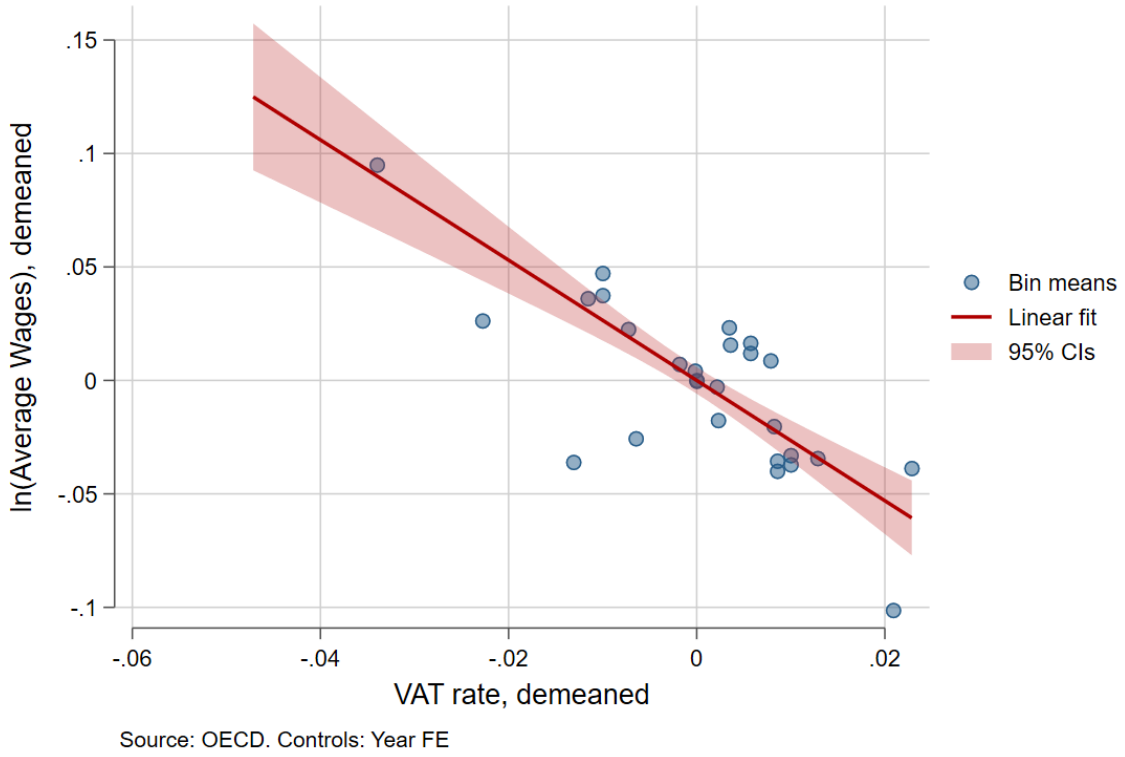
4.2. Country-Level Analysis

4.2.1. Wages

Having established a negative effect of VAT rates on firm-level employee costs, we next assess our first hypothesis regarding the impact of VATs on nominal wage levels. We demean the logarithm of country-year average wages (OECD database) and the standard VAT rates, each by country, thereby controlling for country fixed effects. We add year fixed effects and plot demeaned log country-year wages against demeaned standard VAT rates. In the second panel, observations are binned along the demeaned VAT rates to facilitate visual inspection.



(a) All data points



(b) Binned data

Figure 2: Association between country-year ln(Average Wages) and VAT, both demeaned by country.

The visual evidence presented in Figure 2 suggests a strong negative association between VAT rates and average nominal wages. Building on this preliminary graphical analysis, we proceed to formally test this association by estimating a country-level fixed effects regression model for the stacked sample based on Equation (2), specified as follows:

$$Y_{j,t} = \alpha_0 + \beta_1 \, \text{VAT}_{j,t} + \gamma X_{j,t} + \delta_j \times cohort_k + \delta_t \times cohort_k + \varepsilon_{j,t} \tag{4}$$

where j, t, and k are a country, time and cohort index, respectively. $Y_{j,t}$ represents the natural logarithm of average wages (ln(*average wages*), OECD). The independent variable is the VAT rate ($VAT_{j,t}$) in country j and year t. We control for population (log), GDP growth rate, corporate personal income tax rate and the tax wedge. δ_i and δ_t are time and country fixed effects. $cohort_k$ is the cohort (stack). We cluster standard errors at country level.

The results of this regression are presented in Table 7, column (1). We find a statistically significant negative effect of VAT increases on the average nominal wages of European countries. Economically, a one percentage point increase in the VAT rate leads to a 2.802% decrease in average nominal wages, in line with our first hypothesis.

In Table 7, columns (2) and (3), we use our established strategies to mitigate endogeneity concerns: First, we use country-group × year × cohort fixed effects to address the concern that year-specific economic shocks hit countries differently so that simple year-fixed effects are not sufficient to absorb region-year specific shocks. In the regression model from Equation (2), we replace the year × cohort fixed effects with an interaction of our four country groups and year × cohort fixed effects.[12] Table 7, column (2) shows a coefficient of -2.453. The results suggest that unobserved regional shocks are not the key

[12]Table 7 reports fewer observations (595) in the specification (2), which includes countrygroup × year × cohort fixed effects, than in specification (1) with year × cohort fixed effects (644). The difference arises because the estimation is conducted in Stata using *reghdfe*, which by default drops singletons, and the number of singletons depends on the fixed effects structure. When estimating the same specifications using *xtreg*, the number of observations is 644 in both cases and the coefficient estimates are identical.

Table 7: VAT and Average Wages: Country-Level Regression Results

	(1) ln(Average Wages) local curr.	(2) ln(Average Wages) local curr.	(3) ln(Average Wages) local curr.
Endo×VAT			-2.770***
			(0.607)
Exog×VAT			**-2.679*** **
			(0.598)
VAT	**-2.802*** **	**-2.453*** **	
	(0.695)	(0.844)	
Observations	644	595	240
Country Controls	YES	YES	YES
Country×Cohort FE	YES	YES	YES
Year×Cohort FE	YES	NO	YES
Countrygrp×Yr×Cohort FE	NO	YES	NO
Data	OECD	OECD	OECD
SE Clustering	COUNTRY	COUNTRY	COUNTRY
Within R2	0.311	0.342	0.289

Note: The table reports the main results of the stacked regression estimating the effect of VAT changes on the natural logarithm of average wages at the country-level. Column (1) includes country-level controls as well as country×cohort fixed effects and year×cohort fixed effects. Column (2) replaces the year×cohort fixed effects with country-group×year×cohort fixed effects. Column (3) introduces an interaction specification in which VAT is interacted with the dummy variables *Endo* and *Exog*. The variable *Endo* equals one if a VAT reform is classified as endogenous, while *Exog* equals one if a reform is classified as exogenous, following the classification of Gunter et al. (2021). A detailed overview of this classification is provided in Table A3.

driver for our findings. Accordingly, the evidence suggests that the second mechanism, the profitability effect, is operative: An increase in VAT has been shown to reduce both firms' sales (Benzarti et al., 2020; Fuest et al., 2023; Kosonen, 2015; Thompson & Rohlin, 2012) and profits (Loewe, 2024). As a consequence, average wages decline in response to a VAT hike, consistent with low labor mobility, wage bargaining over economic rents, and insights from efficiency wage theory.

Second, we use the Gunter et al. (2021) classification of VAT rate changes into exogenous (indicator *Exog*) and endogenous (*Endo*) changes. In the regression model in Equation (2), we interact the VAT rate with *Exog* and *Endo*. We lose the observations with unclassified VAT rate changes. The results of this specification are reported in Table 7, column (3). We observe that the coefficients obtained using endogenous VAT reforms closely mirror those from the exogenous reforms and show no meaningful deviation from the estimates based on the full sample reported in Table 7, column (1). This evidence mitigates concerns that endogeneity drives our findings.

The OECD wage data that we used in the analysis are in nominal US-$. Therefore, the negative effects of VATs on wages can be induced by nominal wage reductions (or reduced wage increases) or by VAT-induced currency adjustments. To investigate which of the two effect channels is more important, we repeat the analysis with wage data in local currencies. Table 8 presents the results:

In specifications (1) and (2), we find slightly stronger effects when we analyze the data in local currencies, whereas the effects in specification (3) are slightly weaker. We conclude that a potential currency devaluation does not explain our results.

To broaden the picture, we analyze data from the Eurostat Labor database which provides country level data on nominal unit labor cost per employed person and per hours worked. We presume that these cost are strongly driven by nominal wages. We divide the data, which are index values with 2015 = 100, by 100 to allow comparable interpretations. We replicate the regression from Equation (2) using nominal unit labor

Table 8: VAT and Average Wages in Local Currency: Country-Level Regression Results

	(1) ln(Average Wages)	(2) ln(Average Wages)	(3) ln(Average Wages)
Endo×VAT			-2.101***
			(0.580)
Exog×VAT			**-2.028*** **
			(0.576)
VAT	**-3.064****	**-2.642***	
	(1.309)	(1.365)	
Observations	721	672	240
Country Controls	YES	YES	YES
Country×Cohort FE	YES	YES	YES
Year×Cohort FE	YES	NO	YES
Countrygrp×Yr×Cohort FE	NO	YES	NO
Data	OECD	OECD	OECD
SE Clustering	COUNTRY	COUNTRY	COUNTRY
Within R2	0.272	0.244	0.352

Note: The table reports the main results of the stacked regression estimating the effect of VAT changes on the natural logarithm of average wages in local currency at the country level. Column (1) includes country-level controls as well as country×cohort fixed effects and year×cohort fixed effects. Column (2) replaces the year×cohort fixed effects with country-group×year×cohort fixed effects. Column (3) introduces an interaction specification in which VAT is interacted with the dummy variables *Endo* and *Exog*. The variable *Endo* equals one if a VAT reform is classified as endogenous, while *Exog* equals one if a reform is classified as exogenous, following the classification of Gunter et al. (2021). A detailed overview of this classification is provided in Table A3.

cost per employed person and per hours worked as the dependent variables. We stack the sample and estimate the same models as in Table 7: (1) cohort × year fixed effects, (2) cohort × country group × year fixed effects, and (3) exogenous VAT rate changes. We summarize the results in Table 9.

All estimated coefficients are negative. The economic interpretation of model (1) is that a one percentage point VAT rate increase is associated with a 2.254% reduction in nominal unit labor cost. We interpret the results as additional support for H1: VATs reduce wages.

In our fixed effects models, we estimate the average of the short term and long term wage adjustment. Therefore, we analyze the time structure of the effect in the OECD data by estimating a first difference regression of the change in logs of average wages on the change in VAT rates, including three leads and three lags in the stacked sample. We control for changes in population (log), GDP growth, corporate and personal income tax rates and the tax wedge. We include year × cohort fixed effects. The coefficients are plotted in Figure 3:

Table 9: VAT and Nominal Unit Labor Cost based on Hours Worked and on Persons: Country-Level Regression Results

	(1) Nominal Unit Labor Cost based on Hours Worked	(2) Nominal Unit Labor Cost based on Hours Worked	(3) Nominal Unit Labor Cost based on Hours Worked	(4) Nominal Unit Labor Cost based on Persons	(5) Nominal Unit Labor Cost based on Persons	(6) Nominal Unit Labor Cost based on Persons
Endo×VAT			-1.356**			-1.432***
			(0.464)			(0.458)
Exog×VAT			**-1.324****			**-1.356****
			(0.467)			(0.463)
VAT	**-2.254*****	**-2.136*****		**-2.240*****	**-2.155*****	
	(0.519)	(0.518)		(0.524)	(0.511)	
Observations	798	784	251	798	784	251
Country Controls	YES	YES	YES	YES	YES	YES
Country×Cohort FE	YES	YES	YES	YES	YES	YES
Year×Cohort FE	YES	NO	YES	YES	NO	YES
Countrygrp×Yr×Cohort FE	NO	YES	NO	NO	YES	NO
Data	EUROSTAT	EUROSTAT	EUROSTAT	EUROSTAT	EUROSTAT	EUROSTAT
SE Clustering	COUNTRY	COUNTRY	COUNTRY	COUNTRY	COUNTRY	COUNTRY
Within R2	0.271	0.197	0.396	0.267	0.198	0.401

Note: The table reports the main results of the stacked regression estimating the effect of VAT changes on the nominal unit labor cost based on hours worked (columns 1-3) and based on persons (columns 4-6) at the country level. Columns (1) and (4) includes country-level controls as well as country×cohort fixed effects and year×cohort fixed effects. Columns (2) and (5) replaces the year×cohort fixed effects with country-group×year×cohort fixed effects. Columns (3) and (6) introduces an interaction specification in which VAT is interacted with the dummy variables *Endo* and *Exog*. The variable *Endo* equals one if a VAT reform is classified as endogenous, while *Exog* equals one if a reform is classified as exogenous, following the classification of Gunter et al. (2021). A detailed overview of this classification is provided in Table A3.

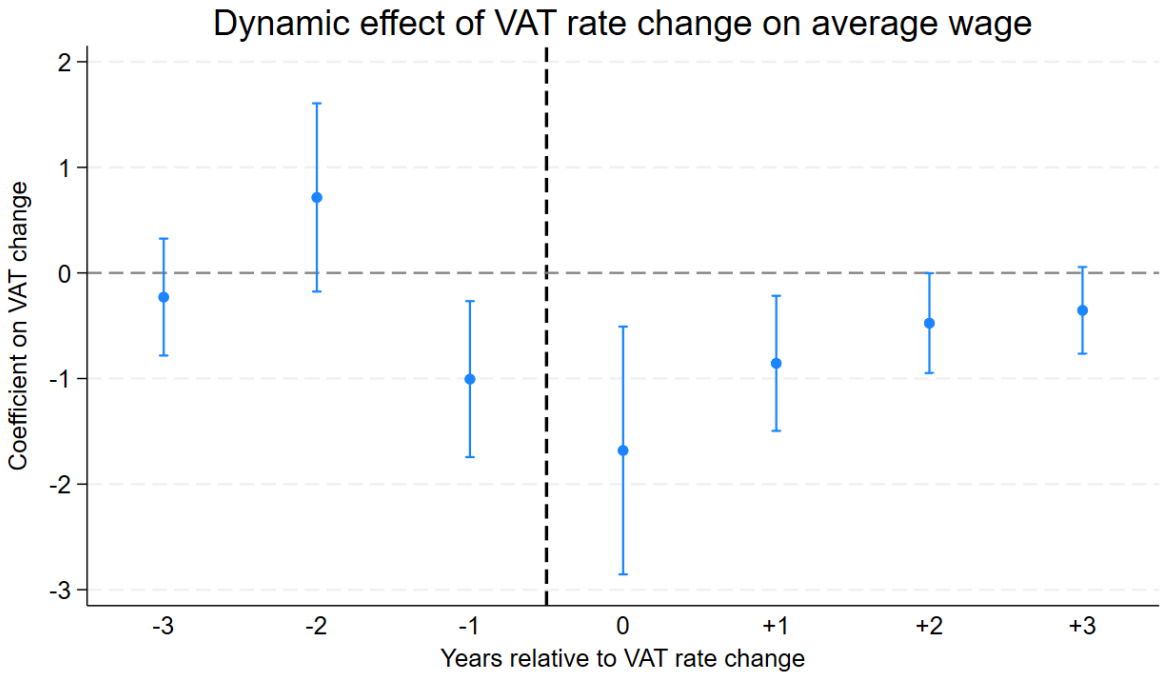


Figure 3: Dynamic effects of VAT changes on nominal wages. The figure plots coefficient estimates from a first-difference regression of changes in log country-year average wages on changes in standard VAT rates, including three leads and three lags. The specification controls for changes in log population, GDP growth, corporate and personal income tax rates, and the tax wedge, and includes year × cohort fixed effects. Points denote coefficient estimates and vertical bars indicate 95% confidence intervals.

We observe negative and statistically significant coefficients beginning in t-1 and ending in t+2. This observation is consistent with an announcement effect in the year before a VAT rate change becomes effective. At the same time, it seems to take some time (about 2-3 years) until the full effect is in place.

4.2.2. Working Hours

Having established that both employee costs at the firm level and average wages at the country level decline, we next investigate whether labor demand is also affected. We analyze employment outcomes at the country level to test our second hypothesis that higher VAT rates reduce employment. We analyze two key indicators: working hours and employment. We begin by plotting the average weekly working hours (logarithm) against

the standard VAT rate, both demeaned by country. Once again, we control for year fixed effects and bin the observations.

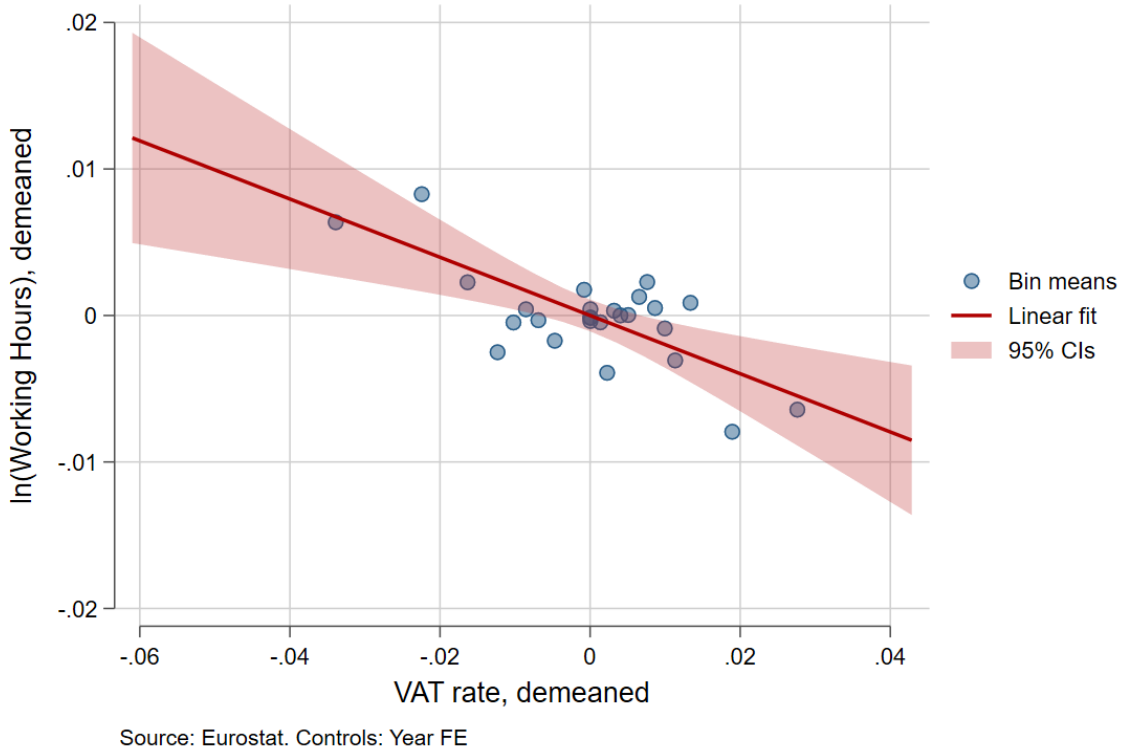


Figure 4: Association between weekly working hours (ln) and VAT (both demeaned by country), binned.

The visual evidence provided in Figure 4 suggests a negative association between VAT rates and working hours. Building on this graphical analysis, we employ the regression from Equation (2), using the natural logarithms of weekly working hours as dependent variables. The results are reported in Table 10.

The coefficient on the VAT rate in column (1) is negative, suggesting that an increase in the VAT rate reduces the average number of weekly hours worked. However, the estimate is only marginally statistically significant.

We re-estimate Equation (2) with (a) country-group × year × cohort fixed effects to account for regional shocks and (2) interactions between the VAT variable and the dummy

Table 10: VAT and Working Hours: Country-Level Regression Results

	(1) ln(Working Hours)	(2) ln(Working Hours)	(3) ln(Working Hours)
Endo×VAT			-0.339*
			(0.181)
Exog×VAT			**-0.375***
			(0.187)
VAT	**-0.228***	**-0.107**	
	(0.121)	(0.0875)	
Observations	20,981	20,981	6,531
Country Controls	YES	YES	YES
Country×Cohort FE	YES	YES	YES
Year×Cohort FE	YES	NO	YES
Ctrygrp×Yr×Cohort FE	NO	YES	NO
Data	EUROSTAT	EUROSTAT	EUROSTAT
SE Clustering	COUNTRY	COUNTRY	COUNTRY
Within R2	0.00189	0.00118	0.0131

Note: The table reports the main results of the stacked regression estimating the effect of VAT changes on the natural logarithm of working hours at the country-level. Column (1) includes country-level controls as well as country×cohort fixed effects and year×cohort fixed effects. Column (2) replaces the year×cohort fixed effects with country-group×year×cohort fixed effects. Column (3) introduces an interaction specification in which VAT is interacted with the dummy variables *Endo* and *Exog*. The variable *Endo* equals one if a VAT reform is classified as endogenous, while *Exog* equals one if a reform is classified as exogenous, following the classification of Gunter et al. (2021). A detailed overview of this classification is provided in Table A3.

variables *Exog* and *Endo*, which distinguish exogenous and endogenous VAT reforms.[13] The results are presented in Table 10, columns (2) and (3). The estimates on working hours are not or only marginally significant. We interpret these results as weak but inconclusive evidence that VATs reduce working hours.

As a second data source, we analyze data from Eurostat Labor. This database provides country level data on hours worked per employed person and per capita. To ease interpretation, we recalculate the index value data to 2015 = 1. We replicate the regression from Equation (2) using hours worked per employed person and per capita as the dependent variables. We stack the sample and estimate the same models as in Table 10: (1) cohort × year fixed effects, (2) cohort × country group × year fixed effects, and (3) exogenous VAT rate changes. We summarize the results in Table 11.

Five out of six columns show negative estimates. However, only the coefficients in specifications (4) and (6) are significant at conventional levels, whereas the coefficients in specifications (3) and (5) are only marginally significant. Altogether, we have no clear evidence on how VATs affect working hours.

4.2.3. Employment

We now focus on employment at country level. The data show employment per country-industry-year. Again, we start by plotting ln(employment) against the standard VAT rate, both demeaned by country, for each country-year. We add year-fixed effects and bin observations along the demeaned VAT rates. The visual evidence provided in Figure 5 suggests a negative association between VAT rates and employment levels.

[13] See section 3.1 for further explanations.

Table 11: VAT and Hours Worked per Employed Person and per Capita: Country-Level Regression Results

	(1)	(2)	(3)	(4)	(5)	(6)
	Hours Worked per Employed Person			Hours Worked per Capita		
Endo×VAT			-0.110			-1.608**
			(0.0731)			(0.594)
Exog×VAT			**-0.169***			**-1.701****
			(0.0843)			(0.597)
VAT	**-0.0490**	**0.0340**		**-1.443****	**-1.109***	
	(0.140)	(0.200)		(0.583)	(0.594)	
Observations	798	784	251	798	784	251
Country Controls	YES	YES	YES	YES	YES	YES
Country×Cohort FE	YES	YES	YES	YES	YES	YES
Year×Cohort FE	YES	NO	YES	YES	NO	YES
Countrygrp×Yr×Cohort FE	NO	YES	NO	NO	YES	NO
Data	EUROSTAT	EUROSTAT	EUROSTAT	EUROSTAT	EUROSTAT	EUROSTAT
SE Clustering	COUNTRY	COUNTRY	COUNTRY	COUNTRY	COUNTRY	COUNTRY
Within R2	0.00549	0.00290	0.178	0.164	0.135	0.377

Note: The table reports the main results of the stacked regression estimating the effect of VAT changes on hours worked per employed person (columns 1–3) and per capita (columns 4–6) at the country level. Columns (1) and (4) include country-level controls as well as country × cohort fixed effects and year × cohort fixed effects. Columns (2) and (5) replace the year × cohort fixed effects with country-group × year × cohort fixed effects. Columns (3) and (6) introduce an interaction specification in which VAT is interacted with the dummy variables *Endo* and *Exog*. The variable *Endo* equals one if a VAT reform is classified as endogenous, while *Exog* equals one if a reform is classified as exogenous, following Gunter et al. (2021). A detailed overview of this classification is provided in Table A3.

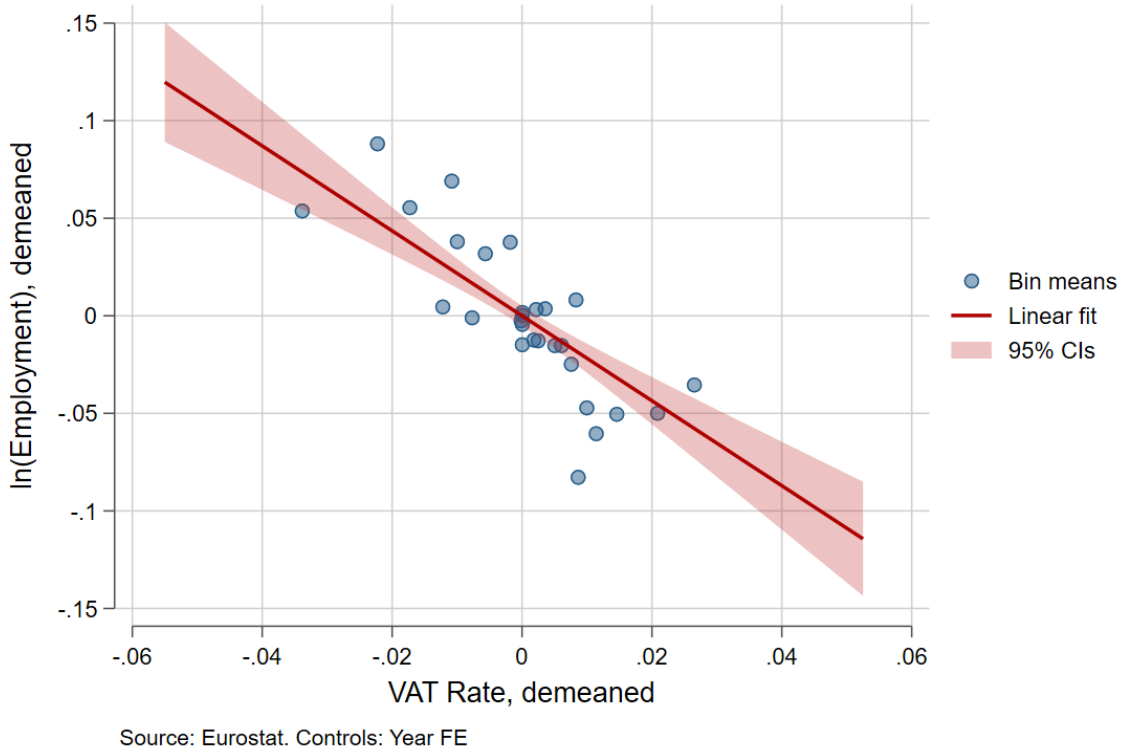


Figure 5: Association between employment (ln) and VAT (both demeaned by country), binned.

Starting with the regression model from Equation (2), we insert employment as dependent variable. We control for population (log), GDP growth, corporate and personal income tax rates, and the tax wedge. As employment is a count variable (number of employees), we use a pseudo-poisson maximum likelihood estimator. We re-estimate Equation (2) with (a) country-group × year × cohort fixed effects to account for regional shocks and (2) interactions between the VAT variable and the dummy variables *Exog* and *Endo*, representing exogenous and endogenous VAT reforms to account for endogenous VAT rates.[14] The results are presented in Table 12.

In Table 12, the estimated coefficients are negative. In specification (1), a one percentage point VAT rate hike is associated with a 1.444% reduction in employment, in line with our second hypothesis (H2). However, the coefficient in column (2) is not

[14]See section 3.1 for further explanations.

Table 12: VAT and Employment: Country-Level Regression Results

	(1) Employment	(2) Employment	(3) Employment
Endo×VAT			-1.739***
			(0.505)
Exog×VAT			**-1.862*** **
			(0.487)
VAT	**-1.444****	**-0.375**	
	(0.610)	(0.273)	
Observations	74,637	74,637	24,250
Country Controls	YES	YES	YES
Country×Cohort FE	YES	YES	YES
Year×Cohort FE	YES	NO	YES
Ctrygrp×Yr×Cohort FE	NO	YES	NO
Data	EUROSTAT	EUROSTAT	EUROSTAT
SE Clustering	COUNTRY	COUNTRY	COUNTRY

Note: The table reports the main results of the stacked regression estimating the effect of VAT changes on employment at the country level. As employment is a count variable, we use a pseudo-Poisson maximum likelihood estimator. Therefore, we abstain from reporting R-squares. Column (1) includes country-level controls as well as country × cohort fixed effects and year × cohort fixed effects. Column (2) replaces the year × cohort fixed effects with country-group × year × cohort fixed effects. Column (3) introduces an interaction specification in which VAT is interacted with the dummy variables *Endo* and *Exog*. The variable *Endo* equals one if a VAT reform is classified as endogenous, while *Exog* equals one if a reform is classified as exogenous, following the classification of Gunter et al. (2021). A detailed overview of this classification is provided in Table A3.

significantly different from zero. When we separate exogenous and endogenous VAT rate changes, the estimate in model (3) shows a statistically significant reduction of 1.862% for a one percentage point VAT hike.

As a robustness test, we analyze employment per capita from the Eurostat Labor database. We recalculate the index values to 2015 = 1. We estimate the regression from Equation (2) using employment per capita as the dependent variable. We stack the sample and estimate the same models as in Table 7: (1) cohort × year fixed effects, (2) cohort × country group × year fixed effects, and (3) exogenous VAT rate changes. We summarize the results in Table 13.

All estimated coefficients are negative. In model (1), a one percentage point VAT hike is associated with a 1.355% decrease in employment per capita. The estimate from model (2) is not statistically significant. Model (3), where we separate exogenous and endogenous VAT rate changes, shows a statistically significant negative estimate (-1.499%). Overall, we interpret the results as support for the results from our main test that VATs reduce employment (H2).

5. Additional Tests: Labor Productivity and Factor Allocation

We first test whether VATs affect labor productivity. The labor productivity per hour in Eurostat is measured as the ratio of GDP to total hours worked by employees and self-employed. The GDP is expressed in PPS (Purchasing Power Standard) to account for differences in price levels between countries. The labor productivity per hour worked indicates how much each hour worked in the economy contributes to economic production. The labor productivity per person in Eurostat is the ratio of GDP (in PPS) to the number of persons employed. It indicates how much each person employed in the economy contributes to economic production. We recalculate the index values to 2015 =

Table 13: VAT and Total Employment per Capita: Country-Level Regression Results

	(1) Total Employment per Capita	(2) Total Employment per Capita	(3) Total Employment per Capita
Endo×VAT			-1.467**
			(0.553)
Exog×VAT			**-1.499****
			(0.547)
VAT	**-1.355****	**-1.089**	
	(0.569)	(0.688)	
Observations	798	784	251
Country Controls	YES	YES	YES
Country×Cohort FE	YES	YES	YES
Year×Cohort FE	YES	NO	YES
Countrygrp×Yr×Cohort FE	NO	YES	NO
Data	EUROSTAT	EUROSTAT	EUROSTAT
SE Clustering	COUNTRY	COUNTRY	COUNTRY
Within R2	0.180	0.160	0.393

Note: The table reports the main results of the stacked regression estimating the effect of VAT changes on total employment per capita at the country level. Column (1) includes country-level controls as well as country × cohort fixed effects and year × cohort fixed effects. Column (2) replaces the year × cohort fixed effects with country-group × year × cohort fixed effects. Column (3) introduces an interaction specification in which VAT is interacted with the dummy variables *Endo* and *Exog*. The variable *Endo* equals one if a VAT reform is classified as endogenous, while *Exog* equals one if a reform is classified as exogenous, following the classification of Gunter et al. (2021). A detailed overview of this classification is provided in Table A3.

1.

We use labor productivity per hour and per person as the dependent variables in regressions following Equation (2). We stack the sample and estimate: (1) cohort × year fixed effects, (2) cohort × country group × year fixed effects, and (3) exogenous VAT rate changes. We summarize the results in Table 14.

We find negative point estimates for the effect of VAT rates on labor productivity. For exogenous VAT rate changes, the effect is not significant for labor productivity per hour and only marginally significant for labor productivity per person. Overall, we conclude with due caution that there is some evidence that VAT rates reduce labor productivity. This result must be interpreted together with the negative effect of VAT rates on employment and the weak evidence for a negative effect on hours worked, both of which reduce the denominators of labor productivity. We interpret the fact that labor productivity nevertheless declines as evidence for the underlying mechanism we propose: VATs reduce firms' sales and profitability, which in turn lowers labor productivity, and firms shift a notable share of the burden to employees through reduced wages and employment.

VATs may also alter factor allocation. In his seminal study, Harberger (1962) analyzes how taxes influence the allocation of capital and labor across industries. VATs are supposed to tax labor and excess profits, but not the normal market return on capital. This feature may increase the relative attracitivity of capital to labor, thereby reducing the labor intensity of production. [15] As we have presented evidence that VATs reduce employment, a decline in labor input could translate to a reduction of labor intensity of production. On the other hand, Jacob et al. (2019); Hundsdoerfer (2022) find that VATs reduce capital and debt, so the net effect of VATs on the labor intensity of production is an empirical question.

We operationalize factor allocation with $factor\ mix_{i,j,t} = ln(1 + Employee\ Cost_{i,j,t}) -$

[15]For a payroll tax cut in Chile, Gruber (1997) finds no evidence of employment effects. However, because payroll taxes differ from VATs (e.g., in their direct progressivity and the absence border adjustments), it is unclear to what extent this evidence is informative for VAT effects.

Table 14: VAT and Real Labor Productivity per Hour Worked and per Person: Country-Level Regression Results

	(1) Real Labor Productivity per Hour Worked	(2) Real Labor Productivity per Hour Worked	(3) Real Labor Productivity per Hour Worked	(4) Real Labor Productivity per Person	(5) Real Labor Productivity per Person	(6) Real Labor Productivity per Person
Endo x VAT			-0.581			-0.687
			(0.374)			(0.419)
Exog x VAT			**-0.562**			**-0.716***
			(0.350)			(0.391)
VAT	**-0.795****	**-1.172*****		**-0.855****	**-1.198*****	
	(0.357)	(0.313)		(0.366)	(0.279)	
Observations	798	784	251	798	784	251
Country Controls	YES	YES	YES	YES	YES	YES
Country x Cohort FE	YES	YES	YES	YES	YES	YES
Year x Cohort FE	YES	NO	YES	YES	NO	YES
Countrygrp x Yr x Cohort FE	NO	YES	NO	NO	YES	NO
Data	EUROSTAT	EUROSTAT	EUROSTAT	EUROSTAT	EUROSTAT	EUROSTAT
SE Clustering	COUNTRY	COUNTRY	COUNTRY	COUNTRY	COUNTRY	COUNTRY
Within R2	0.164	0.195	0.259	0.162	0.187	0.262

Note: The table reports the main results of the stacked regression estimating the effect of VAT changes on the real labor productivity per hour worked (columns 1-3) and per person (columns 4-6) at the country level. Columns (1) and (4) includes country-level controls as well as country×cohort fixed effects and year×cohort fixed effects. Columns (2) and (5) replaces the year×cohort fixed effects with country-group×year×cohort fixed effects. Columns (3) and (6) introduces an interaction specification in which VAT is interacted with the dummy variables *Endo* and *Exog*. The variable *Endo* equals one if a VAT reform is classified as endogenous, while *Exog* equals one if a reform is classified as exogenous, following the classification of Gunter et al. (2021). A detailed overview of this classification is provided in Table A3.

$ln(1 + Fixed\ Assets_{i,j,t})$. Figure 6 plots factor mix against the VAT rate, with both variables demeaned by firm. We control for year fixed effects and bin observations along the independent variable.

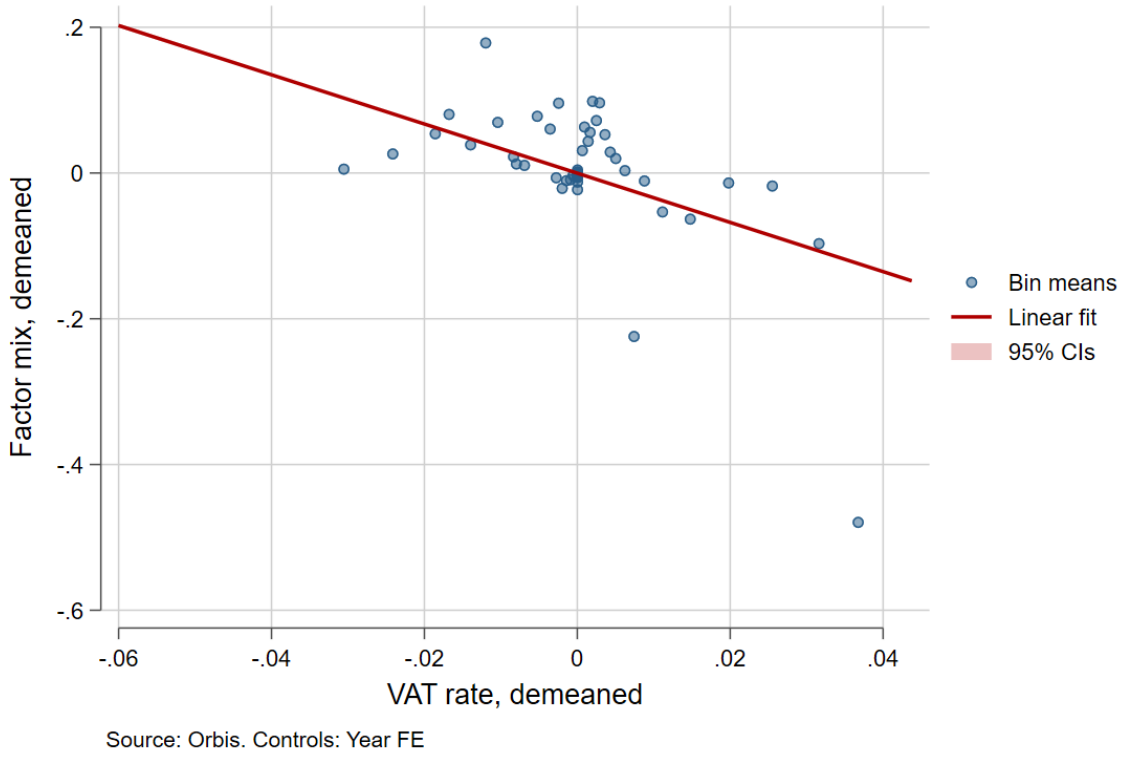


Figure 6: Association between firm-year factor mix and VAT (both demeaned by firm), binned. Factor mix is $ln(1 + Employee\ Cost_{i,j,t}) - ln(1 + Fixed\ Assets_{i,j,t})$.

The figure suggests a negative association between factor mix and VAT rates. The economic interpretation is that with rising VAT rates, the input share of labor (capital) decreases (increases), rendering production more capital intensive.

To formally analyze the effect of VAT on labor intensity of production, we estimate the regression models described in Equation (2) and in Section 3.1, using factor mix as the dependent variable. As in section 4.1, we estimate (1) a model with cohort $\times$ year fixed effects without firm level controls, (2) with firm level controls, (3) with cohort $\times$ country group $\times$ year fixed effects, and (4) a specification exploiting exogenous VAT rate changes. At the country level, we control for the size of the population, GDP growth

rate, the corporate and personal income tax rate, and the tax wedge. At the firm-level, we control for firm size, leverage and margin in the specification in column (2). The statistical inference is based on standard errors clustered at the country level.

Table 15: VAT and Labor Intensity of Production: Firm-Level Regression Results

	(1) Factor Mix	(2) Factor Mix	(3) Factor Mix	(4) Factor Mix
Endo×VAT				-2.216***
				(0.517)
Exog×VAT				**-2.114*** **
				(0.510)
VAT	**-2.484*** **	**-2.325*** **	**-1.947*** **	
	(0.281)	(0.439)	(0.191)	
Observations	7,441,667	7,441,667	7,441,667	2,685,511
Estimator	OLS	OLS	OLS	
Country Controls	YES	YES	YES	YES
Firm Controls	NO	YES	NO	NO
Firm FE	YES	YES	YES	YES
Year×Cohort FE	YES	YES	NO	YES
Ctrygrp×Yr×Cohort FE	NO	NO	YES	NO
Data	BVD ORBIS	BVD ORBIS	BVD ORBIS	BVD ORBIS
SE Clustering	COUNTRY	COUNTRY	COUNTRY	COUNTRY
Within R2	0.00265	0.144	0.000895	0.00354

Note: The table reports the main results of the stacked regression estimating the effect of VAT changes on the labor intensity of production ($factor\ mix_{i,j,t} = ln(1 + Employee\ Cost_{i,j,t}) - ln(1 + Fixed\ Assets_{i,j,t})$) at the firm-level. Column (1) includes country-level controls as well as firm fixed effects and year×cohort fixed effects. Column (2) augments the specification by adding firm-level controls, namely leverage and firm size. Column (3) replaces the year×cohort fixed effects with country-group×year×cohort fixed effects. Column (4) introduces an interaction specification in which VAT is interacted with the dummy variables *Endo* and *Exog*. The variable *Endo* equals one if a VAT reform is classified as endogenous, while *Exog* equals one if a reform is classified as exogenous, following the classification of Gunter et al. (2021). A detailed overview of this classification is provided in Table A3.

Table 15 reports the regression results. All estimates are negative. We interpret these results as evidence that the labor share of firms' production inputs declines following VAT increases. From an economic perspective, the results reported in column (1) imply that a one percentage point VAT rate increase is associated with a 2.484% decrease in the

labor intensity (factor mix).

In unreported analyses, we replace factor mix with the ratio of employment costs to total assets (Grubaugh, 1987) and the ratio of employment costs to sales (Faia & Pezone, 2024), each winsorized at the 1% level by year. All point estimates are negative, and seven out of eight estimates (with the exemption of the association between exogenous VAT rate changes and the ratio of employee costs to turnover) are statistically significant. These results further support the conclusion that VAT increases reduce the labor intensity of production.

6. Heterogeneity Analyses

Our identification strategy allows us to examine potential heterogeneity effects both among European firms and within the European population. We start on firm level. In Table 16, the results of the firm-level heterogeneity analysis are reported using the Orbis dataset, with the dependent variable specified as *ln(Costs of Employees)*.

To disentangle potential sources of heterogeneity in the effects of interest, we interact the VAT rate with a subsample indicator. First, column (1) separates the sample into small and large firms, where *size* is proxied by the natural logarithm of total assets. A firm is classified as *small* (*large*) if its average size lies below (above) the median of the distribution. Differentiating by firm size allows the analysis to test whether the capacity to absorb or pass on tax-induced cost shocks differs systematically by scale, as larger firms may possess greater pricing and financial flexibility. Moreover, it can be expected that smaller firms operate predominantly in more localized output markets compared to larger firms, and as a result, may be more strongly affected by domestic VAT changes (Jacob et al., 2019). Indeed, the evidence from our sample suggests that large firms are better able to cushion the impact of a VAT increase on employee costs compared to smaller firms, as reflected by estimated effects of -2.972 for large firms versus -4.15 for

Table 16: VAT and Employment Cost: Firm-Level Heterogeneity

	(1) Ln(Empl Costs) Large vs Small Firms	(2) Ln(Empl Costs) High vs Low Margin
VAT	-4.283***	-1.744**
	(0.354)	(0.662)
Large Firms×VAT	1.150***	
	(0.337)	
High Margin×VAT		-3.737***
		(1.227)
Observations	7,686,349	7,686,349
Country Controls	YES	YES
Firm×Cohort FE	YES	YES
Year×Cohort FE	YES	YES
Data	BVD ORBIS	BVD ORBIS
SE Clustering	Country	Country
Within R2	0.00514	0.00597

Note: The table presents the results of the heterogeneity analysis based on the stacked regression estimating the effect of VAT changes on employee costs at the firm level. All specifications include country controls, firm×cohort fixed effects, and year×cohort fixed effects. Column (1) splits the sample into large and small firms. Column (2) distinguishes firms with high versus low profit margins. A firm is classified as small (large) if its average size, measured as the mean of the natural logarithm of total assets, falls below (above) the sample median. The indicator variable high margin (low margin) equals one when a firm's profit margin, defined as the ratio of EBIT to sales, lies above (below) the sample median.

small firms. Nonetheless, the adverse effect of a VAT increase on the employee costs of large firms remains substantial and economically significant, underscoring that even firms with greater resources and market presence are not immune to the labor cost pressures induced by VAT hikes. As large firms are less likely to evade business taxes, the negative effect for large firms corroborates our argument that tax evasion is not a key driver for our results (see Subsection 4.1).

In Table 16, column (2), the analysis distinguishes between firms with low and high profit margins, using indicator variables set to one when a firm's profit margin falls below or above the sample median, respectively. Profit margin is defined as the ratio of EBIT to sales. Differentiating by profitability enables the exploration of heterogeneous effects along the dimension of economic performance, as firms with greater profitability may have distinct incentives or constraints relevant to employee costs dynamics. This distinction is central to understanding incidence: firms with lower margins, reflecting limited market power (Jacob et al., 2019; Lerner, 1934), are less able to pass taxes onto final consumers. Consequently, such firms may be forced to reduce costs elsewhere, most immediately in terms of wages or number of employees, thus amplifying the employee costs effects of VAT increases. In contrast, high-margin firms, have higher rents to share so that their payroll may be stronger affected by VATs. Indeed we find a higher effect for high-margin firms (-5.346 vs. -1.592). This suggests that, within our sample, the adverse impact of VAT increases on employee costs is not concentrated among less profitable firms, but instead affects firms across the profitability distribution at a greater magnitude for those with higher margins. Overall, our heterogeneity analyses demonstrate that regardless of how the sample is partitioned, VAT increases exert a highly statistically significant and economically meaningful negative effect on European firms' employee costs, underscoring the robustness and relevance of our findings.

We continue on country level. We disaggregate the Eurostat data on hours and employment by age groups (15–24 years, 25–49 years, and 50–64 years) and by gender.

The results of the heterogeneity analysis for working hours are reported in Table 17.

Table 17: VAT and Working Hours: Country-Level Heterogeneity Analysis

	(1) ln(Working Hours)	(2) ln(Working Hours)
VAT	-0.161	0.00539
	(0.135)	(0.108)
15-24 Years×VAT		-0.529**
		(0.237)
25-49 Years×VAT		-0.226***
		(0.0761)
Female×VAT	0.0812	
	(0.0815)	
Observations	36,319	20,981
Country Controls	YES	YES
Country x Cohort FE	YES	YES
Year x Cohort FE	YES	YES
Data	EUROSTAT	EUROSTAT
SE Clustering	COUNTRY	COUNTRY
Within R2	0.00326	0.00263

Note: The table presents the results of the heterogeneity analysis based on the stacked regression estimating the effect of VAT changes on working hours at the country level. All specifications include country controls, country × cohort fixed effects, and year × cohort fixed effects. Column (1) splits the sample by gender into male and female workers, while column (2) distinguishes three age groups: 15–24 years, 25–49 years, and 50–64 years.

The effect difference between women and men (column (1)) is positive but not statistically significant. In column (2), the baseline is the age group 50-64. It does not show a significant reaction, with a point estimate close to zero. Compared to this group, the working hours in age group 25-49 years and especially in the age group 15-24 years are reduced. In the latter age group, working hours are reduced by an additional 0.529%, compared to the baseline group, for a one percentage point VAT rate hike.

Next, we analyze heterogeneity in employment, reported in Table 18.

Table 18: VAT and Employment: Country-Level Heterogeneity Analysis

	(1) Employment	(2) Employment
VAT	-1.293	1.414
	(0.798)	(0.930)
15-24 Years×VAT		-8.678**
		(3.561)
25-49 Years×VAT		-3.363**
		(1.649)
Female×VAT	-0.341	
	(0.623)	
Observations	74,637	74,637
Country Controls	YES	YES
Year×Cohort FE	YES	YES
Country×Cohort FE	YES	YES
Data	EUROSTAT	EUROSTAT
SE Clustering	COUNTRY	COUNTRY

Note: The table presents the results of the heterogeneity analysis based on the stacked regression estimating the effect of VAT changes on employment at the country level. As employment is a count variable, we use a pseudo-Poisson maximum likelihood estimator. Therefore, we abstain from reporting R-squares. All specifications include country controls, country × cohort fixed effects, and year × cohort fixed effects. Column (1) splits the sample by gender into male and female workers, while column (2) distinguishes three age groups: 15–24 years, 25–49 years, and 50–64 years (baseline).

In column (1) we find no significant difference between women and men in the effect on employment. With respect to age groups, the strongest adverse impact on employment is again observed among individuals aged 15–24 years (column (2)). By contrast, no discernible effect is found for the oldest age group, which forms our baseline. This finding is in line with the heterogeneity result for working hours: The youngest employees are hit hardest by the labor market effects of a VAT.

7. Conclusion

We investigate how VATs affect labor market outcomes: employee costs, wages, hours, and employment. To identify these effects, we exploit variation in standard VAT rates using both firm-level data (BvD Orbis) and country-level data (OECD and Eurostat). To our knowledge, our study is the first to provide systematic cross-country evidence on the labor market consequences of VATs.

Our results show economically strong negative effects of VAT rates on firms' employee costs, wages, and employment (measured by headcount). For working hours, some weak evidence hints at a negative effect. At the firm level, a one percentage point increase in the standard VAT rate corresponds to a 3.886% reduction in employee costs. At the country level, a one percentage point increase in the standard VAT rate is associated with a 2.802% decline in average nominal wages. For working hours, the inconclusive evidence at most suggests a reduction. Regarding employment, a one percentage point higher VAT rate is linked to a 1.444% decline at the country level. These findings are consistent with firms reacting to reduced profitability (the profitability effect) and remain robust across several specification checks, including when restricting variation to plausibly exogenous VAT reforms (Gunter et al., 2021).

In additional tests we present evidence for VATs reducing labor productivity and firm-level labor intensity. A one percentage point increase in the standard VAT rate is

associated with a 1.205% decrease in real labor productivity per hour worked. On firm level, the same VAT rate change is associated with a 1.811% decrease in labor intensity.

Heterogeneity tests show that the negative effect of VATs on employee costs is present in large firms but stronger in smaller firms. It is more accentuated in firms with high profit margins. The employment effects are concentrated in younger workers (15-24 years), whereas we see no effect on employment and working hours for the age group 50-64.

Further research could address data limitations on the firm level, e.g. the lack of information on hours worked or employee skill composition. In addition, future work could explore dynamic effects, distributional consequences, and the interaction between VATs and labor market institutions.

VATs are often perceived as consumption taxes with limited firm-level implications. For instance, Berg (2025) argues that for the UK *"a 2.5 percentage point rise in the average VAT rate is the most viable option to raise sufficient revenue without reducing growth. ... Since it also applies to people who are outside the labor market, it dampens work incentives less than income taxes do."* Our findings suggest caution: VATs substantially reduce nominal wages and employment, in addition to their inflationary effects on prices. These potentially unintended labor market consequences should be taken into account in policy debates on which taxes to adjust to meet fiscal needs.

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Appendix

Table A1: Variable descriptions

Panel A: Country Level Variables	
Ln(Average Wages)	Natural Logarithm of annual average wages in US Dollars
Ln(Workings Hours)	Natural Logarithm of working hours per employed person
Ln(Employment)	Natural Logarithm of Employment in thousand persons
Ln(Employment per Capita)	Natural Logarithm of total employment per capita
Ln(Hours worked per Employee)	Natural Logarithm of hours worked per employed person
Ln(Labor Productivity Hours worked)	Natural Logarithm of real labor productivity per hour worked
Ln(Labor Productivity Employee)	Natural Logarithm of real labor productivity per person
Population	Annual population in million persons
GDP Growth Rate	Annual growth rate of gross domestic product
Tax Wedge	Wedge between labor cost per hour and net wage per hour
Value Added Tax (VAT)	Standard VAT rate
Panel B: Firm Level Variables	
Ln(Employee Costs)	Natural Logarithm of costs of emloyees
Factor Mix	ln(Employee Costs) - ln(Depreciation)
EBIT	Earnings before interest and taxes
Company Size	Natural logarithm of total assets
Leverage	Long-term debt plus current liabilities scaled by lagged total asstes
Profit Margin	EBIT scaled by sales
Panel C: Dummy Variables	
Exog	Assumes the value of 1 if a reform is classified as exogenous by Gunter et al. (2021)
Endo	Assumes the value of 1 if a reform is classified as endogenous by Gunter et al. (2021)
Small Firms	Assumes the value of 1 if the average size of a firm is below the sample median
Large Firms	Assumes the value of 1 if the average size of a firm is above the sample median
Low Margin	Assumes the value of 1 if a firm is below the sample median of margin
High Margin	Assumes the value of 1 if a firm is over the sample median of margin

Table A2: Value Added Tax by Country (2006-2019)

	Value Added Tax			
	(1) Mean	(2) SD	(3) Min	(4) Max
Austria	0.20	0.00	0.20	0.20
Belgium	0.21	0.00	0.21	0.21
Bulgaria	0.20	0.00	0.20	0.20
Croatia	0.24	0.01	0.22	0.25
Cyprus	0.17	0.02	0.15	0.19
Czech Republic	0.20	0.01	0.19	0.21
Denmark	0.25	0.00	0.25	0.25
Estonia	0.19	0.01	0.18	0.20
Finland	0.23	0.01	0.22	0.24
France	0.20	0.00	0.20	0.20
Germany	0.19	0.01	0.16	0.19
Greece	0.22	0.02	0.19	0.24
Hungary	0.25	0.03	0.20	0.27
Ireland	0.22	0.01	0.21	0.23
Italy	0.21	0.01	0.20	0.22
Latvia	0.20	0.01	0.18	0.22
Lithuania	0.20	0.01	0.18	0.21
Luxembourg	0.16	0.01	0.15	0.17
Malta	0.18	0.00	0.18	0.18
Netherlands	0.20	0.01	0.19	0.21
Poland	0.23	0.00	0.22	0.23
Portugal	0.22	0.01	0.20	0.23
Romania	0.21	0.02	0.19	0.24
Slovakia	0.20	0.00	0.19	0.20
Slovenia	0.21	0.01	0.20	0.22
Spain	0.19	0.02	0.16	0.21
Sweden	0.25	0.00	0.25	0.25

Table A3: Classification of VAT Reforms

	(1) Year	(2) Old VAT	(3) New VAT	(4) Classification	(5) Description
Cyprus	2012	15.00%	17.00%	No classification	
Cypurs	2013	17.00%	18.00%	No classification	
Cyprus	2014	18.00%	19.00%	No classification	
Czech Republic	2010	19.00%	20.00%	Endogenous	GDP Procyclical
Czech Republic	2013	20.00%	21.00%	Exogenous	Inherited Deficit-Driven
Germany	2007	16.00%	19.00%	Exogenous	Inherited Debt-Driven
Estonia	2010	18.00%	20.00%	No classification	
Spain	2011	16.00%	18.00%	Endogenous	GDP Procyclical
Spain	2013	18.00%	21.00%	Endogenous	GDP Procyclical
Finland	2011	22.00%	23.00%	Endogenous	GDP Procyclical
Finland	2013	23.00%	24.00%	Exogenous	Inherited Deficit-Driven
France	2014	19.60%	20.00%	No classification	
Greece	2010	19.00%	21.00%	Endogenous	GDP Procyclical
Greece	2011	21.00%	23.00%	Endogenous	GDP Procyclical
Greece	2016	23.00%	24.00%	No classification	
Croatia	2010	22.00%	23.00%	No classification	
Croatia	2012	23.00%	25.00%	No classification	
Hungary	2006	25.00%	20.00%	Endogenous	GDP Procyclical
Hungary	2010	20.00%	25.00%	Endogenous	GDP Procyclical
Hungary	2012	25.00%	27.00%	Exogenous	Inherited Debt-Driven
Ireland	2008	21.00%	21.50%	Endogenous	GDP Procyclical
Ireland	2010	21.50%	21.00%	Endogenous	GDP Countercyclical
Ireland	2012	21.00%	23.00%	Exogenous	Inherited Debt-Driven
Italy	2012	20.00%	21.00%	Exogenous	Inherited Debt-Driven
Italy	2014	21.00%	22.00%	Exogenous	Inherited Debt-Driven
Latvia	2009	18.00%	21.00%	Endogenous	GDP Procyclical
Latvia	2011	21.00%	22.00%	Exogenous	Inherited Deficit-Driven
Latvia	2013	22.00%	21.00%	Exogenous	Long Run Growth
Lithuania	2009	18.00%	19.00%	Endogenous	GDP Procyclical
Lithuania	2010	19.00%	21.00%	Endogenous	GDP Procyclical
Luxembourg	2015	15.00%	17.00%	No classification	
Netherlands	2012	19.00%	21.00%	Exogenous	Inherited Debt-Driven
Poland	2011	22.00%	23.00%	Exogenous	Inherited Debt-Driven
Portugal	2008	21.00%	20.00%	Endogenous	GDP Countercyclical
Portugal	2010	20.00%	21.00%	Endogenous	GDP Procyclical
Portugal	2011	21.00%	23.00%	Exogenous	Inherited Debt-Driven
Romania	2011	19.00%	24.00%	Endogenous	GDP Procyclical
Romania	2016	24.00%	20.00%	No classification	
Romania	2017	20.00%	19.00%	No classification	
Slovenia	2013	20.00%	22.00%	No classification	
Slovakia	2011	19.00%	20.00%	Exogenous	Inherited Deficit-Driven

Note: the table contains a list of the VAT reforms in my sample as well as the classification into endogenous and exogenous reforms according to the narrative approach by Gunter et al. (2021).

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