Income Tax Credits for Consumer Services: a Tool for Tackling VAT Evasion?*

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Abstract

This paper analyzes the effects of an income tax credit for hard-to-tax consumer services on evasion of the value-added-tax (VAT). Based on the individual tax files of the universe of VAT payers in Germany, our analysis shows that harnessing incentives for consumers through tax credits fosters firms' compliance with VAT by bringing in an element of third-party reporting at the last VAT stage. Our results point at strong stimulating effects of the introduction of the tax credit on reported sales as well as on the ratio of reported sales to inputs and we find limited price effects. While two thirds of the revenue losses in the income tax are recovered by an increase in VAT revenues, at least a quarter and up to half of the revenue gain is associated with a response at the VAT evasion margin. The policy thus fosters considerable formalization effects.

Keywords: Tax evasion; Value-added tax; Income tax credit; Third-party reporting

JEL classification: H26; H25; H24

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1 Introduction

The value added tax (VAT) has experienced a growing popularity over the last decades (e.g., Bird, Gendron, et al., 2007; Helgason, 2017). In comparison to a sales tax, the VAT has two key advantages: it does not induce production inefficiencies arising from the taxation of intermediate goods and services (e.g., Keen and Lockwood, 2010), and it limits tax evasion due to its self-enforcing incentive structure (e.g., Pomeranz, 2015). The VAT is, nevertheless, subject to a "last-mile" problem (Naritomi, 2019). While the common credit-invoice method of calculating VAT generates a third-party reported paper trail on business-to-business (B2B) transactions along the value chain, this trail is absent at the final business-to-consumer (B2C) stage as end users cannot claim back VAT. Moreover, the wedge between the price charged by a seller and that paid by a buyer incentivizes tax evasion at the last stage in the form of under-the-counter supply of goods and informal provision of taxable services.

To tackle VAT evasion and hinder the associated shift of activity into the informal economy, governments have resorted to various types of measures. Some policies directly address informality by providing tax incentives for incorporation (Waseem, 2018) or by enforcing VAT registration (Asatryan, Gomtsyan, et al., 2020). Others promote more truthful reporting of the sales of already registered firms by lowering the gains from evasion, typically through taxing services provided to private households and some activities in the hospitality sector at a reduced rate (e.g., Frederiksen et al., 1995, Copenhagen Economics, 2008, Bettendorf and Cnossen, 2015).

In an attempt to induce third-party reporting and lower the evasion premium at the B2C stage, another increasingly implemented measure targets consumers by offering direct financial benefits for requesting an invoice. The assumption is that documented transactions with consumers will leave a paper trail which facilitates VAT enforceability. The recent literature has thus far focused primarily on programs, in which sales slips serve as lottery tickets (e.g., Marchese, 2009; Fabbri and Hemels, 2013; Mattos, Rocha, and Toporcov, 2013; Arbex and

Mattos, 2015; Fooken, Hemmelgarn, Herrmann, et al., 2015; Naritomi, 2019). An alternative design of this measure, which has received much less attention, is to deliver the financial incentive through a personal income tax (PIT) credit. Such a set-up allows consumers to reduce their PIT liability with a fraction of their expenses on evasion-prone goods and services while conditioning the granting of the credit on an invoice that completes the VAT paper trail.

This paper assesses the effectiveness of a German tax credit scheme as a potential tool for deterring tax evasion in services purchased by private households. Since 2003, households in Germany can lower their tax bills by up to 20 percent of expenses pertaining to selected services. After the inclusion of craftsman services in 2006, the scheme has evolved into one of the largest tax expenditures in the present German tax system (Bundesrechnungshof, 2011; Bundesregierung, 2020). Similar policies are implemented in other European countries.[1] Along with reduced rates and direct subsidies through voucher systems, income tax measures for household-related services have so far been predominantly regarded as an instrument for the promotion of formal employment in the household context (Angermann and Eichhorst, 2013). Their effects on VAT compliance have been hardly addressed.

Using individual tax files of the universe of VAT payers in Germany, which cover more than 6 million firms in the period 2001-2011, we employ a difference-in-differences specification to contrast yearly VAT remittances of firms that offer subsidized (tax-credit eligible) services with remittances of other firms. The selection of a suitable reference group is guided by the economic motivation behind the introduction of the scheme in Germany, i.e. the deterrence of tax evasion and illegal employment. Specifically, based on industry-level data on fines imposed for evasion and other irregularities involving taxes and social-security contributions

[1]For a detailed overview of related policies in Finland, France, Italy, the Netherlands, and Belgium refer to Farvaque (2015). Finland created an income tax credit for household services in 1997. Belgium initiated a system of service vouchers in 2001 (*titres services*). France replaced earlier subsidy programs in 2005 by the CESU (*Cheque emploi service universel*) program, which covers assistance to the elderly, disabled or dependent persons, child care, small household repairs and various other services (Sansoni, 2009).

and other official sources, we identify sectors that are particularly susceptible to noncompliance, but whose services do not qualify for the income-tax credit. VAT-remittance outcomes of firms in those industries are then used to construct a counterfactual. In order to distinguish a compliance shift from market expansion or higher prices induced by the tax credit, we explore the effects on reported sales, the ratio of output to input taxes as well as the response of consumer prices in the eligible industries. To do so, we draw on consumption index data at the 10-digit level and use different empirical methods to provide robust evidence.

Our results confirm a stimulating effect of the tax credit both on reported sales and on the ratio of declared sales to input purchases. This increase partly reflects market expansion or price effects, and partly a *formalization* effect. Based on our point estimates and assumptions on whether and how input prices respond to the credit, at least 27% and up to 48% of the increase in reported sales can be attributed to the tax-evasion margin and thus captures a shift from informal to formal sales. Overall, net VAT revenue gains are estimated to recover about two thirds of the total income tax revenue losses.[2]

The paper contributes to a growing literature on the role of third-party-reported information in contemporary tax enforcement. In particular, we study a policy aimed at improving the "system of information reporting [which] discourages noncompliance by increasing the risk of detection for a given amount of tax authority resources" (Slemrod, Gillitzer, et al., 2014, p.101). To the best of our knowledge, we provide the first empirical evaluation of the effectiveness of an income tax credit in fostering VAT compliance. By focusing on sales, the ratio of sales to input purchases, and consumer prices, the paper not only quantifies the policy's aggregate revenue effect, but also distinguishes the different mechanisms behind it.

The existing literature on policies directed at the B2C stage has mainly considered reduced VAT rates and rebate programs with a tax lottery as compliance incentives. Kosonen (2015)

[2]To obtain a more complete picture of the net revenue effect of the tax credit, our analysis may be supplemented with a study of the policy's employment effect, which, due to data availability, is beyond the scope of this paper.

explores the effect of a substantial VAT reduction for hairdressing services in Finland and finds limited pass-through to prices and lack of expansion of (formal) sales. Similarly, Benzarti and Carloni (2019), who evaluate a VAT cut for the restaurant industry in France, document no notable responses in output and employment. The obstructive impact of a consumer's request for an invoice on VAT evasion is demonstrated in a field experiment by Doerr and Necker (2021) who show that once invoices are demanded, a large fraction of offers for household services are withdrawn by firms operating in unregulated online markets. Naritomi (2019) studies a program implemented in Brazil that offers VAT rebates and monthly lottery prizes to consumers reporting their purchases to tax authorities. Mainly targeting retail sales, the program yielded a net gain of 9.3% of VAT revenues. Bohne (2018) examines an income tax deduction scheme implemented in Ecuador which aims at increasing formality more broadly, and explores outcomes on reported business profits by self-employed individuals.

The paper proceeds as follows. The next section provides a formal discussion of the effects of a tax credit with the goal of highlighting empirical predictions for VAT reporting of firms and for prices. Section 3 provides an overview of the tax deduction scheme in Germany. The relevant data sets are described in Section 4 followed by a presentation of the empirical methodology in Section 5. Section 6 reports and analyzes results on sales and consumer prices, differentiating between demand, evasion and price effects. Section 7 derives the aggregate and mechanism-specific tax revenue implications, while Section 8 concludes.

2 Theoretical and Empirical Predictions

This section provides a brief discussion of the expected effects of an income tax credit for taxable consumer services and derives predictions for outcomes observed in the individual tax returns. Consider a firm which provides a total level of services X to final consumers. It may deliver some of these services informally (I) without charging taxes and others formally ($S \equiv X - I$), i.e. VAT is charged and remitted to the tax authorities. The consumer price

of formal sales is $P(1+\tau)$, where P is the producer price. As the rate τ introduces a tax wedge, incentives arise for the producer and consumer to conduct an informal transaction at a price $\Psi \in [P, P(1+\tau)]$.

From the producer's point of view, an undeclared sale involves no tax remittance to the tax authorities: the producer engages in tax evasion. Provided that the selling price exceeds the producer price, this action can be profitable. The decision to sell informally can be described as a gamble in the tradition of Allingham and Sandmo (1972) – the producer balances a higher profit from an expansion of informal sales against an increasing risk of detection with the corresponding costs of taxes due and penalties. The greater the gap between the informal price and the producer price $\Psi - P$, i.e. the higher the evasion premium, the more risk the producer is willing to take and hence, the higher the level of informal sales.

Given that the obligation to charge and remit the tax typically lies with the seller, the buyer is not necessarily committing tax evasion. In fact, unlike intermediate customers, consumers are not entitled to a rebate of taxes paid on their purchases. Hence, the seller knows that transactions involving end users are unlikely to be reported to the tax authority. Thus, it is possible that evasion is unilateral (Pomeranz, 2015) in the sense that the buyer is unaware that the tax is being evaded. Under these circumstances, the consumer/buyer would be willing to pay the same price regardless of whether or not the seller is evading the tax, such that the difference between the selling and the formal producer price equals the tax wedge $\Psi - P = \tau P$. If the government introduces a tax credit σ, the consumer price of formal sales becomes $P(1+\tau-\sigma)$, and the tax wedge falls to $\Psi - P = (\tau - \sigma)P$. Therefore, an increase in the tax credit, ceteris paribus, should lead to more formal and fewer informal sales. Importantly, unilateral tax evasion becomes riskier for the seller, as the buyer receives a tax credit only after filing an income tax return. This third-party reporting of transactions results in a higher probability of detection.

Even without a tax credit, the seller will avoid issuing an invoice to ensure that an informally

provided service creates no paper trail. When this requires the explicit consent of the buyer, tax evasion becomes collusive (Pomeranz, 2015). In this case, the buyer risks liability to prosecution for assisting in tax evasion. Depending on the type of service rendered, the waiver of an invoice may also exert adverse effects on product quality due to difficulties in holding the seller liable for defects. These potential costs suggest that consumers would only be willing to partake in collusive tax evasion for a discount. In fact, Doerr and Necker (2021) provide evidence that firms willing to supply services informally are prepared to offer discounts as high as the tax wedge. At any rate, irrespective of how it is distributed, a tax credit should lead to a decrease in collaborative evasion by diminishing the potential gains from participation.

In addition to influencing the decision for or against tax evasion, the introduction of a tax credit also affects the respective market. Specifically, the consumer price of formal sales decreases ceteris paribus, resulting in income and substitution effects. Given a normal good, the total demand for formal sales $X - I$ increases in σ. Hence, enhanced VAT payments may occur even in the absence of an evasion response, i.e. when I remains constant. Moreover, due to higher demand, the producer price could rise as well. In any case, market expansion and price effects would both increase the value of output pX.[3]

Turning to empirical predictions, we consider first the reported sales

$$S = P\left(X - I\right).$$

Denoting the (semi-)elasticity of the producer price with $\beta_P \geq 0$, we can specify the (semi-)elasticity of S ($\frac{1}{S}\frac{\partial S}{\partial \sigma}$) as:

$$\beta_S = \beta_P + \frac{1}{X - I}\left(\frac{\partial X}{\partial \sigma} - \frac{\partial I}{\partial \sigma}\right). \tag{1}$$

[3]Higher prices might have further implications for tax evasion. It is difficult, however, to make a prediction on these second-order effects, because both the tax wedge and the relief provided by the tax credit rise with the producer price.

As noted above, a rise in the subsidy rate σ lowers the evasion premium and increases the detection probability, with both outcomes diminishing the informal provision of services ($\frac{\partial I}{\partial \sigma} < 0$), while boosting declared sales. Expression (1) nevertheless indicates that any positive impact of the tax credit on reported sales cannot be solely attributed to changes in tax evasion – it may also reflect market expansion if output increases ($\frac{\partial X}{\partial \sigma} > 0$) and/or a price increase ($\beta_P > 0$). Eq. (1) therefore combines compliance, demand and price effects, all of which contribute to larger reported sales and, in turn, tax remittances.

To distinguish a decline of evasion from a market expansion, it is useful to explore the effect on the ratio of reported sales to reported intermediate input purchases by the producer. With a fixed input-coefficient, production of X requires $\alpha_X X$ inputs. Denoting the input price by Q, input costs equal $Q\alpha_X X$. In addition, the producer pays input taxes amounting to $\tau Q\alpha_X X$, which are refundable as part of the VAT return.

To simplify matters, henceforth we assume that all input taxes are refunded. This assumption reflects the widespread misuse of the VAT refund mechanism (Agha and Haughton, 1996).[4] In the Appendix we provide a generalized illustration, in which taxes on input purchases made in connection with informal sales are only partially filed. It shows that under the assumption that all input taxes are deducted, the estimates of the tax credit's effect on informal sales represent a lower bound of the actual impact.[5]

The ratio of output to input taxes or the ratio of reported sales to input purchases is:

$$R \equiv \frac{\tau P\left(X-I\right)}{\tau Q\alpha_X X} = \frac{P}{Q\alpha_X}\left(\frac{X-I}{X}\right).$$

[4]It is also commonly used in the literature, e.g., Asatryan, Gomtsyan, et al. (2020).

[5]The intuition is as follows: If all input taxes are deducted regardless of whether the sales are formal or informal, a decrease in informal sales has no effect on input taxes, but affects output taxes, thus leading to an increase in the output-to-input tax ratio. If input taxes are only partially reclaimed, formalization leads to a higher deduction of input taxes, and hence a weaker increase in the output-to-input tax ratio. With partial deduction, therefore, a given increase in the ratio implies a stronger decline in informal sales. For the formal derivation, see section A.1 in the Appendix.

The semi-elasticity of this ratio with respect to σ ($\frac{1}{R}\frac{\partial R}{\partial \sigma}$) is:

$$\beta_R = \frac{1}{X-I}\left(\frac{\partial X}{\partial \sigma} - \frac{\partial I}{\partial \sigma}\right) - \frac{1}{X}\left(\frac{\partial X}{\partial \sigma}\right) + (\beta_P - \beta_Q)\,. \tag{2}$$

The first term on the right-hand side reflects the effect on reported sales (cf. eq. (1)), while the second term is the effect on input purchases. The impact of the subsidy on prices, captured by the last term, is zero when output and input prices vary proportionally and positive if the effect on the output price is stronger.

Note that in the special case with zero informal sales, any changes in R reflect only differential price trends. In other words, absent price effects or when these were identical in input and output markets, the ratio would be constant and $\beta_R = 0$. Allowing for sales underreporting and abstracting from price effects, a constant sales-to-inputs ratio implies that growth in reported sales is driven by an industry expansion and not by a shift from informal to formal sales. If the ratio increases, however, the increase in reported sales is partly caused by a shift in compliance.

Using (2) to replace $\frac{\partial X}{\partial \sigma}$ in equation (1) allows us to derive the effect of the subsidy on informal sales from the semi-elasticities β_S, β_R, β_P and β_Q. Formally,

$$\frac{1}{X-I}\frac{\partial I}{\partial \sigma} = -\left(1 + \frac{I}{X-I}\right)(\beta_R - \beta_P + \beta_Q) + \left(\frac{I}{X-I}\right)(\beta_S - \beta_P)\,. \tag{3}$$

The change in informal sales can thus be determined as a weighted sum of the observable VAT-performance and price effects. The first term on the right hand side is the price-adjusted response of the sales-to-input ratio. Provided that $\beta_R - \beta_P + \beta_Q > 0$, this term is negative leading to lower informal sales.[6] The second term is the price-adjusted change in reported sales. Keeping all else qual, the more the ratio increases for a given rise in reported sales, the stronger the decline in informal sales.

[6]Note that the price correction for the increase in the ratio of reported sales to inputs is not necessary if the prices of sales and inputs develop in the same way.

3 Income Tax Credits for Services in Germany

Since 2003, conditional on a positive tax liability, taxpayers in Germany can claim income tax credits for household-related services and employment under the Federal Income Tax Law (§35a EStG). The policy was implemented to stimulate formal demand for services by fighting tax evasion and illegal employment (Bundesregierung, 2003). Initially, households could subtract 10 to 20 percent of service costs from their income tax liability up to a maximum of 2,400 euro for single filers and 4,800 for couples.[7] The credit applied to a fixed list of services, including cooking, cleaning, gardening, child care and elder care.

In 2006, the subsidy was expanded through the Act of Tax Promotion of Growth and Employment (*Gesetz zur steuerlichen Förderung von Wachstum und Beschäftigung*), which added craftsman services to the list of favored services. Households could now reduce the amount of income tax they owe by 20 percent of expenditures on measures pertaining to the renovation, maintenance or modernisation of their property up to a maximum of 600 euro annually for single filers and 1,200 for married couples. Moreover, care and support services, a former sub-group of household-related services, became a separate eligible group with a more generous credit.[8]

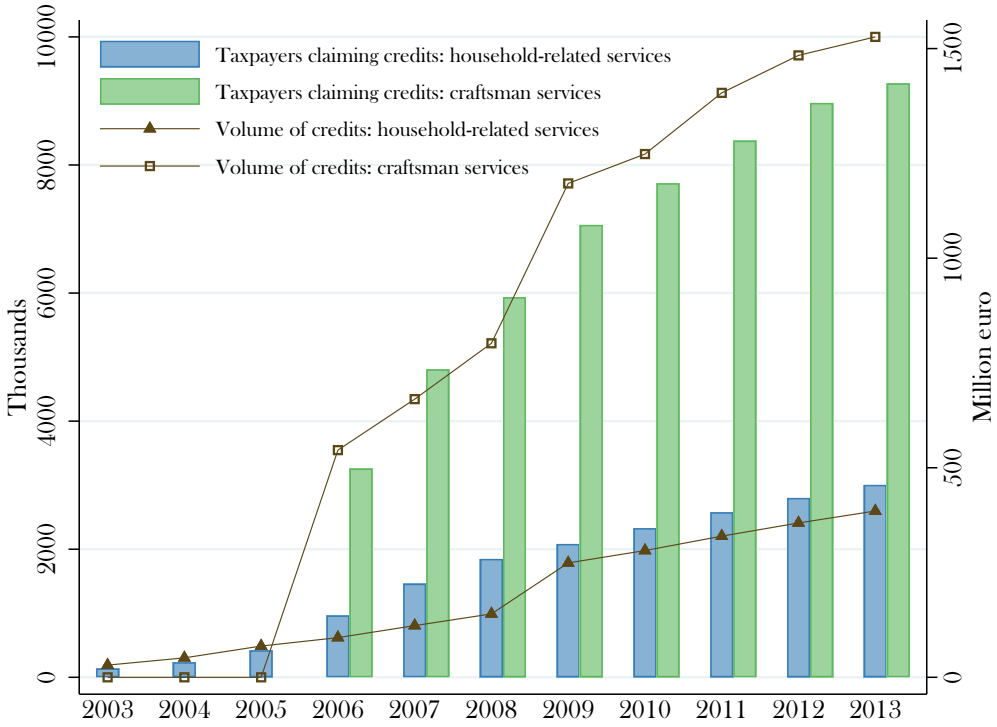
In the course of the Global Financial Crisis the subsidy underwent further expansion. In 2008, the German parliament passed the Stimulus Package I (*Konjunkturpacket I*), whose goal was to strengthen and stabilize the economy, save jobs and reduce financial pressure on households. As part of this package, the maximum credit amount for single filers (married couples) for household-related services including care and support services increased to 4,000 (8,000) euro, and that for craftsman services to 1,200 (2,400) euro.[9]

[7] To successfully claim the tax credit, households have to provide invoices that differentiate between expenses for manual work, driving to work and the cost of materials, because only expenses for manual work and commuting are eligible.

[8] 20 percent up to 1,200 euro for single filers and 2,400 euro for married couples.

[9] For an overview of the broad categories of eligible services, credit rates and maximum amounts, as well as changes in these over time, see Table A-1 in the Appendix.

Figure 1: Number of Taxpayers and Tax Credit Volume



Note: The figure shows developments in the annual number of taxpayers claiming an income tax credit and the annual granted volumes between 2003 and 2013, differentiating between craftsman services and household-related employment and services. Data source: German Federal Statistical Office.

Over time, the tax credit has evolved into one of the largest tax expenditures in the present German tax system (Bundesrechnungshof, 2011). Since its implementation, the volume of the subsidy has been steadily increasing reaching close to 2 billion euro in 2013 (Bundesregierung, 2020). Figure 1 depicts developments in claimed credit and number of taxpayers over time differentiating by type of service. Craftsman services constitute the largest part of total claims by far (1.5 billion euro in 2013). In contrast, other household-related services (0.4 billion in 2013) play a minor role.[10]

The relative importance of craftsman services is also reflected in the number of taxpayers

[10]Table A-9 in the Appendix provides detailed numbers on annual take-up and amount of claimed credit for the policy under consideration.

claiming income tax credits. In 2013, more than 9.2 million taxpayers subtracted expenses for craftsman services, whereas 3 million claimed for either household-related services or employment. On average, every participating household reduced its tax liability by 126 up to 288 euro per year. All in all, more than 11 billion euro have been granted as a tax credit over the observed eleven-year period.

4 Data

The empirical analysis makes use of two main data sets. The first is the German VAT Panel (*Umsatzsteuer-Panel*) provided by the Research Data Center of the Federal and State Statistical Offices in Germany.[11] The second, accessed via Destatis, i.e. the German Federal Statistical Office, is the Harmonized Index of Consumer Prices (HICP) following the Classification of Receipts and Expenditure of Households (*Systematik der Einnahmen und Ausgaben der privaten Haushalte*, SEA), which is based on the UN/European Classification of Individual Consumption According to Purpose (COICOP).[12]

The VAT Panel is a firm-level annual data set spanning 2001 to 2011, which covers more than 6 million firms, i.e. all firms that are registered for German VAT.[13] The data consists of firms' taxable, exempt or zero-rated sales and VAT remittances – output taxes charged on the selling price of goods and services and deductible VAT paid on inputs. The tax variables originate from monthly and quarterly advance VAT returns, which underlie the remittance procedure.[14] The VAT panel additionally includes a five-digit industry classification code for each firm (*Wirtschaftszweige*, WZ), location by federal state, and type of legal business

[11] Forschungsdatenzentrum der Statistischen Ämter der Länder; https://www.forschungsdatenzentrum.de/de/steuern/ustp.

[12] https://www-genesis.destatis.de/genesis/online.

[13] The German VAT registration threshold was 16,617 euro in 2001, 16,620 euro in 2002, and was set to 17,500 euro until 2020.

[14] Note that variables do not reflect final adjustments in firms' annual VAT declarations (Vogel and Dittrich, 2008).

Table 1: Mapping of Activities across Classification Versions and Treatment Assignment

Case I: One-to-one		Case II: Many-to-one		Case III: Many-to-many	
WZ2003	WZ2008	WZ2003	WZ2008	WZ2003	WZ2008
74.70.4	*81.29.2*	29.32.2	*95.22.0*	75.14.0	*81.10.0*
		29.41.0		*70.32.0*	*81.10.0*
		29.56.4			68.32.1
		52.72.1			68.32.2
		Treatment Assignment			
WZ2003 if first year $<$ 2009		WZ2003 if first year $<$ 2009		WZ2003$\cap$WZ2008 if first year $<$ 2009	
WZ2008 if first year $\geq$ 2009		NA if first year $\geq$ 2009		NA if first year $\geq$ 2009	

Notes: The table shows three different examples of the mapping of economic activities across the 2003 and 2008 classifications. Codes in italics are services, which are eligible for tax credit. "First year" refers to the first year of a firm's spell in the VAT panel. Case I is a one-to-one mapping, where the only difference between the economic activity in 2008 (last year WZ2003 applies in VAT Panel) and 2009 (VAT Panel switches to WZ2008) is the code describing the activity. Thus "Disinfecting and pest control" is listed under code 74.70.4 in WZ2003, and becomes 81.29.2 in WZ2008. Given Case I, for firms whose first year in the data is between 2002-2008, the 5-digit WZ2003 code (carried forward for years after 2008) is used to assign firms into treatment. For firms that first appear in the data in or after 2009, treatment is based on the corresponding WZ2008 code. Case II demonstrates a situation where several different economic activities under WZ2003 are mapped into a single code under WZ2008. An identification problem emerges when not all activities in WZ2003 are eligible for a credit, as in the example above. As the treated activity, 52.72.1, maps uniquely into 95.22.0 in WZ2008, treatment is determined solely on the basis of the WZ2003 code. For firms established in or after 2009, therefore, treatment cannot be assigned. Case III illustrates the issues arising when two codes map into one or several activities, some of them overlapping. Treatment is then determined conditional on both the WZ2003 and WZ2008 code, which implies that a firm is present in the data both before and after 2009. Tables A-6 and A-7 in the Appendix show how credit-eligible services listed in Bundesregierung (2010) are matched to industries, as well as how treatment is determined for each industry based on the above three cases. 70% of firms are assigned into treatment under Case I or straightforwardly under Cases II and III, because all entries are treated. Case II applies to 10% of firms, i.e. only the 2003 code is used to determine treatment. Lastly, for 20% of firms the 2003 and 2008 industry codes are used jointly to assign treatment under Case III.

structure.[15]

The HICP data is available on a yearly basis for the period 1991-2017 at a 10-digit SEA classification. At this level of disaggregation, the 1998 SEA version (DESTATIS, 1998) contains price indices for 578 consumption categories. In 2013, a new edition of the SEA classification (DESTATIS, 2013) resulted in even more extensive coverage of 645 categories.

[15]Table A-2 in the Appendix provides an exhaustive list and descriptions of the variables in the German VAT panel, while Table A-3 shows descriptive statistics.

As in several instances the newer version allows the identification of price trends even for products and services that could not be previously observed, we augment the 1998-based consumption items with price information from the 2013 classification.[16]

Treatment Assignment and Control Group Selection

A list of tax-credit-eligible personal, household, and on-site services by craftsmen is provided by the Federal Ministry of Finance (Bundesregierung, 2010). To identify industries and consumption categories affected by the policy, we first match the description of the services on the Ministry of Finance's list to their closest corresponding a) business activity under the industry classification in the tax return data, and b) consumption item under the SEA classification in the price data. On the basis of the service-to-industry match, the resulting eligible industry codes are then used to assign firms into treatment in the VAT panel. A similar procedure is applied to the HICP data, where we pair COICOP categories with services on the official list. In the Appendix, we report all services subject to a tax credit in 2003 and 2006 as outlined in Bundesregierung (2010), as well as their closest industry and COICOP matches.[17]

Treatment assignment in the VAT panel proved non-trivial due to a change in the German industry classification in the period under consideration. For the years 2003-2008 the data reports a classification introduced in 2003 (denoted by WZ2003). In the remaining years, 2009-2011, the relevant classification is the one introduced in 2008 (WZ2008).[18] How firms are assigned into treatment depends on the first year they appear in the VAT panel, their economic activity, and how this activity's classification changes between WZ2003 and WZ2008. Table 1 provides examples to illustrate the three relevant cases that emerge in the data and highlights some resulting sample restrictions. Case I indicates a simple one-to-one mapping

[16]For details on the price data and its collection by the statistical office, see Section A.2 in the Appendix.

[17]See Tables A-6 and A-7.

[18]The WZ2003 classification of economic activities is in line with the General Industrial Classification of Economic Activities within the European Communities (NACE) in 2003 (NACE Rev.1). The WZ2008 classification follows the revision from 2008 (NACE Rev.2).

of an economic activity across classifications resulting only in a different code designation. In this case, the WZ2003 code is used to determine treatment for firms that enter the panel before 2009, and the WZ2008 code for those whose first year is 2009 or later. In Case II, several economic activities under WZ2003 are combined into a single activity under WZ2008, or vice versa (many-to-one and one-to-many mapping). Case III refers to a complex mapping with overlapping changes (many-to-many mapping).

Cases II and III are straightforward to deal with provided that all affected industries before and after the classification change are eligible for a credit – then treatment status is unambiguous as in Case I. Identification issues arise, however, whenever in Case II the WZ2008 code incorporates ineligible services, or if either WZ2003 and WZ2008 contain ineligible services in Case III. In these instances, treatment cannot be cleanly determined for those firms that appear in the data set for the first time in or after 2009. For firms entering prior to 2009, treatment is assigned based on the WZ2003 code in Case II; and based on the joint consideration of WZ2003 *and* WZ2008 codes in Case III – effectively requiring a firm to be present in the panel both before and after 2009.[19] Close to 70% of firms are assigned into treatment either under Case I or straightforwardly under Cases II and III as all old and new classifications are tax-credit eligible.

In order to construct a group of credible counterfactual firms, we rely on the economic characteristics of targeted industries used by the German government to justify the introduction of a tax credit – high level of illegal employment and high level of tax evasion – and select non-treated sectors that exhibit similar characteristics. This is done by relying on two sources: The first is an official report to the federal parliament, which identifies industries particularly prone to tax and labor-law violations on the basis of information from the revenue authorities (Bundesregierung, 2009). A second source is a ranking of industries by the

[19]Tables A-6 and A-7 in the Appendix report corresponding industry codes both under WZ2003 and WZ2008. The tables also denote how treatment is assigned for each industry based on the cases outlined in Table 1.

number of fines imposed between 2005 to 2016 for illegal employment and tax offenses.[20] The top sectors based on this ranking, i.e. construction, hotels and restaurants, forwarding, transport and logistics as well as meat processing, coincide with those highlighted in Bundesregierung (2009). We add two more highly-ranked industries in terms of noncompliance, namely hairdressing and repair of motor vehicles. It is these six sectors that we use to determine how reported sales and the ratio of reported sales to input purchases for eligible services would have evolved had the tax credit not been introduced at all. We also match these industries to their nearest equivalents in the HICP data. Table A-8 in the Appendix lists the five-digit codes and activities of firms in the control group as well as the closest corresponding COICOP classification codes.

Sample Restrictions

Based on observable firm characteristics, we impose a set of (institutional) restrictions aimed at removing firms that are either unlikely to engage in tax evasion or are bounded by specific VAT provisions. In particular, we exclude all firms that may be exempt from VAT due to their legal business structure and focus solely on partnerships (*Personengesellschaften*)[21] and corporations (*Kapitalgesellschaften*). To ensure that all firms in the sample charge the standard VAT rate which applies to all credit-eligible services, we further discard firms that report any exempt sales or sales taxed at reduced VAT rates. Firms belonging to a VAT group for tax purposes in the sense of Article 2(2) of the German VAT law are not taken into account in order to guarantee that repored output and input taxes refer to the same entity. Exporting firms are also not considered.[22] In addition, we reduce variability in sales and input purchases stemming from entry and exit by removing firms' first and last year

[20] So-called *Bußgeldentscheidungen gemäß §149 Abs. 2 Satz 1 Nr. 3 li. A GewO)* based on the Federal Agency for Combatting Illegal Employment (*GZR-Daten zur Schwarzarbeit.*)

[21] *Personengesellschaften* also include individual companies or enterprises (*Einzelunternehmen*).

[22] Exports are zero rated under VAT. Excluding exporting firms is also useful as during the time period under consideration policies have been implemented to stop VAT fraud related to EU trade.

in the VAT panel.[23] This restriction safeguards against confounding bias from firm-specific trends in VAT performance that can arise in the context of start-ups or exiting firms. Newly established firms in particular often incur excessive input tax credits as they pay VAT on setup costs before they start trading and collecting VAT on sales.

Another restriction addresses self-selection bias. Given that the identification of firms in the treatment group hinges on their industry classification, the possibility of self-selection in or out of treatment is problematic: If the main economic activity changes as a firm expands or reduces informal provision of services, the firm's industry classification is adjusted accordingly. To avoid capturing such responses and to ensure that policy-induced entry and exit are not an issue, we drop firms that enter the panel or change their industry classification in the year of introduction of the tax credit or after. All in all, the combined impact of the constraints is close to a 50% reduction in the sample.[24]

As reported in more detail in the Appendix, about 60% of the estimation sample of treated industries is composed of firms providing plumbing, electrical installation, carpentry and painting services. Firms offering household-related services have limited representation: They comprise 8% of firm-year observations in the treatment group and cover predominantly gardening and cleaning work.[25] Regarding the sectoral composition of the control group, 75% are hairdressers, car repair & maintenance businesses, and restaurants and pubs.[26]

Table 2 provides descriptive statistics of the estimation sample in the pre-treatment period prior to 2003. The average annual taxable sales at the standard rate of 19% are a little

[23]Note that we are not able to distinguish between a newly established VAT-registered entity that appears in the VAT panel, and a previously existing firm below the VAT threshold, which enters the VAT panel once its turnover exceeds the statutory maximum.

[24]Table A-4 in the Appendix reports descriptive statistics of the main outcome variables for firms in the treated industries separately for household-related and craftsman services. The table sequentially shows the impact of the above-mentioned institutional and entry constraints. Table A-5 reports similar statistics for the control group.

[25]See the note to Table A-4 in the Appendix.

[26]Refer to note of Table A-5 in the Appendix.

Table 2: Descriptive Statistics: Estimation Sample, Pre-Treatment

	Treatment group			Control group			
	Mean (1)	Median (2)	N.Obs. (3)	Mean (4)	Median (5)	N.Obs. (6)	(1)-(4) (7)
	VAT Panel						
Taxable sales	317,255 (611,385)	168,278	213,375	176,563 (1,064,932)	74,410	171,856	140,691***
Output tax	50,743 (97,746)	26,920	213,377	28,219 (170,074)	11,906	171,883	22,524***
Input tax	25,406 (55,223)	12,843	211,682	14,983 (113,155)	4,376	167,717	10,423***
	Harmonized Index of Consumer Prices						
Index	1.20 (0.096)	1.20	72	1.14 (0.116)	1.12	545	0.055***

Notes: The first panel shows summary statistics for the treatment and control groups in the VAT panel per firm per year averaged across time and firms after the data adjustments discussed in the text for the pre-treatment period 2001-2002. N.Obs. refers to the number of firm-year observations. Column (7) reports a two-sample t-test on means' equality. For statistics of treatment and control groups in the VAT panel prior to data restrictions, see Tables A-4 and A-5 in the Appendix. The second panel of the table reports summary statistics for the treatment and control groups in the HICP data for years $\leq$ 2002. In total, we identify nine individual price-indices for services eligible for the tax credit: for services subsidized in 2003, the consumer price statistics contains three matching indices, and for services included in 2006 – six price indices (see last columns of Tables A-6 and A-7 in the Appendix). The statistics of the control group pertain only to those non-treated COICOP categories matching the set of control industries used in the VAT panel (refer to last column of Table A-8 in the Appendix for a detailed list.) The base year is set to 1991. For some indices, we cannot map the entire course since 1991. In these cases, the data for the period without observations are back-calculated using the CPI.

over 317,000 euro for firms supplying some credit-eligible services. The associated output taxes amount to about 50,000 euro, which corresponds almost exactly to the standard VAT rate of 16% relevant in these years.[27] Taxes paid on intermediary inputs are about 25,000, highlighting the importance of the rebate mechanism for input-VAT. While firms in the control group are clearly smaller and their services slightly cheaper than those provided by the treated sectors, the relationship between output and input taxes is similar to that in the

[27] As explained in the data documentation, output and input taxes in the VAT panel are calculated trivially via multiplication of sales and input expenditures, respectively, with the relevant standard (given the sample restrictions) tax rate. This feature of the data leads to an equivalence between the "output tax-to-input-tax ratio" and the "reported sales-to-input-purchases ratio," allowing us to use the two terms interchangeably.

treatment group, pointing to a comparable ratio of reported sales to input purchases.

5 Methodology

5.1 Analysis of VAT Performance

The empirical analysis explores how the change in consumers' tax incentives affects different VAT performance indicators of firms. More specifically, we are interested in the effect on reported sales (Sales) as well as on the output-to-input ratio (Ratio). As explained in Section 2, under certain assumptions, empirical evidence on the response of these two variables can reveal whether and to what extent firms react at the formal-informal margin.

Our estimation approach can be summarized by the following equation:

$$\text{VAT performance}_{it} = \alpha_i + \gamma_t + \beta \text{Treat}_{n(5)t} + \delta_{st} + \rho_{n(2)t} + \psi_{lt} + u_{it}, \tag{4}$$

where the dependent variable is the logarithm of the respective VAT performance indicator, namely ln(Sales) or ln(Ratio) of firm i in year t. $\text{Treat}_{n(5)t}$ is an indicator variable for treatment, which varies by a 5-digit industry classification level $n(5)$ and by year t. It equals one for all industries falling within the personal and household-related service classification starting from 2003, as well as for eligible crafts-related industries from 2006 onwards. The main coefficient of interest, β, measures the direction and the extent to which the respective outcome variable changes due to the tax credit relative to other high-evasion, but not tax-credit-eligible sectors.

In the above specification, α_i are firm-specific fixed effects, which account for all time-invariant unobservable firm-level characteristics, and γ_t are year dummies that capture the impact of common shocks. Note that α_i fully nest industry-level indicators as long as firms do not change their main economic activity over time. The specification additionally controls for

state-by-year, two-digit industry-by-year and legal-structure-by-year effects, δ_{st}, $\rho_{n(2)t}$, and ψ_{lt}, respectively. These handle any time-varying confounders at the state or legal-type level, and importantly allow for general industry-specific trends at the coarser 2-digit classification.

There are two main identifying assumptions for the unbiased estimation of the treatment effect in eq. (4). The first is that in spite of pre-treatment differences in levels, the sales/the output-to-input ratio of the control group evolve in parallel to those in the treatment group prior to the intervention and serve as a valid counterfactual post-treatment. The second assumption requires that evasion opportunities of firms in the reference group are unaffected by the introduction of the tax credit. Even though $\rho_{n(2)t}$ condition on all time-trends at the more aggregated 2-digit industry level, in the empirical analyses below we perform further tests on the validity of the common-trend assumption. Regarding the no-interference assumption, given the sectoral composition of the reference group, the possibility of any credit-induced mechanisms affecting VAT evasion and compliance in the control units is remote as firms in the two groups are unlikely to be part of the same value chains.

The estimated coefficients can be interpreted as semi-elasticities: reported sales or the ratio change on average by $\widehat{\beta}$ log points due to the introduction of the tax credit. In line with the theoretical predictions, when considering log Sales, we expect $\widehat{\beta}_S > 0$ if firms expand formal sales or charge higher prices. Regarding the output-to-input ratio (log Ratio), if informal sales decline or output prices increase stronger than input prices, we expect $\widehat{\beta}_R > 0$.

To account for the likely serial correlation of residuals u_{it}, we base statistical inference on two-way clustered robust standard errors at the 5-digit industry-level $n(5)$ and at the firm level. This enables us to consider a firm-specific component in the error term in addition to an industry component if a firm is not necessarily nested within a single industry (Cameron, Gelbach, and Miller, 2011).

Note that since April 2004, some B2B transactions in the construction sector in Germany are subject to a reverse-charge mechanism (RCM) which shifts VAT liability from the supplier

to the buyer, and is thus a derogation from standard VAT rules. The rationale for the introduction of the RCM is to prevent a specific type of VAT fraud.[28] We expect that any firms involved in such fraud drop out of the VAT panel in 2004. With respect to other firms, the RCM's commencement may cause a change in compliance costs in the year of implementation. Nevertheless, as the launch of the RCM does not coincide with the introduction of the tax credit, β should solely reflect the effect of the credit.[29]

5.2 Price Analysis

As discussed above, three different mechanisms can spur sales growth in tax-credit-eligible industries: 1) stronger demand for their services due to the subsidy 2) an increase in formal sales as informal provision becomes less attractive and more risky due to third-party reported information, and 3) higher prices as eligible-service providers capture some of the increase in consumer surplus. The use of ln(Ratio) as a second outcome variable helps us to distinguish the first two mechanisms. But, without further information, we cannot disentangle price effects from reporting responses. An upward price adjustment can thus be misleadingly interpreted as an expansion in sales formalization and vice versa.

Because the VAT panel does not provide separate statistics on quantities or prices, to estimate the price effects of the tax subsidy we rely on the HICP data.[30] We apply two different

[28] In its simplest form, the so called intra-community "missing-trader" fraud involves a registered trader collecting VAT on a supply, but disappearing or becoming insolvent before the VAT is remitted to tax authorities while the good is shipped to other EU countries. Fulfilment of the RCM requires that buyers of construction services at the B2B stage report the same amount of VAT both as an input and as an output in their tax return (effectively eliminating the need for input VAT refund), so that no tax on these supplies is remitted to the tax authorities until the last B2C stage.

[29] The RCM introduction resulted in a temporary reporting problem in the VAT Panel in 2004 (Dittrich, 2006). In particular, sales subject to a reverse charge were not accounted for in the reported sales of affected firms. In 2005, reporting was adjusted to correctly assign these transactions to sellers. Consequently, reported sales decreased temporarily in 2004. Our results are robust to controlling for the temporary drop in reported sales in 2004.

[30] In the literature, consumption-by-purpose data has been used to study price responses to various policies, including VAT changes (*e.g.* Benedek et al., 2020), US trade reforms (*e.g.* Cavallo et al., 2021) and others.

methodological approaches. The first reproduces the difference-in-differences specification in eq. (4), only this time we contrast price developments of eligible services with a control group. More specifically, the control group comprises consumption categories reflecting the same set of sectors as in the VAT panel, namely those exhibiting high levels of illegal employment and tax evasion, but not entitled to a subsidy.[31]

The following equation characterizes the first approach:

$$\ln \text{ Price index}_{ct} = \alpha_c + \gamma_t + \theta \text{Treat}_{ct} + u_{ct}, \tag{5}$$

where Treat_{ct} is defined equivalently to the treatment indicator in (4), but now varies by COICOP category c and with time. The coefficient θ measures the price-index response to treatment relative to price developments in the reference group, and is a direct estimate of β_P. As before, γ_t are year-specific dummies, while α_c are COICOP-group-specific fixed effects.

While the analysis of VAT performance utilizes firm-level data, the above approach to estimating price effects relies on aggregate data that captures price developments by consumption categories. Due to the aggregation, a change in the price index may not only reflect developments taking place at the level of the individual firm, but also composition effects arising from changes in market shares of specific commodities or in their cost of production. This can give rise to a composition bias (Card, 1995), which undermines the assumption of common trends central to the difference-in-differences methodology. Therefore, as an alternative way to test for price effects, we also employ the synthetic control group (SCM) method pioneered by Abadie and Gardeazabal (2003). A central feature of this approach is the comparison of price developments for each individual consumption group to a weighted average of groups, which best matches the pre-treatment price trend. The method provides consistent estimates of θ even in the presence of differential trends across the COICOP

[31] See Table A-8 in the Appendix.

groups.[32]

To implement the SCM, we define an unrestricted pool of non-treated services ("donors")[33] and construct a counterfactual series, i.e. a synthetic control for each of the treated services. The counterfactual series is a weighted average of observations of non-treated products/services. The weights are chosen such as to minimize the difference between the pre-intervention characteristics of the treated and non-treated observations (Abadie, Diamond, and Hainmueller, 2010).[34]

Given that this method can be applied to each subsidized service identified in the price index data, we report average treatment effects using weighted averages of the estimates

$$\widehat{\theta} = \sum_{j=1}^{n} \widehat{\theta}_j w_j. \tag{6}$$

Following Acemoglu et al. (2016), the weights w_j correspond to the inverse prediction errors for the price development in the pre-treatment period.[35] Thus, a higher weight is assigned if the pre-treatment outcome is more accurately captured by the procedure.

[32]We refrain from applying the SCM to our analysis of VAT performance as it avoids the above-mentioned composition bias by utilizing panel data for individual firms rather than considering industry-level developments.

[33]Note that we are using all untreated COICOP units as opposed to the regression analysis where a limited set of codes is matched to the same evasion-prone sectors as in the VAT panel.

[34]We use the following predictors for the outcome variable: broad two-digit consumption codes, mean log consumption index by two-digit COICOP and by year, type of category (nondurables, semi-durables, durables, consumer services). In addition, to ensure a good fit prior to the policy adoption, we incorporate the 1992, 1997, and 2002 values of the dependent variable for services that become treated in 2003, and the 1995, 2000, and 2005 values of ln(Price Index) for consumer services first treated in 2006. Estimation is conducted under the restriction that the weights sum to unity and that there is no separate intercept term to account for additive differences between treatment and control units.

[35]Formally

$$w_j = \frac{RMSPE_j^{-1}}{\sum_{j=1}^{n} RMSPE_j^{-1}},$$

where $RMSPE_j$ is the root mean squared prediction error for service j in the pre-treatment period.

6 Empirical Results

6.1 Effects on VAT Performance

Table 3 presents the baseline results from the DID estimation of eq. (4). In both panels A and B, the first two columns show the joint effect of the tax credit on sectors gaining eligibility in 2003 and 2006, while the third and fourth columns refer solely to craftsman services. Column (1) shows that relative to the baseline, reported sales of firms providing credit-qualifying services increase after treatment by 12.5 log points on average. This estimate is significant at 5% level based on statistical inference using clustered standard errors by firm and by 5-digit sectoral codes. The level of clustering allows errors to be correlated both within industries and within firms, and if some firms change industry, permits two-way non-nested error components.[36]

Column (2), which explores the direction of adjustment in the reported output-to-input ratio, reports an estimated rise of 8.7 log points for firms in treated industries. As noted above, under certain assumptions regarding price effects, an increase in the ratio indicates that growth in sales stems not only from a market expansion, but also from a shift towards formalization. A more precise quantification is provided below once we examine price effects.

Columns (3) and (4) report specifications focusing only on craftsman services. Bearing in mind that craftsman-related tax credits comprise close to 75% of the subsidy's volume and, similarly, account for three-quarters of all households who take advantage of the scheme, the small loss of firm-year observations is not surprising. Further, the estimated coefficient on sales remains comparable in magnitude to the outcome inclusive of 2003 eligible services,

[36]Table A-10 in the Appendix tests the reliability of statistical inference in our specification by exploring the sensitivity of standard errors to the choice of clustering. In particular, it displays standard errors clustered by 5-digit industry codes, 4-digit industry codes $n(4)$, and two-way clustered by $n(4)$ and by firm. As expected, clustering at more aggregated industry groups results in higher standard errors, but in most instances statistical inference does not change.

Table 3: Response of Reported Sales and Tax Ratio to Income Tax Credit

	A. No firm-entry post-treatment				B. Unrestricted firm entry post-treatment			
	Household-related and craftsman services		Craftsman services		Household-related and craftsman services		Craftsman services	
	ln Sales (1)	ln Ratio (2)	ln Sales (3)	ln Ratio (4)	ln Sales (5)	ln Ratio (6)	ln Sales (7)	ln Ratio (8)
Treat	0.125**	0.087*	0.117**	0.098**	0.120**	0.084*	0.119**	0.097**
	(0.055)	(0.051)	(0.055)	(0.049)	(0.053)	(0.047)	(0.055)	(0.049)
N	2,001,522	1,974,874	1,927,176	1,902,822	2,486,166	2,453,436	2,325,216	2,295,498
№ firms	238,081	235,658	221,540	219,638	376,265	371,970	350,594	346,748

Notes: The dependent variable is either the log of taxable sales (ln Sales), or the ratio of output to input taxes (ln Ratio). Columns (1)-(2) and (5)-(6) report results from the estimation of eq. (4) for industries affected by the personal income tax subsidy in 2003, or in 2006. In Columns (3)-(4) and (7)-(8) the treatment group comprises only craftsman services. In Panel A, firms entering the panel post-treatment are not part of the estimation sample. In Panel B, the firm-entry restriction is removed. All specifications include firm-, year-, state-by-year, industry-by-year, and legal-form-by-year fixed effects, which are not reported. Standard errors, shown in parentheses, are two-way clustered by a 5-digit industry code ($n(5)$) and by firm throughout. N are firm-by-year number of observations. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

while the ratio of output to input taxes exhibits a slightly larger response relative to column (2).

While firm entry after treatment has been precluded from the sample underlying Panel A, Panel B of Table 3 relaxes this restriction.[37] This restriction may underestimate the effect on reported sales for two reasons: 1) assuming no self-selection out of treatment, firms that under-report sales prior to the policy's enactment may exceed the statutory threshold once their services qualify for credit and consequently appear in the VAT panel and 2) a demand boost for credit-eligible services may trigger the creation of new firms. Given that the estimated responses remain very similar to the baseline results in Panel A, a substantial understatement of the change in declared sales is unlikely.

[37]Descriptive statistics for the estimation sample, in which institutional restrictions apply but entry restrictions are removed is summarized by treatment status in Panel B of Tables A-4 and A-5 in the Appendix.

To test the validity of the common-trend assumption, we compare the development of the two measures of VAT performance before treatment across credit-eligible and non-eligible groups of firms. Since the pre-treatment time-period is longer, and the majority of firms become treated with the extension of the tax credit in 2006, we focus on craftsman services. We proceed in two steps. We first transform the VAT performance variables to remove two-digit-industry-by year effects. This step is necessary because of a data-driven mechanical drop in reported sales for the construction industry caused by the introduction of the reverse-charge mechanism in 2004, with the correct reporting method resuming in 2005 (see discussion in Section 5). The adjusted variables are then regressed on year dummies interacted with a treatment indicator for craftsman services and firm fixed effects.[38]

Plots of the resulting group-specific time paths along with 95% confidence bands are shown in Figure 2 for log Sales and in Figure 3 for log Ratio. Both plots depict largely overlapping confidence intervals prior to implementation suggesting that pre-treatment differences between the two groups of industries are not statistically different from zero, thus corroborating the common-trend assumption.

Table 4 explores heterogeneity of the treatment effect by firm size and business structure.[39] In view of the small sample share of firms providing household-related services and the similarity of the effects when these firms are excluded from the estimation, henceforth we consider only craftsman services. A priori, it is unclear whether one should expect stronger sales responses for smaller or for larger firms. On the one hand, small partnerships may react more strongly along the formal-informal margin. As the risk of detection due to whistleblowing by their

[38]The exact equation is $\widehat{\text{VAT performance}}_{it} = \alpha_i + \gamma_t \times \text{Status}_{n(5)} + \epsilon_{it}$, where $\text{Status}_{n(5)}$ is a treatment indicator equal to one for eligible craftsman services and zero otherwise, while $\widehat{\text{VAT performance}}_{it}$ denotes the VAT performance indicator (log sales or log tax ratio) after removing annual two-digit industry averages using a within transformation.

[39]We apply the firm-size classification of the federal audit regulations (*Betriebsprüfungsordnung*), which define "very small enterprises" as firms whose annual sales and profits are below certain thresholds. In terms of annual sales, these thresholds are 135,492 euro (2001-2003), 145,000 euro (2004-2006), 155,000 euro (2007-2009) and 160,000 euro (2010-2011).

Figure 2: Trends in Reported Sales

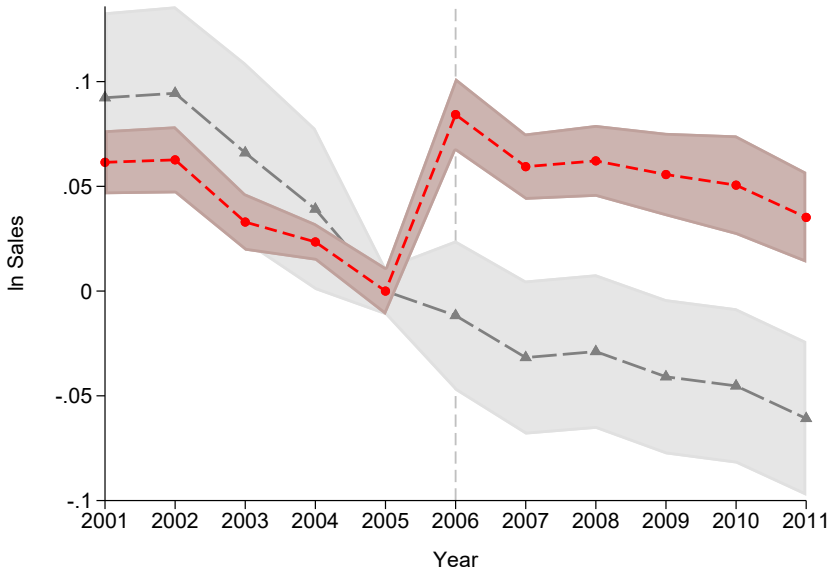
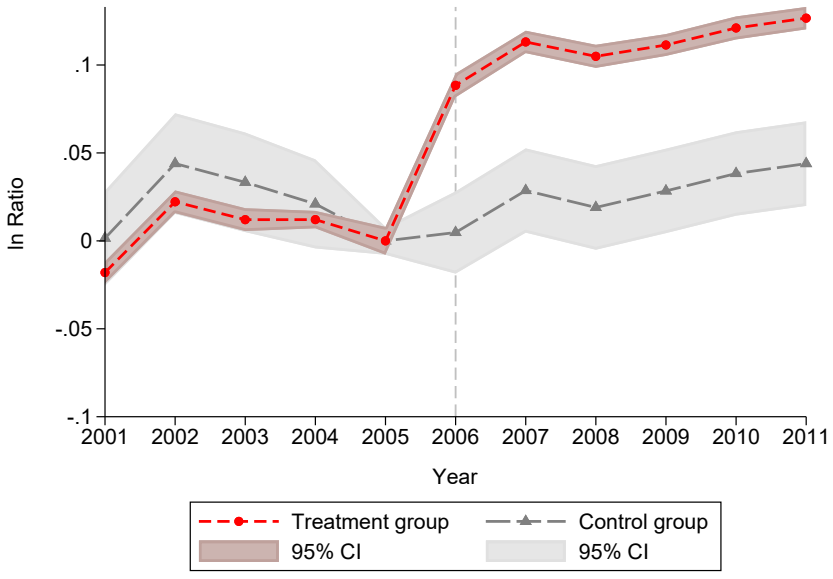


Figure 3: Trends in Input-Output Ratio



Notes: The plots depict group-specific time paths for the log of sales in Figure 2 and the log Ratio in Figure 3. Estimates of group-specific annual effects are based on panel regressions of VAT performance indicators allowing for firm fixed-effects. Note that the performance indicators are within-transformed, i.e. two-digit-industry-by year effects are removed. The 95% confidence bands are based on standard errors clustered at the industry-year level.

Table 4: Response Heterogeneity by Legal Form and Firm Size

	Small Partnerships		All Except Small Partnerships		Corporations		Medium to Large Firms	
	ln Sales	ln Ratio	ln Sales	ln Ratio	ln Sales	ln Ratio	ln Sales	ln Ratio
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Treat	0.083	0.109	0.144**	0.090**	0.158***	0.098***	0.146**	0.090**
	(0.057)	(0.067)	(0.058)	(0.036)	(0.054)	(0.028)	(0.059)	(0.037)
N	1,066,749	1,043,611	841,750	840,525	268,828	268,195	782,237	781,613
№ firms	146,302	144,202	108,207	108,072	30,158	30,113	103,635	103,538

Notes: The dependent variable is either the log of taxable sales (ln Sales) or the ratio of reported sales to inputs, (ln Ratio). The table reports results for different sub-samples of treated firms in 2006: columns (1) and (2) refer to small partnerships; columns (3)-(4) to all firms except small partnerships; columns (5) and (6) – to corporations; and columns (7)-(8) focus on medium-to-large firms. All specifications include firm-, year-, state-by-year, industry-by-year, and legal-form-by-year fixed effects, which are not reported. Standard errors, shown in parentheses, are two-way clustered by a 5-digit industry code ($n(5)$) and by firm in all specifications. N are firm-by-year number of observations.* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

own staff might be smaller,[40] and because of less stringent reporting standards and a lower likelihood of a tax audit than larger corporations,[41] they might be more prone to engaging in tax evasion. On the other hand, the VAT reporting threshold implies that many small firms are exempt from the requirement to charge and remit VAT. Given the fixed threshold, at the lower end of the firm-size distribution tax-payment spells are shorter as firms enter and drop out of the data set. Hence, by construction of the database, it is more difficult to identify the effect of the tax credit against fluctuations of sales over time. And, with respect to larger businesses, if their size is positively related to market power, they may be able to set higher prices for services qualifying for a tax credit.[42]

Columns (1) and (2) show the estimated effects on reported sales and the output-input ratio

[40]For a discussion of firm-size effects in tax evasion see Kleven, Kreiner, and Saez (2016).

[41]The audit probability in Germany increases strongly with firm size. Based on the recent report on auditing, the probably is around 1% for small firms, and above 20% for large firms. See Bundesministerium der Finanzen (2020).

[42]Table A-11 in the Appendix replicates Table 4, but as in Panel B of Table 3, removes the restriction of no firm entry after treatment.

for small partnerships, which, based on the number of observations, account for more than half of the basic estimation sample. The coefficient on taxable sales is considerably smaller, while the effect on the ratio is slightly larger for this type of firm – but rather imprecisely estimated in both cases. Excluding small partnerships and focusing on firms for which the reporting threshold is less of an issue in columns (3)-(4), we do find significant effects, both in economic and statistical terms. In particular, sales increase by 14.4 log points and the ratio of output to input taxes by 9.0 log points. Effects of similar size and significance are found for the subset of medium and large firms in columns (7)-(8), while corporations exhibit slightly larger sales and ratio responses as reported in columns (5)-(6). Overall, the effects are quite similar across subsamples.

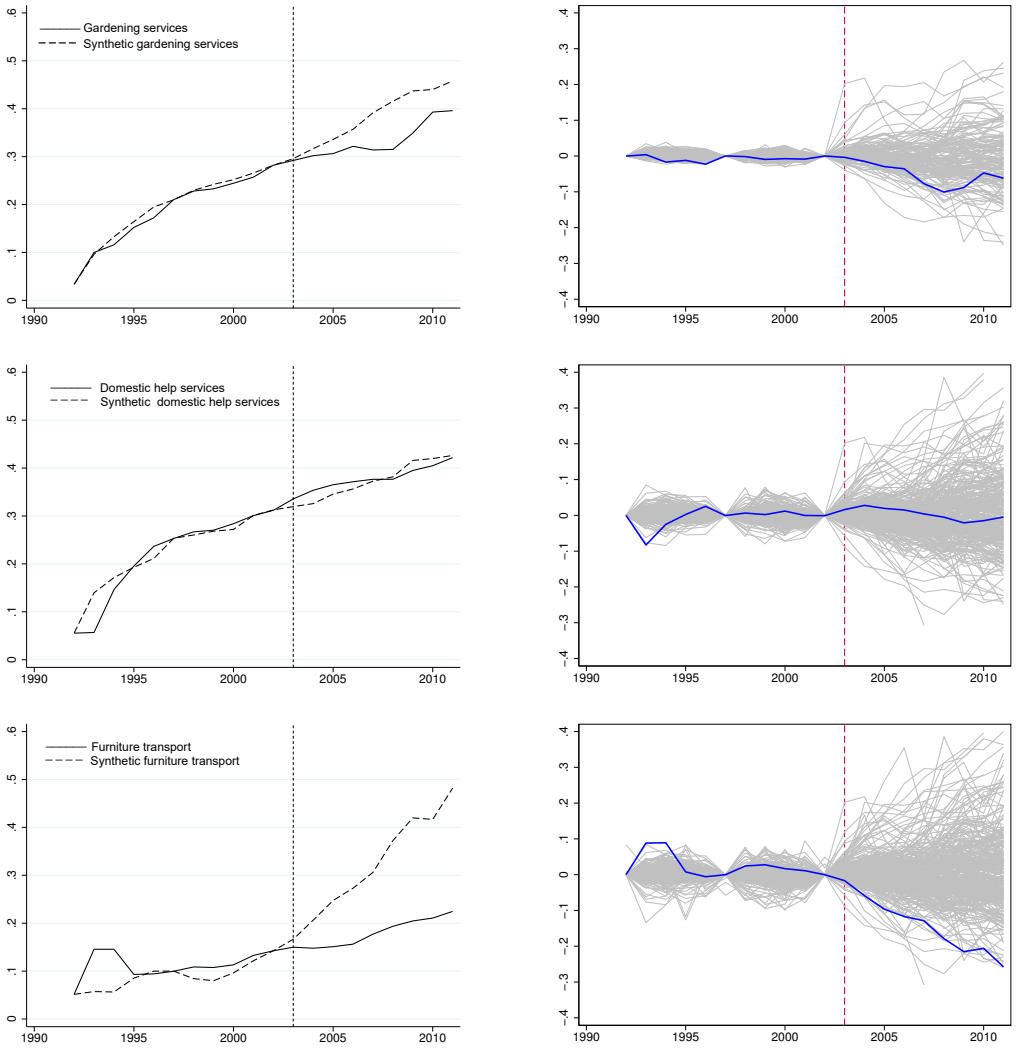
6.2 Price Effects

The previous section shows that the tax credit has not only led to an increase in reported sales, but also in the ratio of output to input taxes. Provided credit-induced price effects are limited, this would point to a shift from informal to formal sales. To shed further light on the matter we consider the price effects. Table 5 reports results from the estimation of eq. (5). Column (1) incorporates two separate treatment indicators, one for services qualifying for the credit in 2003 and one for those becoming eligible in 2006. Column (2) adds a second modified treatment dummy for services already subsidized in 2003, but for the years from 2006 onwards. This is meant to capture any response of these services to the increase in the credit's generosity in 2006. Lastly, column (3) focuses on craftsman services only.

The results indicate that the tax credit introduced in 2003 is not associated with a significant price effect. Moreover, it appears that the near doubling of the maximum credit amounts in 2006 for services first treated in 2003 leads to a price decrease of 3.8%. For craftsman services, however, we find that prices rise by close to 4%. Yet this estimate is imprecise.

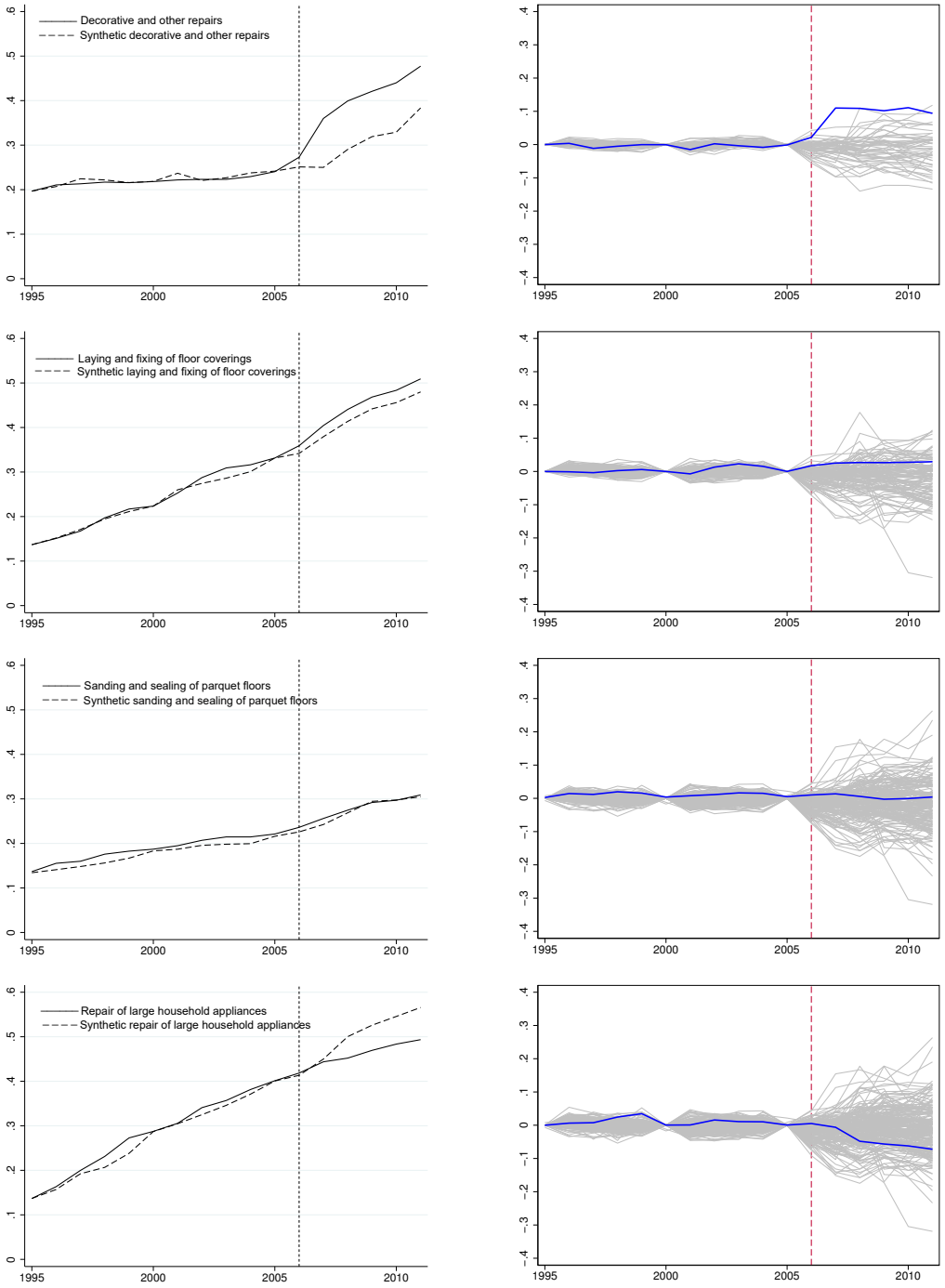
Turning to the alternative Synthetic Control Method (SCM), Figures 4 and 5 plot price

Figure 4: Price Indices and Synthetic Control Estimates, 2003 Reform



Notes: Left-hand side plots report the log price index for three services with COICOP-SEA classifications 04 440 35 100 ("Garden maintenance work"), 05 621 113 100 ("Domestic help services"), and 07 360 55 100 ("Furniture transport"). Right-hand side plots pertaining to the respective left-hand side categories report the estimated treatment effect (solid blue line) as well as placebo-effects obtained from a permutation of estimation across all products/services not eligible for a subsidy (gray lines). Note that the figures report only placebo estimates of treatment effects if the mean squared prediction error (MSPE) does not exceed the MSPE of the pre-treatment period for the treated service.

Figure 5: Price Indices and Synthetic Control Estimates, 2006 Reform



Notes: Left-hand side plots report the log price index for four services with COICOP-SEA classifications 04 320 50 00 ("Decorative and other repairs"), 05 120 90 100 ("Laying and fixing of floor coverings"), 05 130 50 100 ("Sanding and sealing of parquet floors") and 05 330 70 10 ("Repair of large household appliances"). Right-hand side plots pertaining to the respective left-hand side categories report the estimated treatment effect (solid blue line) as well as placebo-effects obtained from a permutation of estimation across all products/services not eligible for a subsidy (gray lines). Note that the figures report only placebo estimates of treatment effects if the mean squared prediction error (MSPE) does not exceed the MSPE of the pre-treatment period for the treated service.

Table 5: Consumer Price Response

	Household-related & craftsman services		Craftsman services
	(1)	(2)	(3)
Treat 2003	-0.030	0.003	
	(0.033)	(0.028)	
Treat 2003 (2006 expansion)		-0.038	
		(0.035)	
Treat 2006	0.040	0.039	0.039
	(0.026)	(0.026)	(0.026)
№ consumption categories	59	59	56
N	1,494	1,494	1,413

Notes: The dependent variable is the log of the price index. Columns (1) and (2) report results from the estimation of eq. (5) using all subsidized services. Column (3) focuses only on craftsman services. All specifications include COICOP category- and year-fixed effects. In all specifications, standard errors are clustered by the 10-digit COICOP code. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

developments and estimated treatment effects.[43] Figure 4 refers to the three services whose subsidization begins in 2003. The plots on the left-hand side depict the respective (log) price index and the synthetic control estimate (dashed line).[44] In two instances, price trends differ before and after the credit's implementation, but both estimates point at a decline of the price relative to the respective synthetic control. Quantitatively, in the first case, the price index displays a decrease after treatment by 5 to 10 log points. In the third case, the price decline is even larger.

To evaluate the significance of the estimated effects, we follow Abadie, Diamond, and Hain-

[43] In all cases the estimation of the synthetic control utilizes the average of the (log) price index of all product/services with the respective first two digits of the product classification.

[44] There are 5 donor COICOP categories with a positive weight for the synthetic control of "Garden maintenance work". Three of these, namely wallpaper, wallpaper paste, thinner and the like, and fishing license or similar receive a combined unit weight of 0.992. For "Domestic help services", the donor pool contains more than 50 categories, of which fees for flower and plant delivery, fishing license or similar, radio, television, or cable fee, and charge for gambling receive a combined weight of 0.437. Regarding "Furniture transport", the synthetic control consists of 5 donors, with car hire, luggage transport and storage, and flight ticket COICOP groups assigned a total weight of 0.906.

mueller (2010) and provide plots that juxtapose actual treatment effects with placebo estimates obtained by iteratively applying the SCM method to non-treated products/services in the same product group. As in Abadie, Diamond, and Hainmueller (2010), we only report placebo estimates of treatment effects if the mean squared prediction error (MSPE) does not exceed the MSPE of the pre-treatment period for the treated service. The right-hand side plots demonstrate that, in the first and third cases, the estimated treatment effects are small relative to the distribution of placebo estimates. Weighting the point estimates with the precision of the synthetic control in the pre-treatment period as suggested by equation (6), the average price change amounts to about -8 log points. Consistently with the regression estimates, the SCM also points at a price decrease for household-related services.

Figure 5 displays corresponding graphs for the group of four services first subject to a subsidy in 2006.[45] In two cases, price trends are quite similar to the synthetic control variable before and after treatment. In the fourth case, the price index change is below the synthetic control – the price decrease evolves gradually and amounts to 7 log points in the final reported year. Only in the first case, the price index increases by 10 log points starting in the second year post-treatment. Based on the corresponding top right-hand side plot, the estimated treatment effect is not captured well by the distribution of placebo estimates indicating that the presence of a positive price effect cannot be rejected for this service. Weighting the point estimates with the precision of the synthetic control in the pre-treatment period yields an average price increase of 2.7 log points.

[45]Two services, CC13-0432500100 "Carpentry work", and CC13-0432200200 "Electrician work", are excluded as, due to missing data, the pre-treatment period has only one observation. There are 6 donor COICOP categories with a positive weight for the synthetic control of "Decorative and other repairs", of which bottled liquified gas and parking fees obtain a total weight of 0.878. The synthetic control for "Laying and fixing floor coverings" includes 6 donors, with the largest weights given to locks, keys and fittings and cupboard element for fitted kitchen (0.847). With respect to "Sanding and sealing of parquet floors", the synthetic control comprises more than 50 units, of which flower and plant delivery fees, veterinary services, and services of photo laboratories or similar obtain a combined weight of 0.727. Lastly, there are 6 COICOP groups in the synthetic control of "Repair of large household appliances". Of these, cutlery, kitchen knives or similar, veterinary services, visit to a swimming pool, and contribution to legal-expense insurance receive a total weight of 0.895.

7 Tax Revenue Implications

This section conducts an evaluation of the tax revenue implications of the income tax credit, first deriving the aggregate revenue effect and then quantifying the contribution of a change of informality.

7.1 Total Revenue Effect

The total revenue outcome of the tax credit is given by

$$(\Delta\text{Output tax} - \Delta\text{Input tax}) \cdot \overline{\text{Firms}},$$

where ΔOutput tax is the annual total change in output taxes per firm caused by a combination of informality, demand and price effects. ΔInput tax is the annual total change in input taxes per firm driven by demand and price effects only, as we assume that input tax deductibility does not vary with informality. $\overline{\text{Firms}}$ is the average annual number of firms affected by the policy.[46]

The changes in output and input taxes are computed by evaluating the point estimates for the treatment effects with the mean values in the sample.[47] Formally,

$$\Delta\text{Output tax} = \left(e^{\beta_S} - 1\right) \underbrace{\left(\frac{11}{n + (11 - n)e^{\beta_S}}\right) \cdot \overline{\text{Output tax}}}_{\text{Counterfactual output tax}} \tag{7}$$

[46] Because the total number of firms that are subject to VAT (see samples B in last column of Table A-4 in the Appendix) likely overestimates participation due to missing spells prior to entry and after exit from the data, we consider the annual average a more accurate estimate of credit-eligible entities.

[47] The means of variables refer to Panels B of Table A-4.

$$\Delta\text{Input tax} = \left(e^{(\beta_S-\beta_R)}-1\right)\underbrace{\left(\frac{11}{n+(11-n)e^{(\beta_S-\beta_R)}}\right)\cdot\overline{\text{Input tax}}}_{\text{Counterfactual input tax}}. \tag{8}$$

In eq. (7), β_S is the point estimate of the treatment effect on output taxes in column (1) of Table 3, n is the number of pre-treatment years, which, given the eleven-year span of the VAT panel, is two for household related services, and five for craftsman services, while $\overline{\text{Output tax}}$ equals the average yearly output taxes of the treated sectors. Note that the last two terms in the expression reveal the counterfactual output VAT that would have been remitted by a treated firm in the absence of the tax credit. Turning to eq. (8), β_R is the estimated treatment effect on the output-input ratio, so that the difference $\beta_S - \beta_R$ captures the tax credit's effect on input taxes. Similarly to (7), $\overline{\text{Input tax}}$ is the mean input tax with the underbraced terms denoting its counterfactual value.

The equations yield a total increase in output and input taxes of 5,946 euro and 803 euro per firm, respectively. Lastly, there are on average 136,050(16,627) firms per year providing craftsman(household-related) services that are subject to the credit. Based on the above estimates, the implied aggregate revenue effect of the income tax credit amounts to 768.5 million euro. The next section imputes the share of the revenue gain attributable to lower informality and that stemming from market expansion and higher prices, and demonstrates that these shares depend on how the price effects are assumed to reverberate through the value chain.

7.2 Role of Informality

Equation (3) indicates that a (lower-bound) estimate of the induced shift from informal to formal sales can be obtained from the semi-elasticities β_S and β_R jointly with information on price effects and the ratio of informal to reported sales $\frac{I}{X-I}$. As the latter cannot be inferred from our data, we resort to estimates provided in the literature on tax evasion. According to Schneider and Enste (2000), empirical estimates of the size of the "shadow economy"

are highly sensitive to the chosen estimation approach. Using a combination of methods, Schneider (2017) estimates the share of unreported construction services in Germany at 0.27 in the years from 2012 to 2016, implying a ratio of informal to reported sales of 0.37.[48]

Regarding the revenue gain from market expansion and higher prices, in the absence of (differential) price trends in sales and input purchases, its magnitude coincides with the treatment effect on inputs. If prices on treated services change but input prices do not, this revenue gain needs to be adjusted upwards.

Table 6 explores the sensitivity of the estimated change in informal sales and the value of output to varying the assumption on how prices respond to the credit. According to the first column, without price effects, eq. (3) yields a 7.3 log-points decline in undeclared relative to reported sales.[49] In the second and third cases, guided by our findings on craftsman services in Section 6.2, which account for by far the largest share of tax credits,[50] we consider a price increase of 2.7 log points. If this price increase applies equally to output and input prices (see column (2)), there is no price adjustment of the sales-to-inputs ratio's estimate as in the previous case, but the outcome of the tax credit is more pronounced (-8.3 log points). The third column displays a scenario when the tax credit only affects output prices. In this case, the price effect contributes to an increase in the ratio and the informality effect is weakest (-4.6 log points).

As expected, the size of the revenue gain from market expansion and higher prices (see value of output effect) is equal in the first two cases (3.8 log points), and moves up if the price

[48] Clearly, as this number relates to the time-period after the tax credit was implemented, the actual ratio before implementation might well be higher.

[49] From equation (3): Inserting our estimates of β_S and β_R from Table 3 and the share borrowed from Schneider (2017) returns $-0.073 = -(1 + 0.37) \times 0.087 + 0.37 \times 0.125$.

[50] Craftsman services represent the vast majority of firms in the treatment group. Given the robustness of the SCM to compositional bias, we rely on the average price effect estimated via this approach to decompose the individual contributions of the compliance and market expansion effects. Footnote 51 below reports the changes in the relative shares of the two mechanisms when the price response is 3.9 log points as the differences-in-differences estimates suggest.

effect only applies to output prices (see column (3)). In all cases, the revenue gains reflect a market expansion, i.e. an increase of the output of the treated industries, which is largest when input prices are unaffected.

The table additionally separates the increase in taxes per firm into a compliance-driven change (Panel A) and a change driven by market expansion and higher prices (Panel B). In conjunction with the average number of firms, these estimates allow for the analogous separation of the aggregate revenue outcome. The total predicted annual increase in output taxes due to shifting from informal to formal sales ranges between 309-547 million euro. The estimates for the net revenue gain associated with market expansion and higher prices range between 221-459 million euro. Table 6 shows that the largest (smallest) revenue gain from a reduction in informality occurs when input and output prices respond equally (differentially) to the credit.[51]

With a total cost of 1,130 million euro[52], the loss of income tax revenues clearly exceeds the gain in VAT revenues: The combined effect is an annual revenue loss of 361 million euro, i.e. about two thirds (68%) of the direct cost of the personal income tax credit is recovered through a net increase of VAT revenues. Lower tax evasion alone, i.e. the shift from informal to formal sales, recovers between 27.3% and 48.4% of the cost.

While our analysis indicates that the income tax credit does not fully pay for itself via enhanced compliance, it is important to bear in mind that our estimates serve as lower-bounds of the effects due to the underlying assumption that VAT payments on inputs used in informal supplies are successfully reclaimed. Furthermore, the analysis abstracts from other

[51] Basing the calculation on the larger and imprecisely estimated effect of 3.9 log points increase in prices reported in Table 5, while not changing the total revenue effect, reduces the relative share of formalization, while strengthening the contribution of market expansion and higher prices. In the second case of proportionate price changes such that $\beta_P = \beta_Q = 3.9$, the % of the tax credit cost recouped through formalization effects falls to 41.6%. In the third case, the formalization effect diminishes by 7 percentage points to 20.3.

[52] The claimed income tax credits for household services in the years 2003-2011 are 159 million euro on average. The corresponding amount for craftsman services in the years 2006-2011 is 971 million euro.

Table 6: Revenue Effects of Tax Credits

	Price response: None $\beta_P = 0;\ \beta_Q = 0$ (1)	Price response: Proportionate $\beta_P = 2.7;\ \beta_Q = 2.7$ (2)	Price response: Output only $\beta_P = 2.7;\ \beta_Q = 0$ (3)
	A. Effects due to Improved Compliance		
Formalization effect	7.3	8.3	4.6
ΔOutput tax per firm (Euro)	3,142	3,554	2,005
Revenue Effect (Mill. Euro)	483.4	546.9	308.6
% from tax credit cost	42.8	48.4	27.3
	B. Effects due to Market Expansion and Higher Prices		
Value of output effect	3.8	3.8	6.5
(ΔOutput tax $-$ ΔInput tax) per firm (Euro)	2,001	1,589	3,138
Revenue Effect (Mill. Euro)	285.4	221.6	459.9
% from tax credit cost	25.2	19.6	40.7

Notes: The table reports estimated informality effects (in log points) indicating the increase in reported sales due to a shift from informal to formal sales, the estimated market expansion (in log points), annual increases in output taxes per firm stemming from better compliance in Panel A and the expansion of the value of output in Panel B due to market expansion and higher prices, and the corresponding aggregate revenue gains under three different scenarios: 1) when the tax credit results in no price response for treated services, in which case the semi-elasticities of output prices (β_P) and input prices (β_Q) are zero; 2) when prices of both output and input expenditures respond identically, in which case we set the semi-elasticities to 2.7 log points in line with the outcome of the SCM analysis performed in Section 6.2; 3) when only prices of treated services respond to the credit, but input prices remain constant. Formalization effects are calculated following eq. (3), where the semi-elasticities of sales (β_S) and the ratio (β_R), are 0.125 and 0.087, corresponding to the estimates in columns (1) and (2) of Table 3, while the ratio of informal to reported sales is 0.37 taken from Schneider (2017). In Panel A, the compliance-driven change in Δ(Output tax) is estimated based on eq. (7), but in the first term β_S is replaced with the respective value of the estimated informality effect. In Panel B, Δ(Output tax) $-$ ΔInput tax equals the total increase in output taxes net of changes in input taxes and the compliance-induced effect in Panel A. The revenue amounts in Panels A and B are obtained by multiplying the estimated annual increase in output taxes by the average yearly number of firms in the estimation sample, which are 136,050 craftsman and 16,627 household-related-service firms. The % of the cost of the tax credit recovered relates revenues to the cost of the tax credit (1.130 billion). Reported output taxes and revenues are averages over craftsman and household-related services.

relevant, potentially revenue-improving margins of adjustment. A shift from informal to formal service provision not only generates higher reported sales and, hence, higher output taxes, but it can also foster a transition from informal to formal employment, possibly associated with higher income tax and social security receipts. Second-order effects may further result in higher wages for formal employment. For a more complete picture on spillover effects on other revenues, it is important, therefore, to also study the formal employment effect of the credit, which we leave to future research. Besides higher reported employment, positive labor market effects can also be expected to arise due to the market expansion in the treated industries.

8 Conclusion

Measures that provide incentives for consumers to favor legal purchases and report previously untraceable transactions to tax authorities tackle VAT evasion at the final business-to-consumer stage. This paper focuses on a personal income tax credit for specific services. From a theoretical perspective, such a credit should obstruct evasion incentives at the last VAT stage by generating a third-party information trail. Our findings show that the introduction of a tax credit for hard-to-tax services in Germany has indeed reduced their informal provision.

Based on our analysis, the policy had led to a substantial increase in reported sales and VAT revenues. The total revenue effect of the tax credit is estimated to be 768.5 million euro. However, this effect cannot be solely attributed to changes in tax evasion, as it arises also from market expansion and price effects. To separate the contribution of the shift from informal to formal provision of services, we study also the ratio of output to input taxes and consumer prices. How the revenue gain is split between the different mechanisms also depends on how the price effect manifests upstream in the supply chain.

Our results indicate that up to half of the increase in reported sales can be ascribed to the

tax evasion margin – a lower-bound range is an increase of 5-8 log points, depending on the assumptions made on price effects. Contrasting the predicted increase in VAT revenues with the actual claims of income tax credits, we find that about two thirds of the revenue loss in income taxes is recouped through the associated increase in VAT revenues. Lower tax evasion alone, i.e. the shift from informal to formal sales, recovers between a quarter and half of the cost of the tax credit.

Fostering the formal economy is an important dimension of the design of tax systems. The proven effectiveness of the personal income tax credit in tackling informality and VAT evasion points to the potential of establishing connections between different taxes that improve the system of information reporting underlying effective tax enforcement. A unique feature of the tax-credit policy is that it induces formalization effects in one tax base through incentives provided in another base. Importantly, unlike reduced rates, these incentives do not increase the already high complexity of the European VAT systems. Further research is needed to explore whether a more precise targeting of tax credits to firms and consumers prone to VAT evasion could limit revenue losses and generate a larger shift from informal to formal sales. Another aspect worth studying is whether the improvement in VAT compliance affects the evasion dynamics of income taxes and social security contributions through changes in undeclared work. For an overall picture, it would therefore be necessary to look also at the interaction with these taxes and contributions.

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Appendix

Income Tax Credits for Consumer Services: a Tool for Tackling VAT Evasion?

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A.1 Empirical Predictions with Partial Input Tax Rebate

The derivation of the empirical predictions in Section 2 of the paper made use of the plausible but nevertheless restrictive assumption that all input taxes are refunded even if inputs are partly used for informal provision. This section shows how predictions change if only a fraction φ of the input taxes associated with informal sales provision is deducted ($0 < \varphi \leq 1$).

In this case, the ratio of output to input taxes is:

$$R \equiv \frac{\tau P\left(X-I\right)}{\tau Q \alpha_X \left(X-I+\varphi I\right)} = \frac{P}{Q\alpha_X}\left(\frac{X-I}{X-I+\varphi I}\right).$$

The semi-elasticity of this ratio with respect to σ ($\frac{1}{R}\frac{\partial R}{\partial \sigma}$) is:

$$\beta_R = \frac{1}{X-I}\left(\frac{\partial X}{\partial \sigma} - \frac{\partial I}{\partial \sigma}\right) - \frac{1}{X-I+\varphi I}\left(\frac{\partial X}{\partial \sigma} - (1-\varphi)\frac{\partial I}{\partial \sigma}\right) + \left(\beta_P - \beta_Q\right). \tag{A.9}$$

Using equation (1) to replace $\frac{\partial X}{\partial \sigma}$ in equation (A.9) allows us to infer the effect of the subsidy on informal sales from the semi-elasticities β_S, β_R, β_P and β_Q. Formally,

$$\frac{1}{X-I}\frac{\partial I}{\partial \sigma} = -\left(\frac{1}{\varphi} + \frac{I}{X-I}\right)\left(\beta_R - \beta_P + \beta_Q\right) + \left(\frac{I}{X-I}\right)\left(\beta_S - \beta_P\right). \tag{A.10}$$

If all input taxes are reclaimed such that $\varphi = 1$, this expression is equivalent to (3). However, if $\beta_R - \beta_P + \beta_Q > 0$, the decline of informal sales becomes stronger as φ declines.

A.2 Price Data

The price data is collected by the federal and state statistical offices as part of the regular reporting of consumer prices for the index of consumer prices (ICP) and the European harmonized consumer price index (HICP). The procedure is carefully designed to ensure representativity and accuracy. The statistical offices report that more than 300,000 individual prices are collected manually each month from retailers and service providers (see DESTATIS, 2021). For this purpose, the country is divided into 100 regions, in each of which representative providers are selected for all types of businesses with a market share greater than 5%. For each of the 578/645 types of goods at the 10-digit level, specific products are then selected according to detailed regulations that aim to ensure representativity and accuracy. The prices of these products are then collected by the survey officers typically on site. The price change is then computed by comparing the prices of the identical products on a monthly or annual basis. In general, the data reports sales prices. In the context of services, this means that the statistics do not reflect bid-prices or offers, but actual invoice prices.

Table A-1: Subsidy Rates and Credit Amounts

Definitions based on §35a EStG	01.01.2003	01.01.2006[1]	29.12.2007[2]	30.12.2008	01.01.2009[3]	14.12.2010[4]	01.01.2012
Household-related employment that is marginal employment as defined by §8a volume IV of the social insurance code	10% (510)	10% (510)	10% (510)	10% (510)	20% (510)	20% (510)	20% (510)
Household-related employment other than that defined in §8a	12% (2,400)	12% (2,400)	12% (2,400)	12% (2,400)	20% (4,000)	20% (4,000)	20% (4,000)
Household-related services that are not marginal employment	20% (600)	20% (600)	20% (600)	20% (600)			
Care and support services as well as expenses for placement in a home or permanent care*		20% (1,200)	20% (1,200)	20% (1,200)	20% (4,000)	20% (4,000)	20% (4,000)
Craftsman services regarding renovation, maintenance or modernisation of dwelling		20% (600)	20% (600)	20% (1,200)	20% (1,200)	20% (1,200)	20% (1,200)

Notes: The table reports the fraction of total services expenses eligible for income tax credit and maximum credit amounts in euro shown in parentheses for all eligible types of services.

*Care and support services have been favored under household-related services since the reform implementation in 2003, but with the "*Gesetz zur steuerlichen Förderung von Wachstum und Beschäftigung (WachsBeschStFördG k.a.Abk.)*" an own section in the act was implemented.

[1]Exception for supported services of the KfW-Bank (version §35a EStG a.F. until 2006.05.06).

[2]Not only domestic, but also EU and EEA households can claim income tax credit (version §35a EStG a.F. until 2007.12.29).

[3]Tax credits may be reduced if taxpayers cannot provide supporting documents within certain time limits (version §35a EStG a.F. until 2009.01.01).

[4]Expenses that are publicly supported do not qualify for an income tax credit (version §35a EStG a.F. until 2010.12.14).

Table A-2: Variables in the VAT Panel

Variable	Description
Total sales	Total sales of goods and services
Taxable sales	Taxable sales of goods and services
Taxable sales at 19%	Taxable sales of goods and services at standard rate
Taxable sales at 7%	Taxable sales of goods and services at reduced rate
Tax-free sales	Tax-free sales of goods and services
Tax-free sales zero	Zero-rated goods and services with credit for VAT on inputs
Intra-community	Zero-rated intra-community sales of goods and services (within EU)
Other	Zero-rated other sales of goods and services
Tax-free sales exempt	Tax-free sales of goods and services without credit for VAT on inputs (exempt goods and services)
Output tax	Output tax charged on the selling price of taxable goods or services
Output tax sales	Output tax on goods and services
Output tax intra-community	Output tax on intra-community sales of goods and services (within EU)
Input tax	Deductible VAT on inputs
Input tax sales	Deductible input VAT on the sales of goods and services
Input tax invoice	From invoices of other firms
Import vat	From customs, VAT levied at the border from extra-community sales of goods and services
Input tax intra-community	Deductible input VAT on inta-community sales of goods and services (within EU)

Notes: The table provides an exhaustive list and descriptions of the tax variables present in the German yearly firm-level VAT Panel. In addition, the data contains information on the federal state (Baden-Württemberg, Bavaria, Berlin, Brandenburg, Bremen, Hamburg, Hesse, Lower Saxony, Mecklenburg-Vorpommern, North Rhine-Westphalia, Rhineland-Palatinate, Saarland, Saxony, Saxony-Anhalt, Schleswig-Holstein, Thuringia) in which a firm is located, the legal business structure (partnerships, cooperations, commercial and industrial cooperatives, and other legal forms), and a five-digit industry classification (WZ1990, WZ2003, WZ2008).

Table A-3: Descriptive Statistics: Full Sample

	Mean (euros)	Median	S.D.	N
Total sales	1,572,861	90,163,906	105,362	33,699,769
Taxable sales	1,224,193	59,116,323	99,061	33,538,967
Taxable sales at 19%	1,081,411	55,606,565	82,674	32,998,977
Taxable sales at 7%	656,901	26,646,312	29,052	7,964,466
Tax-free sales	2,059,688	112,066,495	16,663	5,558,799
Tax-free sales zero	2,530,288	122,584,133	19,414	3,802,002
Intra-community	2,216,669	78,775,259	27,528	2,323,848
Other	1,627,911	77,818,803	13,063	2,745,395
Tax-free sales exempt	821,921	46,301,389	9,245	2,225,194
Output tax	228,336	13,299,646	15,936	33,563,725
Output tax sales	206,854	12,124,985	15,779	33,554,068
Output tax intra-community	157,688	5,591,465	1,333	4,418,971
Input tax	198,649	13,280,692	8,520	31,878,767
Input tax sales	165,760	9,866,756	8,253	31,851,909
Input tax invoice	152,758	8,749,510	8,206	31,806,032
Import vat	285,952	8,725,397	2,502	1,471,664
Input tax intra-community	162,461	5,672,551	1,290	4,268,622

Notes: The table shows descriptive statistics of the raw data for the period 2001-2011, covering a total of 6,271,517 observations. All variables are described in Table A-2. N denotes the number of firm-by-year observations.

Table A-4: Descriptive Statistics: Treated Sectors Before and After Sample Restrictions

	Mean (€)	Median	S.D.	N	N Firms
			Craftsman Services		
	A. No restrictions				
Taxable sales	389,712	141,829	3,112,459	2,255,130	358,151
Output tax	70,539	24,696	599,507	2,258,882	
Input tax	40,199	13,364	343,925	2,253,185	
	B. Institutional restrictions				
Taxable sales	270,807	131,128	554,350	1,438,344	237,912
Output tax	48,381	22,831	108,479	1,439,805	
Input tax	26,430	12,199	59,348	1,435,947	
	C. Post-treatment firm entry and institutional restrictions				
Taxable sales	281,487	143,314	543,828	1,185,626	137,071
Output tax	50,233	24,921	105,755	1,186,944	
Input tax	27,291	13,264	57,346	1,181,767	
			Household-related services		
	A. No restrictions				
Taxable sales	453,626	105,077	2,761,510	335,315	60,407
Output tax	78,804	17,590	491,127	335,333	
Input tax	28,951	7,080	159,252	330,571	
	B. Institutional restrictions				
Taxable sales	277,716	90,212	849,020	167,217	32,228
Output tax	49,027	15,732	153,871	167,217	
Input tax	15,915	5,496	47,670	164,497	
	C. Post-treatment firm entry and institutional restrictions				
Taxable sales	335,997	110,552	948,519	106,231	12,149
Output tax	58,633	18,973	169,228	106,058	
Input tax	18,087	6,410	50,651	104,450	

Notes: The table shows summary statistics per firm per year averaged across time and firms separately for craftsman services in the first part of the table and household-related services in the second part. Sub-panels A provide summary statistics for the raw samples of eligible industries. Sub-panels B show the resulting changes in the samples after the imposition of several institutional restrictions, namely only two types of legal forms are considered (partnerships or corporations); exporters, firms belonging to a VAT group and firms with any zero- or reduced-rated sales are excluded; first and last years of each firm (except 2001 and 2011) are dropped. Sub-panels C impose the additional restriction of removing firms entering the panel post-treatment. Sub-panels C therefore summarize the treatment group in the estimation sample. The sectoral shares in % in the restricted treated craftsman sample are erection of roofs (45.22.1), frames (45.22.3), and chimneys (45.25.3): 6.75, 4.66, and 0.42; scaffolding (45.25.4): 1.37; electrical installation (45.31.0): 13.66; insulation (45.32.0): 3.86; plumbing (45.33.0): 22.93; plastering (45.41.0): 4.35 and painting (45.44.1): 17.17; joinery installation (45.42.0): 10.57; laying out, repair, and maintenance of floors (45.43.1, 45.43.2, 45.43.3, 45.43.4, 45.43.5, 45.43.6): 0.71,6.82, 0.65, 3.26, 0.08, 2.54; disinfection and pest control (74.70.4): 0.021. The sectoral shares in % in the restricted treated household services sample are gardening (01.41.2): 59.96; caretaker services (70.32.0): 3.65; cleaning (74.70.1): 36.39. Tables A-6 and A-7 show the corresponding industry descriptions. N denotes the number of firm-year observations. N Firms are a total number of firms.

Table A-5: Descriptive Statistics: Control Sectors Before and After Sample Restrictions

	Mean (€)	Median	S.D.	N	N Firms
	A. No restrictions				
Taxable sales	314,350	90,646	4,079,443	4,120,273	801,505
Output tax	48,151	13,640	550,450	4,121,442	
Input tax	29,060	7,254	385,199	4,070,166	
	B. Institutional restrictions				
Taxable sales	175,363	72,760	875,913	947,088	201,759
Output tax	32,652	12,562	182,352	973,481	
Input tax	15,446	4,749	97,301	951,802	
	C. Post-treatment firm entry and institutional restrictions				
Taxable sales	162,444	74,806	761,890	748,768	91,674
Output tax	29,224	12,873	145,748	748,890	
Input tax	13,816	4,635	82, 545	732,375	

Notes: The table shows summary statistics per firm per year averaged across time and firms for industries in the control group. Panel A provides summary statistics of the raw sample. Panel B imposes the same institutional restrictions outlined in Table A-4. Panel C shows the resulting changes in the sample once firms entering the panel post-treatment are not taken into account in addition to the institutional restrictions. Panel C therefore summarizes the control group in the estimation sample. The sectoral shares in % in Panel C are hairdressing (93.02.5): 49.22; repair of motor vehicles (50.20.3): 2.22; washing of motor vehicles (50.20.4): 1.01; other maintenance of motor vehicles (50.20.5): 12.71; restaurants with service (55.30.1): 6.49; public houses (55.40.1) 6.99; earth moving (45.11.2): 2.55; glazing (45.44.2): 2.19; demolition (45.11.1): 1.36; hotels (55.10.1): 1.03; inns (55.10.3) 1.66; real estate developing (70.11.3): 1.15. The remaining 11.42% belong to the other industries in the group outlined in Table A-8. N denotes the number of firm-year observations. N Firms are a total number of firms.

Table A-6: Service-to-Industry Matching and Treatment Assignment in 2003

Eligible services	WZ 2003 Code	WZ 2003 Description	WZ 2008 Code	WZ 2008 Description	COICOP-SEA Code	COICOP-SEA Description
Gardening	01.41.2	Laying out, planting & maintenance of gardens, parks & green areas	81.30.1	—'—	04 440 35 100	Garden maintenance work
Removal services	60.24.5†	Commercial freight haulage subject to permit	49.42.0†	Removal services	07 360 55 100	Furniture transport
	60.24.6†	Road haulage not subject to permit or optional	49.42.0†	–"–		
Caretaker services	70.32.0†	Management of real estate on a fee or contract basis	81.10.0†	Combined facilities support activities		
Cleaning	74.70.1†	Cleaning of buildings, rooms & equipment	81.21.0†	General cleaning of buildings	05 621 13 100	Domestic help services
Child care	95.00.2*	Private households employing domestic personnel for child care	97.00.0*	Activities of households as employers of domestic personnel		
Other household work	95.00.3*	Private households employing domestic personnel for other purposes	97.00.0*	–"–	05 621 13 100	–"–

The first column lists tax-credit-eligible services in 2003 under §35a EStG as outlined in Bundesregierung, 2010. The remaining columns provide the code and description of the closest matching industries in the VAT panel, both in their WZ2003 and WZ2008 classifications, and closest matching COICOP categories. Within a column, –"– signifies an identical description to the immediately preceding one. Within a row, —'—signifies an identical description to a preceding one. How treatment is assigned in the VAT panel is indicated by superscripts on codes. No superscript means that treatment is determined on the basis of Case I, as explained in Table 1. Codes marked with † show treatment assignment following Case III in Table 1, i.e. WZ2003∩WZ2008 conditional on a firm's first year in the data being prior to 2009, and its last year – in or after 2009. Codes marked with asterisks are industries, which are not present in the VAT panel, but are listed for the sake of completeness.

Table A-7: Service-to-Industry Matching and Treatment Assignment in 2006

Eligible services	WZ 2003 Code	WZ 2003 Description	WZ 2008 Code	WZ 2008 Description	COICOP-SEA Code	COICOP-SEA Description
Roof work; garage work; gutter cleaning; carport; patio covering	20.30.1†	Manufacture of wooden goods intended to be used primarily in the construction industry	43.91.2†	Erection of frames & constructional timber works		
			43.32.0†	Joinery installation		
	45.22.1	Erection of roofs, roof covering & related plumbing work	43.91.1	—'—		
	45.22.3†	Erection of frames & constructional timber work	43.91.2†	—'—		
	45.25.3	Erection of chimneys & industrial ovens	43.99.2	—'—		
Scaffolding set-up	45.25.4†	Scaffolds & work platforms erecting & dismantling	43.99.1†	—'—		
Repair, maintenance & installation of electrical systems & of heating systems	45.31.0†	Installation of electrical wiring & fittings	43.21.0†	Electrical installation	04 322 00 200	Electrician work
	45.33.0	Plumbing	43.22.0†	Plumbing, heat & air-conditioning installation		
Thermal insulation	45.32.0	Insulation work activities	43.29.1	—'—		
Work on facade, interior, exterior walls; water, fire damage; fungus control	45.41.0	Plastering	43.31.0	—'—		
	45.44.1	Painting and lacquering	43.34.1	—'—	04 320 50 000	Decorative repairs & other repairs

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Repair, maintenance of windows & doors, closet repair	45.42.0§	Joinery installation	43.32.0	—'—	04 325 00 100	Carpentry work
Repair, maintenance, replacement, modernization of floor coverings	45.43.1	Laying of parquet & other wooden floor coverings	43.33.0	Floor and wall covering	05 130 50 100	Sanding & sealing of parquet floors
	45.43.2	Laying of wall or floor tiles	43.33.0	–"–	05 120 90 100	Laying & fixing floor coverings
	45.43.3	Floor screed works	43.33.0	–"–		
	45.43.4	Other floor laying & pasting	43.33.0	–"–		
	45.43.5	Wall papering	43.33.0	–"–		
	45.43.6	Equipping of rooms without specialization	43.33.0	–"–		
Repair & maintenance of household items	52.72.1§	Repair of electrical household goods (excl. radio & television goods)	95.22.0	Repair of household appliances & home and garden equipment	05 330 70 100	Repair of large household appliances
Chimney sweeping	74.70.2	Chimney-sweeping	81.22.1	—'—	04 440 32 100	Chimney-sweeping fees
Pigeon, pest & vermin control	74.70.4	Disinfecting & pest control	81.29.2	—'—		

The first column lists tax-credit-eligible services in 2006 under §35a EStG as outlined in Bundesregierung, 2010. The remaining columns provide the code and description of the closest matching industries, both in their WZ2003 and WZ2008 classifications, and closest corresponding COICOP categories. Within a column, –"– signifies an identical description to the immediately preceding one. Within a row, —'—signifies an identical description to a preceding one. How treatment is assigned in the VAT Panel is indicated by superscripts on codes. No superscript means that treatment is determined on the basis of Case I, as explained in Table 1. Codes marked with † show treatment assignment following Case III in Table 1, i.e. WZ2003∩WZ2008 conditional on a firm's first year in the data being prior to 2009, and its last year – in or after 2009. Industries whose codes are marked with § are assigned into treatment following Case II. Even though present in the VAT panel, and listed above, the service of chimney sweeping is not included in the empirical analysis. For insurance purposes, home-owners need to save invoices and prove payment for chimney sweeping, which implies zero treatment effect as payment and invoice requirements under §35a EStG are already met.

Table A-8: Industries with High Level of Noncompliance (Control Group)

	WZ 2003		WZ 2008		COICOP-SEA
Industry	Code	Description	Code	Description	Code
Meat industry	15.11.1	Production & preserving of meat, except rendering of edible fats of animal origin	10.11.0	Processing & preserving of meat	01 112 10 100 01 112 20 100
	15.11.2	Rendering & processing of edible fats of animal origin	10.11.0	–"–	... 01 112 72 100
	15.12.0	Production & preserving of poultry meat	10.12.0	—'—	
	15.13.0†	Production of meat & poultry meat products	10.13.0†	—'—	
	15.13.0†	–"–	10.85.0†	Manufacture of prepared meals & dishes	
Repair of motor vehicles	50.20.3	Spraying & painting of motor vehicles	45.20.1	—'—	07 230 15 100
	50.20.4	Washing, polishing, etc. of motor vehicles	45.20.2	—'—	07 230 15 100 07 230 17 000
	50.20.5	Maintenance & repair of motor vehicles (excl. spraying, painting & washing of motor vehicles)	45.20.3	Maintenance & repair of motor vehicles with a weight not exceeding 3.5 tons (excl. spraying, painting & washing of motor vehicles)	07 230 18 100
	50.20.5	–"–	45.20.4	Maintenance & repair of motor vehicles with a weight exceeding 3.5 tons (excl. spraying, painting & washing of motor vehicles)	
Passenger and freight operations/ transportation	60.22.0	Taxi operation	49.32.0	—'—	07 320 31 100
	60.23.1	Non-scheduled passenger transport by motor bus	49.39.2	—'—	
	60.24.5†	Commercial freight haulage subject to permit	49.41.0†	Freight transport by road	
	60.24.6†	Road haulage not subject to permit or optional	49.41.0†	–"–	
Hairdressing	93.02.5	Hairdressing	96.02.1	—'—	12 110 11 100, 12 110 11 200, 12 110 15 000

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Construction	45.11.1	Demolition & wrecking of buildings & other structures	43.11.0	Demolition
	45.11.2	Earth moving	43.12.0	Site preparation
	45.11.4	Development & preparation of mineral properties; back-filling of disused sites	43.12.0	–"–
	45.12.0	Test drilling & boring	43.13.0	—'—
	45.23.1	Construction of motorways, streets, roads, airfield runways & sport facilities	42.11.0	Construction of roads & motorways
	45.23.1	–"–	42.99.0	Construction of other civil engineering projects n.e.c.
	45.23.2	Construction of railways	42.12.0	Construction of railways & underground railways
	45.21.3	Erection of complete prefabricated constructions of concrete from self-manufactured parts	41.20.2	Assembly & erection of prefabricated constructions
	45.21.4	Erection of complete prefabricated constructions of concrete from purchased parts	41.20.2	–"–
	45.21.5	Erection of complete prefabricated constructions of wood or plastics from purchased parts	41.20.2	–"–
	45.21.6	Construction of bridges, tunnels, etc.	42.13.0	Construction of bridges and tunnels
	45.21.7	Construction of pipelines, installation of communication & power lines & ancillary urban works in civil engineering	42.21.0	Construction of utility projects for fluids
	45.21.7	Construction of pipelines, installation of communication and power lines & ancillary urban works in civil engineering	42.22.0	Construction of utility projects for electricity and telecommunications
	45.24.0	Construction of water projects	42.21.0	Construction of utility projects for fluids
	45.24.0	–"–	42.91.0	Construction of water projects
	45.25.1	Water well drilling and construction	42.21.0	–"–
	45.44.2	Glazing	43.34.2	—'—
	70.11.1	Development of land not built-on	41.10.1	—'—
	70.11.2	Activities of real estate developing companies dealing with non-residential buildings	41.10.2	Development of building projects for non-residential buildings
	70.11.3	Activities of real estate developing companies dealing with residential buildings	41.10.3	Development of building projects for residential buildings

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Hotels &	55.10.1 Hotels (excl. hotels with B&B only)	55.10.1 —'—	
	55.10.2 Hotels providing bed & breakfast only	55.10.2 —'—	11 200 10 000,
restaurants	55.10.3 Inns	55.10.3 —'—	11 200 41 100,
	55.10.4 Guest houses	55.10.4 —'—	11 200 50 200,
	55.21.0 Youth hostels & mountain refuges	55.20.4 —'—	11 200 70 100
	55.21.0 –"–	55.30.0 Camping grounds, recreational vehicle parks and trailer parks	
	55.22.0 Camping sites, including caravan sites	55.30.0 –"–	
	55.23.1 Recreation & holiday homes	55.20.1 —'—	
	55.23.2 Holiday centres	55.20.2 —'—	
	55.23.3 Chalets & holiday flats	55.20.3 —'—	
	55.23.4 Private accommodation	55.90.1 —'—	
	55.23.6 Boarding houses	55.10.1 Hotels (excl. hotels with B&B only)	
	55.23.6 –"–	55.10.2 Hotels providing B&B only	
	55.23.7 Other provision of lodgings n.e.c	55.90.9 Other accommodation n.e.c.	
	55.30.1 Restaurants with service	56.10.1 Full-service restaurants	11 110 11 000,
	55.30.2 Self-service restaurants	56.10.2 —'—	11 110 12 000
	55.30.3 Cafés	56.10.4 —'—	11 110 13 000
	55.30.4 Ice-cream parlors	56.10.5 —'—	11 110 14 000
	55.30.5 Snack bars	56.10.3 Snack bars & the like	11 110 16 000
	55.40.1 Public houses	56.30.1 —'—	11 110 17 000
	55.40.3 Discotheques & bars with dancing	56.30.2 —'—	11 110 51 000
	55.40.5 Bars	56.30.3 —'—	11 110 52 000
	55.40.6 Bars with entertainment	56.30.4 —'—	11 110 53 000
	55.40.7 Other bars	56.30.9 —'—	11 110 54 000
	55.51.0 Canteens	56.29.0 Other food service activities	11 110 55 000
	55.52.0 Catering	56.10.1 Full-service restaurants	11 110 56 000
	55.52.0 –"–	56.10.2 Self-service restaurants	11 110 57 000
	55.52.0 –"–	56.21.0 Event catering activities	
	55.52.0 –"–	56.21.0 Other food service activities	

The table lists the codes and descriptions of industries with high number of labor-related and tax offenses as outlined in Bundesregierung (2009). These are also the industries with the highest number of fines for illegal employment and evasion, which, however, do not provide tax-credit-eligible services. The closest corresponding COICOP categories are also listed. Within a column, –"– signifies an identical description to the immediately preceding one. Within a row, —'—signifies an identical description to a preceding one. How the industry classification change from WZ2003 to WZ2008 is handled in the VAT panel is indicated by superscripts on codes, identically to procedure in Tables A-6 and A-7.

Table A-9: Claimed Tax Credits, 2003-2013

	Number of taxpayers (in '000)			Claimed tax credits (in m. €)		
Year	Marginal employment	Household-related services*	Craftsman services	Marginal employment	Household-related services*	Craftsman services
2003	28.97	138.26	–	4.85	29.16	–
2004	68.57	235.13	–	13.69	46.41	–
2005	90.90	422.11	–	18.39	74.65	–
2006	123.41	966.55	3,260.26	22.09	94.74	542.06
2007	144.93	1,462.31	4,808.13	25.30	123.37	663.73
2008	166.28	1,849.73	5,936.49	28.59	151.32	797.01
2009	201.26	2,083.10	7,065.18	54.71	272.99	1,178.36
2010	219.37	2,329.22	7,715.01	60.45	302.51	1,248.46
2011	234.01	2,577.42	8,379.63	65.42	336.81	1,394.42
2012	245.24	2,801.90	8,969.22	69.24	368.28	1,483.83
2013	258.07	3,005.99	9,275.13	72.06	396.76	1,527.93

Notes: The table shows the number of taxpayers claiming tax credits by type of service under §35a EStG as well as the actual volume of tax credits from 2003 until 2013.
*Household-related services include services provided as part of a social insurance-based employment relationship between the service provider and the household. Data source: German Federal Statistical Office, own calculations.

Table A-10: Response of Declared Sales and Ratio: Statistical Inference

	Household-related and craftsman services		Craftsman services	
	ln Sales (1)	ln Ratio (2)	ln Sales (3)	ln Ratio (4)
Treat	0.125	0.087	0.117	0.098
$n(5) \cup i$	$(0.055)^{**}$	$(0.051)^{*}$	$(0.055)^{**}$	$(0.049)^{**}$
$n(5)$	$(0.059)^{**}$	(0.054)	$(0.059)^{**}$	$(0.052)^{*}$
$n(4)$	$(0.056)^{**}$	(0.057)	$(0.057)^{**}$	$(0.053)^{*}$
$n(4) \cup i$	$(0.053)^{**}$	(0.054)	$(0.053)^{**}$	$(0.050)^{*}$
N	2,001,522	1,974,874	1,927,176	1,902,822
№ firms	238,081	235,658	221,540	219,638

Notes: The table replicates the first part of Table 3 and for convenience repeats the standard errors for the baseline level of two-way clustering by five-digit industry code ($n(5)$) and firm (i) reported under the estimate, and additionally reports standard errors clustered in three different ways: only at $n(5)$-level, at a four-digit industry code $n(4)$, and two-way by $n(4)$ and firm-level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A-11: Response Heterogeneity by Legal Form and Firm Size: Unrestricted Firm Entry

	Small Partnerships		All Except Small Partnerships		Corporations		Medium to Large Firms	
	ln Sales (1)	ln Ratio (2)	ln Sales (3)	ln Ratio (4)	ln Sales (5)	ln Ratio (6)	ln Sales (7)	ln Ratio (8)
Treat	0.084	0.110	0.144^{**}	0.090^{**}	0.159^{***}	0.100^{***}	0.145^{**}	0.090^{**}
	(0.057)	(0.066)	(0.057)	(0.036)	(0.052)	(0.028)	(0.058)	(0.036)
N	1,321,178	1,293,195	969,974	968,496	317,224	316,353	896,539	896,009
№ firms	231,790	227,975	150,768	150,508	46,421	46,300	141,597	141,486

Notes: The dependent variable is either the log of taxable sales ($\log Sales$), or the ratio of output to input taxes, ($\log Ratio$). The table reports results for different sub-samples of treated firms in 2006: columns (1) and (2) refer to small partnerships; columns (3) and (4) to all firms except small partnerships; columns (5) and (6) to corporations; and columns (7) and (8) to medium-to-large firms. All specifications include firm-, year-, state-year, industry-year, and legal-form-year fixed effects, which are not reported. Standard errors, shown in parentheses, are clustered at a 5-digit industry level. N are firm-by-year number of observations.* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.