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Abstract

We investigate whether firms engage in VAT evasion at the retail stage—typically a point of weakness in VAT systems—in a high-enforcement, low-informality setting. To measure evasion, we exploit a reform of VAT rules (the reverse charge, RC) whereby retailers do not only remit taxes on their own value-added, but on that created along the entire supply chain, increasing their incentive to evade. Using German administrative firm-level VAT return data and an instrumental variable approach based on RC's staggered introduction, we find no evidence of greater evasion under RC. Our results suggest that evasion at the retail stage might not be quantitatively important in high-enforcement and low-informality settings, implying little need to enlist consumers in tax enforcement to boost tax compliance.

JEL Classification: H21; H26; D22
Keywords: Value Added Tax; VAT; Reverse Charge Mechanism; Tax Evasion; Withholding; Last- Mile Problem

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1 Introduction

More than 160 countries around the world impose a value-added tax (VAT), which raises on average a third of the tax revenues (De Mooij and Swistak, 2022). The popularity of VAT as a tax instrument is linked to its self-enforcing properties (e.g., Pomeranz, 2015; Naritomi, 2019; Waseem, 2022). First, an effective form of third-party reporting ensues from independent reporting of each transaction by both the buyer and the seller—who have asymmetric reporting incentives. Second, VAT is incrementally collected along the value chain, preventing collection at a unique point and thus protecting upstream VAT revenues.

However, third-party reporting does not take place at the retail stage, when businesses sell to consumers (B2C transactions), because consumers do not have to report to the tax authorities for VAT purposes. This offers firms an opportunity to commit tax evasion by under-reporting their (B2C) sales to the tax authorities, and thus not fully remitting the VAT charged to consumers—the so-called *last-mile problem* (Slemrod, 2007). The last-mile problem has been found to be important in a range of developing countries, which have implemented strategies to combat it that typically extend the chain of third-party reporting to B2C transactions, by incentivizing consumers to collect receipts (Naritomi, 2019; Naritomi, Nyamdavaa, and Campbell, 2025).

In this paper, we investigate whether the last-mile problem is quantitatively important in a high-enforcement and low-informality setting, in which consumers are not enlisted in tax enforcement.

To answer this question, we exploit a reform of VAT rules that increases the incentive to evade VAT at the retail (B2C) stage, the "reverse charge" (RC) mechanism. This reform shifts the VAT liability for B2B transactions of selected products from the seller to the buyer, removing the withholding and remittance of taxes along the value chain for these products (e.g., De La Feria, 2019; Buettner and Tassi, 2023). Under RC, tax collection exclusively takes place at the retail stage, at which point retailers charge VAT to consumers and remit it to the tax authorities. Crucially, the retailer does not only remit taxes on the value-added it generates itself (unlike under standard VAT rules), but on the value-added created along the entire supply chain. Reverse charge, in other words, transforms VAT into a retail sales tax (Keen and Smith, 2006; De La Feria, 2019). Hence, evasion becomes more profitable under RC, arguably aggravating the last-mile problem. So, from a theoretical perspective, RC might increase evasion by retailers, which we investigate empirically by analyzing if their reported sales decline under RC.

RC has been implemented by all European Union (EU) member states for certain products in order to curb another type of VAT fraud involving international transactions.[1] For details on this class of fraud, which is not the focus of this paper, see Bussy and Tassi (2025). Here, we focus on Germany, where RC was implemented for a variety of products over the years 2011-2014. The economic value of transactions affected by the policy is substantial. In 2018, for example, the sales falling under RC accounted for around 330 billion euros, just below 10% of German GDP.

We use data from the German VAT panel (2002-17), a firm-level data set that covers the universe of VAT declarations. The data set enables us to identify retailers buying and selling products that fall under the scope of reverse charge. To identify the causal effects of RC, we employ a fixed-effects instrumental variable (IV) model. The IV approach exploits the institutional variation in the adoption of RC, based on the staggered introduction of RC in certain industries. In a nutshell, the introduction of RC in a certain industry is used to predict the intensity of the reform and the value of upstream transactions no longer subject to regular VAT, captured by the inputs subjected to RC, at the firm level. The instrument thus helps isolate the effects of the reform from market dynamics that simultaneously affect inputs and outputs (sales).

The results show that RC-affected retailers do not report lower sales, suggesting that firms do not engage in more evasion despite increased incentives to do so. This indirectly indicates that the last-mile problem is not quantitatively important in this high-enforcement and low-informality setting.

The main results are robust to a battery of tests, in which the group of non-affected industries is refined or matched to the group of affected industries or alternative outcomes are considered. Moreover, additional results from alternative industry-level data are consistent with the main findings. Finally, we look into the firm characteristics that might interact with the propensity to evade, also given other evasion strategies available to the retailer, but we do not find evidence of evasion in any of the subsamples.

[1] RC was initially planned as a temporary measure, but its scope has been extended to a longer period, multiple times. Recently, the adoption of reverse charge has been extended until the end of December 2026 (Official Journal of the European Union, 2022).

Even though the results appear to contradict the baseline expectations and the literature on the self-enforcing properties of VAT, the discussion shows that the null findings are consistent with high enforcement settings, where products are predominantly sold in environments in which transactions are difficult to conceal, e.g., due to electronic payments or because of consumer warranty concerns. The high level of deterrence present in such settings may curb the increase in incentives to evade more (Waseem, 2022).

This paper contributes to the existing literature in several ways. First, this paper relates to the literature on the last-mile problem in VAT compliance, whereby B2C transactions are more prone to evasion (Pomeranz, 2015). Our results suggest that in a high-enforcement, low-informality setting where transactions are strictly monitored up to (but excluding) the retail stage, the last-mile problem does not appear to be quantitatively important, thus potentially avoiding the need to enlist consumers in tax enforcement (Naritomi, 2019; Naritomi, Nyamdavaa, and Campbell, 2025).

Second, this paper relates to the literature on the role of tax remittance liability. Slemrod (2008) points out that the standard (textbooks') "irrelevance proposition" might not hold in practice. That is, who remits the tax matters for the economic incidence of taxation and its efficiency. The different opportunities for evasion and avoidance, and the enforcement technology might affect market equilibria, tax incidence, and efficiency (Slemrod, 2008). A recent and growing strand of the literature explores (empirically) the effects of changes in tax remittance rules. Kopczuk et al. (2016) study evasion and pass-through of state diesel taxes. They find that moving the point of tax collection upstream is related to a greater reported volume of taxed gallons, which could be interpreted as decreased tax evasion by retailers. Garriga and Tortarolo (2024) study the effects of reforms to turnover tax withholding in Argentina, documenting that firms affected by more upstream withholding become more tax compliant. The evidence related to changes in tax liability in the context of VAT is still scant. Importantly and differently from the rest of the literature, we investigate the effects of concentrating tax collection downstream, in a setting where multiple agents had been liable for tax remittance before the introduction of the reform.

Third, the literature on the effects of reverse charge is still sparse and recent work has mostly focused on the effectiveness of RC in preventing cross-border VAT fraud. Buettner and Tassi (2023) discuss how RC can stop VAT cross-border fraud and estimate that the volume of VAT fraud was close to 5% of VAT revenues in Germany, before the introduction of the reform. Bussy and Tassi (2025) and Stiller and Heinemann (2024) show that RC reduces reporting gaps between intra-community imports and exports, and estimate cross-border fraud to be around 0.05-0.2% of VAT revenues in the EU; and the latter additionally discuss and investigate fraud relocation across EU member states. Heinemann (2025) offers some evidence consistent with cross-border fraud removal using firm-level, financial accounting data for multiple EU countries. Other recent work has focused on the construction sector, showing increased VAT compliance after RC implementations (Cipullo et al., 2024; Junttila, Koivisto, and Nivala, 2024). In contrast to the previous literature, we shift the focus from VAT cross-border fraud to VAT evasion at the retail stage. The novel research question guiding this paper is whether RC aggravates VAT noncompliance at the retail stage or not, which has important policy implications. Some early evidence from cross-country analyses shows that RC is not related to an improvement of VAT collection efficiency (Madzharova, 2020; Holá, Arltová, and Zídková, 2022). A candidate explanation could be that domestic VAT evasion (the focus of this paper) increases at the same time as cross-border fraud declines. Our results suggest that this is not the case.

Finally, this paper complements the literature on VAT roll-out and evasion. Asatryan and Gomtsyan (2020) find that large retailers brought into the VAT net in Armenia are less likely to comply with the law and to print receipts. Waseem (2022) finds that an upstream extension of VAT in the supply chain in Pakistan causes a large increase in reported sales by firms downstream, providing some evidence for the importance of the withholding mechanism of VAT. More generally, Agrawal and Zimmermann (2025) investigate the effects of switching from a sales tax to a VAT, in India. First, while these papers focus on the roll-out of VAT, we shed some light on a reform that generates a radical change in the VAT system. These findings might be an important first step in understanding whether the effects of rolling-out or departing from VAT on evasion are symmetrical. Second, differently from these papers, we focus on a developed economy. In contrast to developed economies, developing economies are settings of low enforcement and high informality (Waseem, 2023). They also lag behind with respect to the administrative and auditing infrastructures (Harrison and Krelove, 2005).

The remainder of this paper is structured as follows. In Section 2, we introduce the last-mile problem and explain how RC can exacerbate it. Section 3 describes the implementation of RC in Germany. In Section 4 we lay out our empirical strategy and the identification challenges we face. Data is described in Section 5, and the results are in Section 6. Section 7 discusses the results and

Section 8 concludes.

2 The last-mile problem

To understand how reverse charge works and why it can affect tax compliance at the retail stage, it is important to understand how it affects tax liability, tax remittance, and the reporting of sales and inputs. This section starts by outlining the reporting rules before and after the introduction of reverse charge, and then discusses the effects on tax evasion.

2.1 Standard VAT reporting rules

Let us consider the example of a simple supply chain, further illustrated in Figure 1.[2] Under regular VAT rules, a producer sells a good and collects output VAT, which they remit to the tax authorities.[3] The buyer, a wholesaler, further sells the good to a retailer. The wholesaler collects output VAT from the retailer, deducts the paid input VAT and remits the net VAT payment to the tax authorities. The retailer sells the good to a final consumer and collects output VAT, which they remit to the tax authorities, after deducting paid input VAT. The final consumer is not involved in tax remittance and does not provide any third-party reporting.

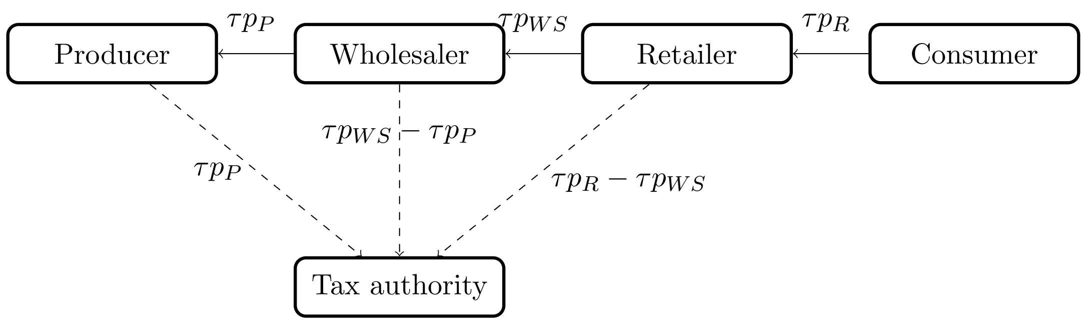
2.2 Reporting rules under reverse charge

Reverse charge shifts the VAT liability from the seller to the buyer in B2B transactions and it applies at the product level. For example, if the legislator establishes that a good is to be sold under reverse charge, all agents involved in the sale and purchase of the good are affected by reverse charge. As described next, reverse charge affects the staggered nature of VAT collection. In particular, reverse charge affects the withholding mechanism of VAT, since sellers are no longer collecting VAT from their buyers.

[2] Figure 1 shows the VAT payment to the upstream seller and the VAT remittance to the tax authority by each agent. Appendix Table B1 describes the transactions, the VAT payments, remittances, and deductions in more detail.

[3] To simplify our arguments, we assume that the producer does not need to source any inputs from suppliers.

Figure 1: VAT chain – a simple illustration



Notes: The trade flow starts from the producer, who sells the product to the wholesaler. The wholesaler sells the product to the retailer, who in turn sells the product to the final consumer. For simplicity we can assume that only one unit of the good x is sold or purchased. The continuous arrows represent the (input) VAT payments to the upstream seller. The dashed arrows represent the VAT remittances by each agent to the tax authority. The sales' values are omitted for simplicity. τ is the tax rate, p_P is the producer's price, p_{WS} is the wholesaler's price, and p_R is the retailer's price.

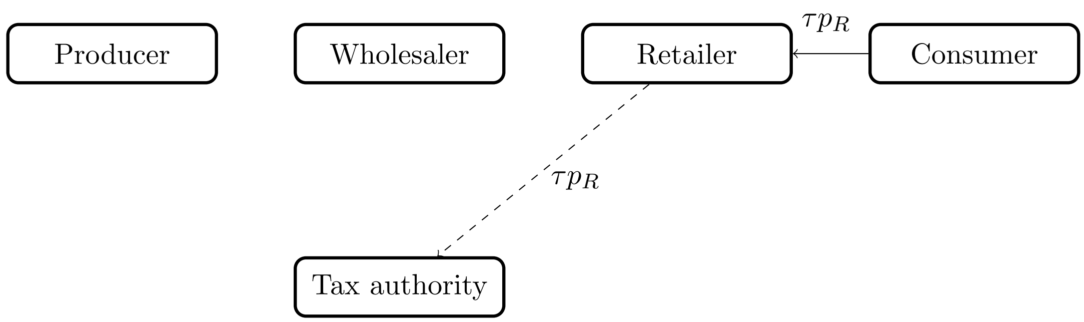
As illustrated in Figure 2, under RC the producer and the wholesaler no longer collect and remit output VAT. When selling goods to the final consumer, the retailer *de facto* collects VAT for the whole value-added of the entire supply chain and remits it to the tax authorities.[4] This implies that the VAT collection is entirely concentrated at the B2C stage. For this reason, the literature describes reverse charge as a measure that transforms VAT into a retail sales tax (Keen and Smith, 2006; De La Feria, 2019).[5]

All firms are still expected to report to the tax authorities the sales and purchases that took place under reverse charge, but while they provide a paper trail, these reports have no implication for VAT payments.

[4] Appendix Table B2 shows reporting and transactions in more detail.

[5] Note that the VAT remittance pattern would be different for a producer if RC applied to a final good, but not to the intermediate inputs they might need to source from a supplier. In this case, the producer would still pay input VAT to the supplier of the intermediate, non-RC inputs and claim a refund, while they would not collect any VAT when they sell to the wholesaler the final good subject to RC. However, in such cases, the remittance patterns for the wholesaler and retailer would be the same as described in Figure 2.

Figure 2: VAT chain with Reverse Charge – a simple illustration



Notes: The trade flow starts from the producer, who sells the product to the wholesaler. The wholesaler sells the product to the retailer, who in turn sells the product to the final consumer. For simplicity we can assume that only one unit of the good x is sold or purchased. The continuous arrow represents the VAT payment to the upstream seller. The dashed arrow represents the VAT remittances to the tax authority. The sales' values are omitted for simplicity. τ is the tax rate and p_R is the retailer's price.

2.3 Implications for tax evasion

If all firms comply, VAT revenues are identical under both regimes, standard VAT and RC. Moreover, since the final consumer is the statutory bearer of VAT in both cases, firms should be indifferent between the two systems. However, the change in the VAT liability following the introduction of RC implies that VAT evasion at the retail stage becomes more profitable.

The key is that the retailer does not pay VAT on its inputs under RC. In fact, the maximum amount a retailer can evade under regular VAT is $\tau \times (p_R - p_{WS})$, where τ is the tax rate, p_R is the retailer's price, and p_{WS} is the wholesaler's price. This implies that the maximum amount evaded is a function of the retailer's own value-added, $p_R - p_{WS}$. Under RC, the maximum amount a retailer can evade is $\tau \times p_R$, a greater amount than possible evasion under a standard VAT regime as it is a function of the total value-added.[6]

This example illustrates that reverse charge could exacerbate the "last-mile problem" of VAT,

[6]This implication hinges on the assumption of unilateral evasion (as compared to collaborative or collusive evasion Chang and Lai (2004); Pomeranz (2015)), in which the retailer does not report some transactions to the tax authorities. Collaborative evasion is mostly relevant for household services (Chang and Lai, 2004; Doerr and Necker, 2021) as compared to the case of (high-value) goods discussed in this empirical application, for which consumers might be interested in an invoice or warranty. Everything else equal, however, also allowing for a collaborative decline in prices should result in a reduction of total reported sales.

since the optimal level of evasion might increase if input VAT is no longer withheld by the supplier (Waseem, 2022). Pomeranz (2015, p. 2544) describes the problem as follows: "The key assumption behind the notion that "self-enforcement" breaks down at the retail stage is that, all else equal, the cost of evasion will be lower at that point than in the middle of the production chain because firm N is not faced by firm N+1 that would want a receipt." Reverse charge, therefore, may increase the optimal level of evasion, at a stage where the costs of tax evasion are relatively lower.[7]

The size of the firm could also affect reporting and evasion. Large companies may have reputational concerns and decide not to engage in VAT evasion, as the chance that someone might blow the whistle is higher. It is also more difficult to conceal tax evasion and fraud in larger firms. There is thus a greater probability that smaller firms evade or engage in fraudulent activities. Kleven, Kreiner, and Saez (2016) provide some theoretical foundations and some empirical stylized facts for this argument. The size of firms also matters for audit probability. Rhines, Bennett, and Bacht (2003) mention that in Germany general tax audits occur regularly for large firms, while it is not the case for smaller firms. Similarly, it could be argued that evasion might be more difficult to detect in the case of partnerships, as they are subject to less stringent reporting rules as compared to companies, and therefore they might be able to engage in evasion more easily.

In summary, if reverse charge leads to increased evasion of a firm at the retail level, we would observe its reported sales to decline. These effects might be more relevant for smaller firms or partnerships. In the next section, we discuss the implementation of RC in Germany.

3 The reverse charge in Germany

Reverse charge is a policy instrument that countries in the EU and beyond have adopted in the fight against "missing-trader fraud" (Buettner and Tassi, 2023). Missing-trader fraud involves fraudulent international traders who disappear without remitting VAT to the tax authorities. This type of fraud is especially a cause of concern in the EU, where missing traders can take advan-

[7] Optimal evasion is in theory also determined by the probability of detection and the penalty for detected evasion (Sandmo, 2005; Slemrod and Gillitzer, 2014). However, the penalty for evasion generally depends on the gravity of the infraction. Conditional on a given amount evaded, whether it was done under RC or standard VAT rules appears immaterial to determine the penalty. Furthermore, no publicly available information suggests that additional measures were taken to increase detection effort under RC (German Federal Government, 2011).

tage of zero-rated cross-border transactions to carry out their fraudulent schemes (Buettner and Tassi, 2023; Bussy and Tassi, 2025). While this type of fraud is not the focus of this paper, we exploit a byproduct of these reforms: they potentially aggravate the last-mile problem for domestic transactions.

Germany has started applying reverse charge in 2002 (Bundesministerium der Finanzen, 2020).[8] This deviation from VAT has gained popularity among policymakers, demonstrated by Germany's request to the European Commission to adopt reverse charge on all transactions (the so-called General Reverse Charge Mechanism, see De La Feria (2019)), which has been refused. Nonetheless and upon the consent of EU institutions, Germany has expanded the list of goods and services subject to reverse charge over time.

For this analysis the identification of firms subject to reverse charge is based on the German VAT Act (*Umsatzsteuergesetz*), which lists goods and services affected by reverse charge; Table 1 shows the relevant amendments. We focus on products (not on services) affected by reverse charge:[9] gold, mobile phones, tablets, game consoles, laptops, and metals (Bundesministerium der Finanzen, 2020, Section 13b).[10] These products are taxed at the standard VAT rate of 19%.

We are able to link the products affected by RC to retailing firms selling them, based on their industry classification. The four identified industries are "retail sale of computers," "retail sale of telecommunication equipment," "retail sales of hardware," and "retail sale of jewelry." For an overview of these industries and their classification, see Appendix Table B3.[11] Together, these four RC industries account for about 5.5% of the whole retail sector in Germany.

[8]See Buettner and Tassi (2023) for an overview. The early applications mostly concerned services and items transferred by way of security.

[9]This choice is shaped by data availability, as it is not possible to know if service providers make B2B or B2C sales. On the contrary we can expect retailers to mostly make B2C sales.

[10]The list of metals includes silver, platinum, iron, steel, copper, nickel, aluminium, lead, zinc, tin, and cermets. See Bundesministerium der Finanzen (2020, Section 13b, Annex IV).

[11]The data at industry level supports the view that the identified retailers are relatively more affected by RC, see Appendix Figure B1.

Table 1: Introduction of Reverse Charge in Germany.

Date of implementation	RC is applied to the supply of...	Value (% of retail sector)
1 January 2011	gold	1.08%
1 July 2011	mobile phones and integrated circuits	0.59%
1 October 2014	tablets, games consoles, laptops, and metals	3.73%

Source: adapted from Buettner and Tassi (2023), based on Bundesministerium der Finanzen, 2020, and earlier years. Data on values as % of retail sector is from Destatis (2019).
Notes: As integrated circuits are intermediate goods, they are shown in the table, but they are not relevant for the subsequent analysis. Each product is assigned to an industry in the retail sector according to the NACE classification as described here in section 3 and summarized in Appendix Table B3. The values refer to the industry's turnover for the year 2018. The overall value of the retail sector, i.e., the denominator, is the turnover of firms belonging to Section G of the NACE industry classification (excluding the wholesale trade sectors and the retail sale in non-specialised stores with food, beverages or tobacco predominating).

4 Empirical Method

4.1 Regression framework

To estimate the effects of reverse charge at the last stage of the supply chain, we compare retailers that buy and sell products subject to RC—and thus do not pay VAT to their suppliers on these transactions—to retailers that are not affected by reverse charge.[12] This enables us to investigate if the change in VAT remittance liability leads to more VAT evasion, measured by the decline in reported sales associated with the introduction of RC. This identification strategy has the advantage of comparing similar firms because, irrespective of RC, all retailers are potentially affected by the last-mile problem of VAT.

We estimate the following two-way fixed-effects (TWFE) model

$$\textit{reported domestic sales}_{it} = \alpha_i + \delta_t + \beta RC\ \textit{input}_{it} + \gamma X_{it} + u_{it}, \quad (1)$$

where the dependent variable, $\textit{reported domestic sales}_{it}$, is sales of firm i at time t.[13] (Reported)

[12] The selection of affected and not affected retailers is discussed in Section 5 in more detail.

[13] The dependent variables are in logs or transformed using the inverse hyperbolic sine. The transformation also depends on the main regressor. While the inverse hyperbolic sine transformation keeps zeroes and negative values, the log transformation does not. If we compare the two types of transformation, we can see that the choice of the

domestic sales captures the firm's domestic activity, and closely reflects the tax base of the firm. The main regressor captures the extent to which a firm is affected by reverse charge, measured by two alternative variables. The first is the value of input VAT subject to reverse charge, labelled *RC input*.[14] The alternative regressor is the *RC intensity*, as measured by the share of input VAT subject to reverse charge with respect to all input VAT ($\frac{\text{RC input}}{\text{Input VAT}}$).[15] The first of the two alternative regressors relates to the absolute volume of RC inputs, while the second considers the relative importance of RC inputs. The reason for exploiting both alternative regressors is that each can help overcome different empirical challenges as explained in the next paragraphs. Under certain assumptions, the estimated parameter β captures the average RC effect on firms affected by RC. If reverse charge is related to an increase in evasion at the retail stage, β will be negative. α_i and δ_t are firm and period fixed effects, and u_{it} is an error term. X_{it} is a vector of the included control variables: the federal state in which the firm has its legal seat and the legal form, which are mostly time-invariant, and two-digit industry-year fixed effects. Especially the latter is a relevant inclusion as it enables us to control for within-industry trends and technological changes, focusing on a cleaner comparison of RC-affected firms with other retailers. Standard errors are two-way clustered at the industry and at the firm level to allow for correlation of the error term within industries and firms, as the two are not necessarily nested due to firms changing industry (Cameron, Gelbach, and Miller, 2011).

The ideal dependent variable to detect VAT evasion at the retail stage would be reported domestic B2C sales. Unfortunately, this is not directly observable in the data. The closest measure available is *sales at 19%* (i.e., sales at the standard VAT rate) which encompasses the bulk of B2B and B2C domestic sales. The issue with this measure, however, is that B2B sales falling under RC are reported separately after the reform, inducing a mechanical decline of *sales at 19%* which would prevent us from gauging evasion-related under-reporting.[16] Instead, we construct *reported domestic sales* as a firm's total sales minus exports and other tax-free sales. *Reported domestic sales* thus

approach does not affect the results in important ways (see columns 4-6 of Table B8).

[14] As *RC input* includes many zeroes, we apply the inverse hyperbolic sine transformation to this variable, and to the outcome variables when we use this regressor, to facilitate the interpretation of the coefficients.

[15] With this regressor, the outcome variables are in logs, except for *RC sales*, see footnote 17.

[16] Although we do not expect retailers to have a large share of business clients and thus of sales under RC, due to their industry classification, it is possible that they do, but retailing remains their main economic activity (Eurostat, 2008). It is also beyond the scope of this paper to establish whether B2B sales reported by retailers are rightful or if they are the consequence of intentional misclassification.

closely capture the firm's domestic activity, by including sales at different VAT rates and sales under reverse charge (cf. Appendix A for more details).

In order to verify that firms report their transactions accurately under RC, we investigate if *sales at 19%* decrease upon reform. We then retrieve *RC sales* from *reported domestic sales*, which are expected to correspondingly increase under RC.[17] Insofar as retailers have some B2B domestic sales, the reclassification of such sales upon reform should lead to a decrease in *sales at 19%* and an increase in *RC sales*. This empirical exercise is crucial, as it lends support to the fact that firms report B2B transactions accurately under RC thus providing some evidence that the quality of the paper trail remains unaltered. A decrease in the quality of the paper trail might otherwise bias our estimates, as discussed next.

4.2 Identification and instrumental variable approach

A threat to identification in Equation 1 is represented by the fact that the regressor of interest, RC input (and, consequently, RC intensity), might be endogenous, i.e., subject to measurement error and simultaneity.

First, RC input is reported by firms and can be manipulated. For instance, the quality of the paper trail could be lower under RC because the decision to report B2B transactions accurately or not has no implication for VAT remittance under RC (no VAT is paid on inputs, and no VAT is collected on sales).[18] While this is in itself not a mechanism we wish to rule out, it could bias our estimates of evasion derived from Equation (1) because our main regressor, *RC input*, would be imprecisely measured. Second, for mobile phones, metals, and computers, reverse charge applies mandatorily only if the (B2B) transaction has a value greater than 5000 Euro (Bundesministerium der Finanzen, 2020), which means that RC can also affect the purchasing behaviour of firms to remain below or to exceed the threshold of 5000 Euro. Third, construction services are also subject

[17] *RC sales* is always transformed with inverse hyperbolic sine, due to the many zeroes for firms that only sell at the standard VAT rate. More details on how the variable is constructed can be found in Appendix A.

[18] Note that third-party liability, whereby one trading party may be held responsible for VAT payments due by another party if it can be proven that they should have known they were involved in illegitimate transactions (De La Feria and Foy, 2016), might encourage traders to accurately report RC transactions even if they are not linked to VAT payments—potentially reducing the risk of collusion at the B2B level. In Germany, for example, federal legislation introduced such provisions in 2001 (see Bundesministerium der Finanzen (2020, Section 25d).)

to RC, implying that if a firm expands in terms of buildings, it is liable for VAT remittance and reports some RC input. This may well be correlated with firm's growth and turnover and may capture fixed costs rather than the extent to which intermediate inputs are subject to RC. Fourth, RC inputs and turnover might be simultaneously determined.

These threats to identification also motivate the alternated use of the two regressors introduced above, RC input and RC intensity. While the value of input VAT subject to RC (RC input) would be the ideal regressor as it could be directly used to infer VAT revenue losses, it is also more problematic than RC intensity in terms of simultaneity bias. The absolute value of (RC) inputs can be positively related to sales reflecting, i.e., an expansion in demand, while the relative importance of RC inputs among overall inputs is arguably a more robust measure in this specific case.

Given these possible sources of bias, we instrument $RC\ input_{it}$ with a variable that captures the institutional variation in the adoption of RC. The IV is a time-varying binary variable, equal to 1 if firm i in industry j is subject to RC in year t, and equal to 0 otherwise. In other words, after policy implementation, the instrument is equal to 1 if a firm belongs to an industry trading products subject to reverse charge. A related identification strategy is used in Buettner and Tassi (2023). We call this instrumental variable RC policy indicator ($RCPI$). The four industries affected by RC are identified with the help of the VAT Act (Bundesministerium der Finanzen, 2020) and the industry classification at the 5-digit level. The first-stage regression thus looks as follows

$$RC\ input_{it} = \psi_i + \theta_t + \pi RCPI_{(i)jt} + \omega X_{it} + \epsilon_{it}, \tag{2}$$

where $RCPI$ only depends on industry j and varies over time depending on the date of implementation of RC.

This IV model estimates a local average treatment effect (LATE)-type parameter: the effect on compliers, that is on firms whose treatment status was changed by the instrument. Given the varied assortment of goods a retailer may offer, it seems plausible to allow for heterogeneous treatment effects, where each firm may respond uniquely to the RCPI-instrument. For this model to produce unbiased estimates, five assumptions need to hold (Cunningham, 2021):

i. the exclusion restriction assumption, which states that any effect of the policy change on $reported\ domestic\ sales_{ijt}$ occurs via RC input (the endogenous variable). A retailer is affected by reverse charge and could perpetrate VAT evasion to a greater extent if and only if it does not pay input VAT to its supplier or, in other words, if it reports positive RC inputs. The exclusion restriction assumption could be violated if, for example, reverse charge also affects compliance costs that relate to a decreased real activity or to bankruptcy and that are not captured by RC inputs. Increased compliance costs due to, i.e., keeping two invoicing systems or training the accounting department are most likely related to purchasing items subject to reverse charge in the first place, though. Moreover, compliance-related fixed costs are likely to be greater in the first period of RC implementation and are likely to be relatively smaller for retailers, which mostly have final customers, as compared to firms buying from and selling to other businesses under RC. As the main analysis mostly focuses on a balanced panel, i.e., firms that do not go out of business nor fall below the VAT threshold, we are less concerned about these issues at the extensive margin;

ii. the stable unit treatment value assumption (SUTVA), which states that the potential outcomes of firm i are unrelated to the treatment status of other firms. In this setting, treatment status relates to the products that one firm sells. Since we are only analysing retailers, which supposedly are not each other's suppliers or trading partners, this assumption is likely to hold;

iii. the independence assumption, which states that the instrument is as good as random. Given that reverse charge is implemented on specific goods to tackle cross-border B2B VAT fraud, it seems plausible to assume that its application is exogenous to retailers and to their pre-existing specialization or economic activity. In addition to that, Germany has introduced RC very promptly following the mechanisms available at the EU level, arguably not leaving time for firms to change their product mix in anticipation of the reform;[19]

iv. the relevance assumption, which states that the instrument is correlated with the endogenous variable. A priori, a firm affected by reverse charge will report more RC input, and this positive relationship can be explored in the first stage;

v. the monotonicity assumption, which states that all treated firms are affected in the same

[19] With its proposal in September 2009, the European Commission introduced a list of goods at risk of cross-border VAT fraud with the possibility of applying reverse charge on them (European Commission, 2009). Germany requested the introduction of reverse charge on some of these goods already after two months (European Commission, 2010). The EC's proposal was published in the official journal in January 2011 (Official Journal of the European Union, 2011). The list of goods included in the proposal, on which RC can be applied, has since then been expanded and introduced in the VAT directive (Council of the European Union, 2013).

direction in the first stage. In our context, this assumption would be violated if firms began reporting transactions for products outside the scope of RC as if they were under RC—a scenario that is highly improbable.

The conditions required for the IV strategy to be unbiased appear to be satisfied, and our main results will rely on this.

5 Data

To study the effects of reverse charge at the retail stage, we use administrative data from the universe of German tax files. Specifically, we use data from the German VAT panel (*Umsatzsteuerpanel*) from 2002 to 2017. This is data at firm level based on the VAT advance returns (*Umsatzsteuer-Voranmeldungen*), which are mandatory reports on taxable sales and VAT-deductible input payments. Firms have to fill in these tax returns on a yearly, quarterly or monthly basis, depending on their turnover. All the firms with a turnover greater than 17,500 Euro have to fill in the VAT advance returns; smaller firms are only required to submit the actual VAT returns.[20] Despite different reporting frequencies, the data is available aggregated on a yearly basis.

The raw data from the VAT advance returns is processed by the statistical offices to generate the VAT panel. A major difference between the VAT panel and the underlying reports is that some variables are combined, i.e., the individual items that firms report in the returns are not always identifiable in the data (see Destatis (2021)). For example, it is not possible to retrieve with full precision the volume of sales subject to reverse charge.[21] An advantage of this data set, however, is the available information on firm's characteristics, including its legal form, the number of employees subject to social security contributions, the federal state where the firm has its seat, and whether the firm belongs to a VAT group.[22] Each firm-year observation is assigned a five-digit industry code (NACE classification), which we use to identify the four retail sectors, listed above, selling

[20] The threshold was 16,620 Euro in 2002 and has been set to 17,500 Euro from 2003 onwards.

[21] The original form in German is shown in Appendix Figures A1 and A2 and a translated version, somewhat simplified, is shown in Appendix Figures A3 and A4. The sales subject to reverse charge correspond to items 60 and 68 on page 1 of the advance returns. Details on the construction of the variable can be found in Appendix A.

[22] In German, *Organschaft*. A VAT group refers to independent businesses that come together to form a taxable unit.

products subject to reverse charge.

5.1 Data processing and treatment identification

The full data set (2002-17) contains about 50 million firm-year observations. We only keep firms in the retail trade sectors (Section G of the NACE industry classification, excluding the wholesale trade sectors). Following Buettner, Madzharova, and Zaddach (2023) we drop firms that are neither corporations nor partnerships, that is commercial and economic cooperatives and commercial enterprises of public sector's corporations as well as retailers with other legal forms, as they might face special tax treatments, which could confound our analysis (these represent at most 2.5% of the observations in a given year). We also drop firms belonging to a VAT group, as joint reporting prevents the identification of sales by individual entities (Buettner, Madzharova, and Zaddach, 2023), and special tax rates may apply (nonetheless, additional results show that the main findings are robust to the inclusion of firms in VAT groups, see Appendix Table B16).

For the definition of the binary instrument in the first-stage regression (Equation 2), we identify four industries affected by RC, based on the NACE industry classification (reported in more detail in Table B3). A firm is considered treated if it belongs to a treated industry in all years prior to treatment. A firm is assigned to the control group if it is in a retail sector, but in none of the treated industries, in all periods before the introduction of reverse charge.[23]

We drop all firms that sort in or out of treated industries after the introduction of reverse charge, in order to reduce the self-selection bias due to firms manipulating treatment.[24] We also drop firms in sectors with an unclear main specialization, as we would need to make strong assumptions concerning their treatment status (i.e., concerning the products they sell).[25] We work with a

[23]One challenge to identification is that the industry classification codes have been modified in 2008; the code NACE Rev. 1.1 applied between 2002 and 2008 and NACE Rev. 2 applies since 2009. Three of the treated industries are clearly and uniquely identifiable through the NACE Rev. 1.1 classification or the NACE Rev. 2 classification, which means that these firms can be easily identified and followed over time. For the other industry, "retail sale of computers," we can identify treatment exclusively though the later NACE Rev. 2 classification, which means that we carry the industry code from 2009 backwards. See Table B3 for more details.

[24]We nevertheless present robustness results for a panel including firms that switch industry in Table B9. Switching industry is not a widespread phenomenon, as less than 1% of firms in the balanced panel do so.

[25]The sectors dropped include "retail sale in non-specialized stores," "other retail sale of new goods in specialized stores," "retail sale of other second-hand goods in stores," "retail sale via stalls and markets of other goods," "retail

balanced panel containing 78,090 firms, in order to reduce confounding effects due to firms exceeding or falling below the VAT threshold only in some years, or due to firm entry or exit.

5.2 Descriptive statistics

Table 2 shows descriptive statistics for firms in sectors affected by reverse charge (Panel A), and separately for firms in industries not affected by reverse charge (Panel B), for the year before and the year after RC implementation. Around 9% of all firms are affected by reverse charge.

The first three rows of each panel refer to the main dependent variables, where we can observe that *sales at 19%* make up most of domestic sales for both groups, while the sales subject to RC (*RC sales*) are clearly a more important component of sales for the affected firms (Panel A) and visibly increase after the introduction of RC. Firms affected by reverse charge are on average smaller than other retailers in terms of turnover and number of employees (cf. last line of each panel).

Table 2 also reports the VAT on inputs (*Input VAT*) that a firm can deduct to compute its VAT remittance, and the main regressors; deductible input VAT related to transactions subject to RC (*RC input*) and the share of RC input of all input VAT (*RC intensity*). Compared to the pre-period, the value of RC input almost doubles in the year after the reform for retailers subject to RC. RC intensity is on average more than twice as great for the firms affected by the reform, but it is overall small, i.e., around 1%, consistent with the fact that RC only affects part of a firm's inputs. Pooled descriptive statistics for all periods of the panel are reported in Appendix Table B4.

6 Results

This section reports the empirical results of the implementation of RC on VAT compliance. If reported domestic sales decline after the introduction of RC, this would indicate that firms evade more and indirectly establish the presence of evasion at the retail stage, thus confirming the last-mile problem in this high-enforcement, low-informality context.

sale via mail order houses or via Internet," and "other retail sale not in stores, stalls or markets."

Table 2: Descriptive statistics.

	Pre			Post		
	Mean	SD	N	Mean	SD	N
Panel A - Retailers subject to RC						
Domestic sales (in €)	739,512	3,295,520	6,778	777,335	3,545,363	6,778
Sales at 19% (in €)	718,797	3,183,280	6,770	712,778	3,286,397	6,768
RC sales (in €)	17,195	281,905	6,778	61,154	636,840	6,778
Input VAT (in €)	107,019	592,837	6,739	111,077	637,224	6,740
RC input (in €)	3,085	80,456	6,739	5,469	137,521	6,740
RC intensity	0.010	0.064	6,739	0.013	0.106	6,740
Employees	3.950	15.319	5,766	4.098	16.152	5,739
Panel B - Other retailers						
Domestic sales (in €)	1,317,489	11,885,075	71,312	1,323,744	12,059,423	71,312
Sales at 19% (in €)	1,178,582	11,499,714	70,777	1,180,489	11,657,416	70,769
RC sales (in €)	5,624	116,560	71,312	7,965	198,075	71,312
Input VAT (in €)	188,610	1828749	70,765	192,596	1913750	70,717
RC input (in €)	1,177	44,769	70,765	1,497	46,744	70,717
RC intensity	0.004	0.028	70,765	0.004	0.045	70,717
Employees	8.272	85.730	51,181	8.587	89.361	50,345

Notes: amounts in € in prices of 2017. Data refer to 78,090 firms. *Panel A* shows the average values for firms in the 4 industries subject to reverse charge for the year before (Pre) and the year after (Post) RC implementation. *Panel B* shows the average values for all the retailers excluding these 4 industries for the year before (Pre) and after (Post) the first RC implementation. SD stands for standard deviation and N stands for number of observations.

6.1 Baseline results

Table 3 shows the baseline results, including covariates (federal state, 2-digit industry-specific time effects, and legal form). These results represent the preferred specification as the inclusion of covariates and of industry-specific year effects also helps control for heterogeneities in technological change.[26] RC input is used as main regressor in Panel A and RC intensity in Panel B. The first-stage results are also reported in Table 3; they show that the policy instrument RCPI is relevant and is positively related to RC inputs, as expected.

Column 1 of Panel A indicates that domestic sales are not impacted by RC input. The coefficient is economically small (a 1% increase in RC input is associated with a 0.007% increase in domestic sales) and statistically insignificant.[27] This zero effect suggests that firms are not evading more under RC. The absence of a change in evasion at the retail stage upon an increase in the incentive to evade indirectly suggests that evasion at the retail stage does not seem to be prevalent. This is our main result.

Next, we turn our attention to whether B2B sales made under RC are reported correctly by affected firms. We expect a mechanical decrease of *sales at 19%* and a corresponding increase in *RC sales*—cf. Section 4.1. Column 2 shows a statistically significant negative relationship between RC input and sales at 19%: a 1% increase in RC input is associated with a decrease in sales at 19% by 0.18%. Column 3 shows that RC sales increase with the implementation of RC, and the effect is large: a 1% increase in RC input is associated with a 4.5% increase in RC sales. While the two effects have different magnitudes, they are not directly comparable since the levels of the corresponding variables are different—cf. Table 2. This is because sales at 19% make up the vast majority of domestic sales and thus its baseline value is large, while RC sales have increased substantially from virtually zero before the introduction of RC. Overall, we observe the expected mechanical effects in the data, which provides some evidence that the quality of the paper trail remains unaltered since firms appear to be reporting RC transactions accurately.

Panel B reports the same results, but with RC intensity as regressor. The results are qualitatively similar, although coefficients' magnitudes are difficult to compare with those of Panel A due to the

[26] Appendix Table B5 shows the IV baseline results without covariates, consistent with those presented here, while the (likely) biased estimates from the TWFE model with covariates are reported in Table B6.

[27] See Bellemare and Wichman, 2020 for the interpretation of elasticities with hyperbolic sine transformations.

different scale of RC intensity.

Taken together, these results show that domestic sales do not decline and thus do not indicate that B2C VAT evasion increases as a consequence of RC, at least in the German retail sector. The absence of a change in evasion at the retail stage upon an increase in the incentive to evade indirectly suggests that evasion at the retail stage does not seem to be prevalent. Furthermore, firms appear to be accurately reporting their B2B RC sales. For conciseness and given the qualitative similarity of the results based on the two different regressors, the remainder of the paper focuses on RC input as main explanatory variable.

Table 3: RC effects on sales.

	Domestic sales (1)	Sales at 19% (2)	RC sales (3)
Panel A			
RC input	0.007	-0.184***	4.541***
	(0.053)	(0.050)	(1.657)
N	1238994	1229719	1238994
First Stage			
RCPI	0.514***	0.511***	0.514***
	(0.080)	(0.081)	(0.080)
F-stat 1^{st}	40.913	39.970	40.913
AR F-test	0.020	9.573	6.039
AR p-value	0.888	0.002	0.014
Panel B			
RC intensity	0.907	-15.111***	374.312**
	(4.432)	(5.336)	(184.142)
N	1238767	1229412	1238994
First Stage			
RCPI	0.006***	0.006***	0.006***
	(0.001)	(0.001)	(0.001)
F-stat 1^{st}	33.124	34.964	33.089
AR F-test	0.043	9.482	6.039
AR p-value	0.836	0.002	0.014

Notes: The table shows the estimated coefficients of Equation 1. The dependent variable is reported in the column header. The first stage regressor, $RCPI$, is a binary variable reflecting the institutional variation of RC. The dependent variables in Panel A and RC sales are in inverse hyperbolic sines, the other variables in Panel B are in logs. Robust standard errors clustered at the industry level and at the firm level in parentheses. The included controls are industry-year FE, legal status, and state of registration. AR F-Test refers to the Anderson-Rubin (AR) F-test, robust to weak instruments (Baum, Schaffer, and Stillman, 2007). One (*), two (**), or three stars (***) indicate statistical significance at 10%, 5%, and 1% levels.

We now address the point that unchanged reported sales might mask price and quantity effects that could still be consistent with evasion. Reported sales are in fact the product of the retailer price p_R and quantity x. In other settings, Asatryan and Gomtsyan (2020) and Doerrenberg and Duncan (2019) show that the availability of increased evasion opportunities could lead firms to lower their prices, transferring part of the gains from evasion to their customers. At the same time the quantity sold increases as these unfairly competitive firms face higher demand.[28] In the context of RC, our baseline expectation is that reported sales decline due to the under-reporting of transactions, i.e., reported x declines, while p_R remains constant. To rule out the possibility that our finding of unchanged reported sales following RC implementation masks price effects consistent with evasion—which conflicts with our proposed evasion mechanism—we examine whether prices adjust after the reform.[29]

The firm-level data does not allow for a separate investigation of prices and quantities. Therefore, we resort to industry-level data on retail prices p_R (2005 to 2017) from Destatis (2023), that allow us to precisely identify the four retail sectors affected by RC, as in the previous analyses. Using the natural logarithm of retail prices ($\ln(p_R)$) as an alternative outcome variable as well as heterogeneity-robust estimators (Sun and Abraham, 2021), we estimate (reduced-form) event-study regressions for the effects of RC introduction on prices. The results are shown in Figure 3. The overall findings support no effect on prices, especially no drop in the price level in the short run. We additionally estimate the effects using the synthetic control approach with staggered adoption (Ben-Michael, Feller, and Rothstein, 2022),[30] and find an average treatment effect (standard error) of 0.009 (0.268). Given an overall null effect on prices, these results also imply no quantity effects, due to the null effect on sales. These tests provide another piece of evidence that RC has not led to greater evasion at the retail stage. Additional tests explore if the effects of RC on evasion are masked by sales growth dynamics à la Meer and West (2016). These findings are also consistent with no evasion as, considering different time spans, sales growth is not significantly (negatively) affected by RC.[31]

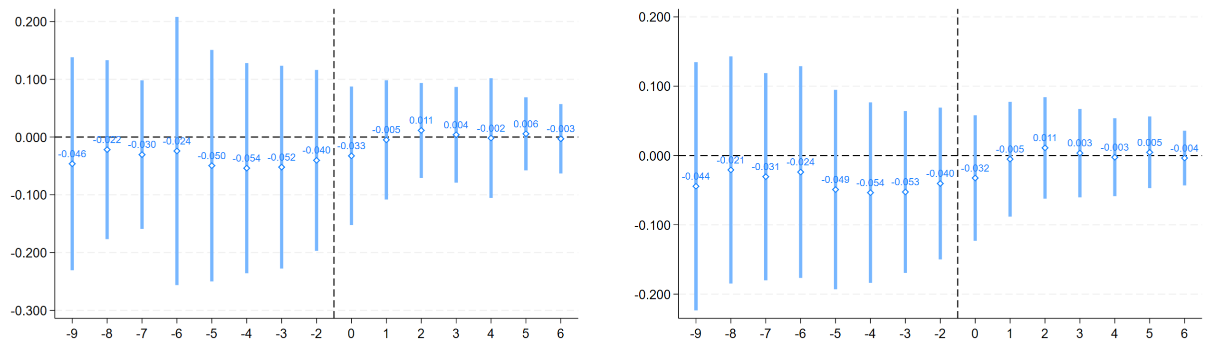
[28] Neither study shows the overall effect on sales, $p_R \times x$.

[29] To the best of our knowledge, data on quantities sold is not available.

[30] The advantage of this approach with respect to traditional synthetic control methods is that it is also robust to the staggered introduction of treatment. Moreover, the researcher is allowed to give more or less weight to improving pre-treatment fit for the average treated unit or across treated units, based on the case at hand. In this application, results are robust to both extreme choices.

[31] Results available upon request.

Figure 3: RC effects on retail prices.



(a) Traditional estimator (b) Sun and Abraham (2021) estimator

Notes: N = 676. The figure shows the estimated event-study coefficients of the introduction of RC on prices. The dependent variable is the natural logarithm of an industry's prices relative to 2020 (= 100) (Destatis, 2023). The main regressor is RCPI. The other included controls on top of year and 5-digit industry fixed effects are the average price within the 3-digit industry sector and 3-digit industry fixed effects. The omitted period is the first lead (−1). 95% confidence intervals (based on robust standard errors clustered at the industry level) are also reported.

6.2 Robustness checks

In this subsection, we present some robustness tests for the baseline results. First, to improve the pre-treatment comparability between affected and non-affected firms in terms of observable characteristics we apply a coarsened exact matching (CEM) algorithm (Blackwell et al., 2009). The pre-treatment characteristics used in the matching algorithm are the average number of employees, the legal form, the state where the firm has its legal seat, and the share of imported inputs, which should help restrict the attention to firms in industries with a similar trade structure and trade exposure. First, the matching algorithm does indeed improve the comparability between the two groups, as the overall imbalance measure decreases from 0.182 to 0.127 (for details, see Iacus, King, and Porro (2012)). Second, the results estimated with the inclusion of the CEM weights remain consistent with the baseline results, as shown in Table 4, Columns 1-3.

In another attempt to improve the comparability between firms affected and not affected by RC, we restrict the focus on firms in similar industries as the RC ones, where similar industries are those within the same 3-digit NACE classification, implying an overall similarity of the products traded. The results for this restricted sample, where about 20% of the observations are lost, are reported in Table 4, Columns 4-6. The findings from this exercise are also consistent with the baseline results.

In additional robustness tests shown in Table B7, we consider RC effects on alternative outcome

Table 4: RC effects on sales – CEM & Selected control industries.

	CEM			Selected control industries		
	Domestic sales (1)	Sales at 19% (2)	RC sales (3)	Domestic sales (4)	Sales at 19% (5)	RC sales (6)
RC input	0.011	-0.168***	4.341***	0.008	-0.169***	4.635***
	(0.048)	(0.049)	(1.579)	(0.070)	(0.062)	(1.761)
N	1226745	1217490	1226745	955044	952952	955044
First Stage						
RCPI	0.546***	0.542***	0.546***	0.491***	0.490***	0.491***
	(0.083)	(0.083)	(0.083)	(0.084)	(0.085)	(0.084)
F-stat 1^{st}	43.244	42.428	43.244	33.848	33.424	33.848
AR F-test	0.049	9.156	6.250	0.013	5.227	5.888
AR p-value	0.825	0.003	0.013	0.910	0.023	0.016

Notes: The table shows the estimated coefficients of Equation 1. The dependent variable is reported in the column header. The first stage regressor, $RCPI$, is a binary variable reflecting the institutional variation of RC. The dependent variables are in inverse hyperbolic sines. Robust standard errors clustered at the industry level and at the firm level in parentheses. AR F-Test refers to the Anderson-Rubin (AR) F-test, robust to weak instruments (Baum, Schaffer, and Stillman, 2007). One (*), two (**), or three stars (***) indicate statistical significance at 10%, 5%, and 1% levels.

variables to further corroborate the baseline results. In columns 1 and 2, the dependent variables are subsets of reported domestic sales (our main dependent variable) that are not expected to (mechanically) change when RC is implemented. We find that neither reported VAT-exempted sales (a common component of domestic sales and of RC sales, cf. Appendix A) nor a measure of residual reported domestic sales (calculated as reported domestic sales minus RC sales and sales at 19%) are affected by RC. Although we learn nothing new about evasion with these checks, it is reassuring that measures of reported sales that are not expected to change when RC is implemented do indeed remain unchanged. In column 3, the dependent variable is deductible VAT inputs. Our proposed evasion channel does not imply any change in reported deductible VAT inputs. Consequently, if reported inputs vary following RC implementation, this would suggest the presence of alternative real or reporting effects, potentially threatening identification (cf. Section 4). For example, reported inputs and sales could change not because of evasion but as a result of firms changing their level of activity. RC could also undermine the reliability of the paper trail. This could result in firms refraining from reporting input purchases or, alternatively, inflating reported inputs to evade VAT by claiming undue input credits (Keen and Smith, 2006). The coefficients for input VAT are economically small and imprecisely estimated, suggesting that these alternative mechanisms are not at play.

Further robustness checks reported in the Appendix show that the results are robust to (i) the exclusion of outliers, i.e., firms with a RC intensity smaller than zero or larger than 1 (Table B8);[32] (ii) to fewer restrictions on sample selection, allowing for firms that switch industry classification after the introduction of RC (Table B9); (iii) clustering standard errors at the firm-industry level while fixing the industry code to 2010 (pre-treatment), since the industry classification changes in 2009 and may vary over time (Table B10); (iv) clustering of standard errors only at the firm level (Table B11); (v) restricting the sample to the 4 years around the event or excluding retailers involved in the sale of gold (jewelry and watches) given the peculiarity and price fluctuations of this material, as shown in Table B12; (vi) allowing for retailers of computers to be affected by RC in 2011 instead of 2014 in case they were also selling mobile phones (Table B13). Reduced-form results, using a binary indicator for having positive RC inputs in the second stage, and using the dependent variables in levels also support the main findings (see Tables B6, B13, and B14, respectively).

Finally, we explore the RC effects on the unbalanced panel, which has the advantage of including firms that were not present in the panel for the whole period of 16 years. We nonetheless have to acknowledge the fact that the unbalanced panel is more likely to violate the exclusion restriction assumption, in case RC-related compliance costs negatively affect firms, which ultimately go out of business. The results from Table 5 show that the probability of entering and exiting the panel are if anything negatively related to reverse charge, but this effect is small and not precisely estimated. This also supports the idea that retail businesses were not set up after the introduction of RC to evade VAT in the affected sectors. The RC effects on sales estimated on the unbalanced panel are largely consistent with the baseline results from the balanced panel, though less precisely estimated (see Table B15).

6.3 Industry-level evidence for the retail sales of mobile phones

This subsection presents results at the industry level, where the only treated industry is the retail sales of telecommunication equipments, i.e., mobile phones, affected by RC in 2011. We focus on this industry because it shows the highest relative uptake of inputs under reverse charge (see Figure B1) and is thus the most likely to show any unintended consequences of the policy. Another

[32] Table B8 additionally shows that results are robust also when the outcome variables are in inverse hyperbolic sines also for the RC intensity, as compared to using log transformations.

Table 5: RC effects on firm entry/exit.

	P(entry) (1)	P(exit) (2)
RC input	-0.033	-0.010
	(0.038)	(0.038)
N	3746633	3746633
First Stage		
RCPI	0.459***	0.459***
	(0.092)	(0.092)
F-stat 1^{st}	25.143	25.143
AR F-test	0.634	0.062
AR p-value	0.426	0.803

Notes: The table shows the estimated coefficients of the probability of firm entry in or exit from the panel. The dependent variable is reported in the column header. The first stage regressor, RCPI, is a binary variable reflecting the institutional variation of RC. Robust standard errors clustered at the industry level in parentheses. AR F-Test refers to the Anderson-Rubin (AR) F-test, robust to weak instruments (Baum, Schaffer, and Stillman, 2007). One (*), two (**), or three stars (***) indicate statistical significance at 10%, 5%, and 1% levels.

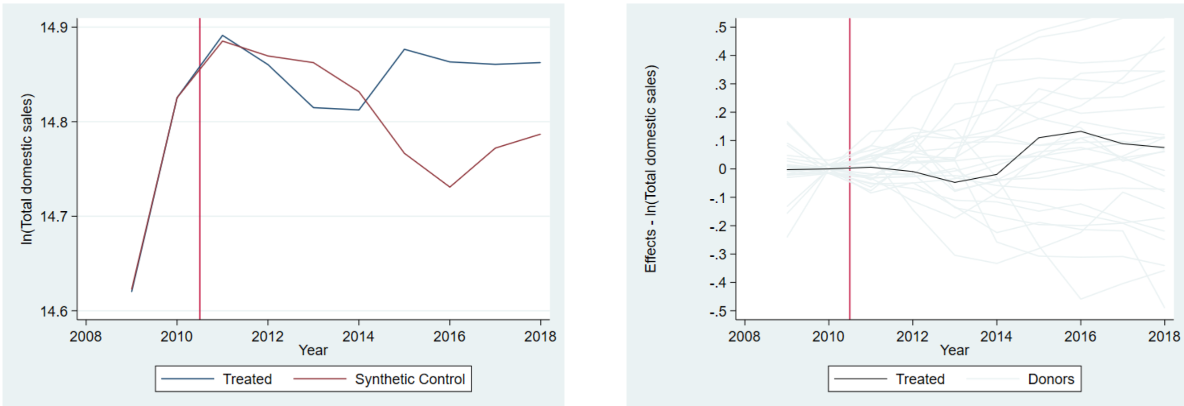
advantage of this analysis is the closer mapping from the products affected by RC into the industry classification, as compared to other retail sectors which might be selling a broader range of products.

To estimate the results on retail sales of mobile phones, we use data at the industry level, also due to the small number of firms in this industry in the balanced panel. Since only one industry is treated, we rely on the synthetic control method to estimate treatment effects (Abadie and Gardeazabal, 2003; Abadie, Diamond, and Hainmueller, 2010). This approach weights potential control observations to create a counterfactual for the treated industry's outcome variables. We use 26 industries in the retail sectors as controls (or donors, excluding the other 3 treated industries).[33] The main outcome variable is *domestic sales*. The variables used to predict domestic sales are inputs and the number of firms in the industry.

Figure 4a shows the development of domestic sales for the treated industry and for the synthetic control. Figure 4b shows the effects of RC on the treated industry and placebo treatments on the donor industries. Even if, at first sight (see Figure 4a), it seems that RC has a positive effect on domestic sales of the treated industry, Figure 4b shows that this result is not significantly different from other placebo treatments. In the Appendix, we also report results for sales at 19%, inputs and sales subject to reverse charge, which can be precisely measured in this data set (see Figure B2). This analysis at the industry level comes with a caveat as the evidence can also be influenced by compositional effects. The analysis is also limited with respect to the time horizon covered.

[33] In this section, we use industry-level data from the VAT advance returns, from 2009 to 2018.

Figure 4: RC effects on domestic sales – Synthetic control.



(a) Development of domestic sales

(b) Effects on domestic sales for retailers of telecommunication equipment and placebo effects for other 26 industries

Notes: The figure uses industry-level data for retailers (2009-2018). These figures result from applications of the synthetic control method. The red vertical line represents the introduction of reverse charge for mobile phones. There are 26 donor industries. The dependent variable is (log) domestic sales. Figure 4a shows domestic sales for the treated industry and the synthetic control. Figure 4b shows the effects of RC on the treated industry (retailers of telecommunication equipment), darker line, and placebo treatments on the donor industries (lighter lines).

Nonetheless, the results presented here mirror the firm-level evidence in Section 6.1.

6.4 Heterogeneity analysis and mechanisms

The following analyses explore the role of mechanisms and firm characteristics that might affect the decision or the opportunities to evade, like firm size, legal form, the exporting status or liquidity constraints. As a preview, all of these additional tests are consistent with the main findings and no sub-sample seems more prone to commit VAT evasion after RC implementations.

First, we split the sample to separate retailers that exported from those that did not. In fact, exporters are perhaps more likely to use different techniques or schemes to evade VAT, like participating in MT fraud or by misreporting domestic sales as exports as no VAT is due on the latter. Therefore, exporters might prefer the export margin relative to domestic sales under-reporting. Instead firms only trading domestically might resort to domestic sales under-reporting. Table 6 shows the RC effects on domestic sales for exporters (Column 1) and non-exporters (Column 2). Neither group seems to be under-reporting sales and evading VAT as a consequence of RC, despite the fact that evasion became more profitable for firms selling domestically under RC.

Table 6: RC effects on domestic sales, sample splits.

	Non-Exporters (1)	Exporters (2)	Small (3)	Large (4)	INC (5)	PAR (6)
RC input	0.012	-0.022	0.145**	0.009	0.066	-0.007
	(0.066)	(0.060)	(0.062)	(0.030)	(0.049)	(0.067)
N	1133427	105456	304091	311556	169835	1068996
First Stage						
RCPI	0.443***	0.462**	0.234***	1.654***	0.560***	0.451***
	(0.082)	(0.200)	(0.055)	(0.381)	(0.141)	(0.077)
F-stat 1^{st}	29.027	5.323	17.816	18.806	15.804	34.543
AR F-test	0.030	0.123	5.399	0.100	2.595	0.010
AR p-value	0.862	0.726	0.021	0.752	0.108	0.922

Notes: The table shows the estimated coefficients of Equation 1. The dependent variable is always domestic sales. The first stage regressor, RCPI, is a binary variable reflecting the institutional variation of RC. Small represents firms below the 25th percentile of the distribution of sales in 2010 and large firms are those with $> p(75)$ sales. "INC" stands for incorporated, while "PAR" stands for partnership. Robust standard errors clustered at the industry level and at the firm level in parentheses. AR F-Test refers to the Anderson-Rubin (AR) F-test, robust to weak instruments (Baum, Schaffer, and Stillman, 2007). One (*), two (**), or three stars (***) indicate statistical significance at 10%, 5%, and 1% levels.

As discussed in Section 2, smaller firms and partnerships might conceal evasion more easily as compared to large firms and corporations. Size might also well correlate with liquidity constraints. To explore the heterogeneous effects for firms of different sizes, we split the sample into two groups using sales volume as a proxy for firm size. We classify as "small" firms with sales in the first quartile of the distribution and compare them with large firms (top quartile). The size is assigned based on the 2010 value, thus before the introduction of reverse charge. Table 6 shows the IV results by firm size in Columns 3 (small) and 4 (large). We can see that for both categories there is no decline in domestic sales. These results are thus not supporting the hypothesis that evasion in this context might be perpetrated by smaller firms, neither because of opportunity nor because of constraints.[34] We also expand the baseline sample to include retailers in VAT groups, to explore if the presence of such, usually larger entities and important market players, influences the findings. The results are shown in Appendix Table B16. Including entities in VAT groups in the analysis does not affect the main results.

[34] Alternatively, we split the sample into two groups based on the skewed distribution of the number of employees subject to social security contributions: Small (up to the 25th percentile of the distribution), and large (with $> p(75)$ employees) firms. The size is assigned based on the number of employees in 2010, thus before the introduction of reverse charge. Table B20 in the Appendix shows the IV results, by firm size. No group shows a decline in domestic sales. A limitation of this analysis is that despite the low number of employees, the cutoff at the 90th percentile might not necessarily well separate small from large firms. The two types of classifications deliver different results, probably also in relation to group size and statistical power.

Next, we look at the results by legal form. As explained in Section 5, the sample only consists of partnerships and companies and we can analyse the two categories separately, to explore differences in the outcomes related to reverse charge.[35] Here, we expect evasion to be more prevalent in the case of partnerships, since they are subject to less stringent reporting rules as compared to companies. Table 6 shows the results by legal form, for companies (INC, Column 5) and partnerships (PAR, Column 6). We can see that in both cases domestic sales do not significantly decline. These findings suggest that even if firms are subject to less stringent reporting requirements, they are not more likely to evade under RC. The results on the other outcome variables for the exporting status, size, and legal form sample splits are reported in Appendix Tables B17, B18, and B19, respectively.

We additionally test if liquidity-constrained retailers are more likely to evade. Liquidity constraints are for example related to the age or the start-up status of a firm, as well as to its size. These tests use the unbalanced panel as the start-up status could not be inferred from nor exploited in the balanced panel. The results, reported in Appendix Table B15, show that startups in RC industries are not more likely to under-report sales as compared to their counterparts in non-RC industries. Moreover, as seen before in Table 5, RC in itself is also not significantly associated with such high liquidity constraints that a firm might be pushed out of business.

7 Discussion

External validity External validity of these results is relevant for the policy implications of the paper, especially since RC will remain in place in the foreseeable future. First of all, in a cross-country analysis of 38 OECD countries, Germany ranks among the lowest quartile in terms of tax evasion (Buehn and Schneider, 2016), and recent estimates suggest that the informal economy might account for less than 15% of GDP (Pappadà and Rogoff, 2025), which sustains the idea that Germany might be a high enforcement setting and optimal evasion is not affected by the reform (Waseem, 2023). Moreover, within Germany, some official sources typically mention construction services, restaurants, hotels, etc., as more informal sectors. These are sectors with higher rates of illegal employment, thus evading income taxation and social security contributions (Bundesministerium der Justiz, 2021, Section 2a). So, the sectors affected by reverse charge might be more formal

[35] Classification is based on the legal form in 2010, i.e., prior to the introduction of RC.

than other (service) sectors in the economy. In addition to that, for purchases of durable goods, consumers are more likely to use electronic payments, as compared to other industries (Deutsche Bundesbank, 2015, p. 63). This implies that in the industries affected by RC (typically involving durable goods) it might be more difficult to conceal sales (Immordino and Russo, 2018). This in turn suggests that we may want to consider industry characteristics when generalising the possible consequences of reverse charge. For example, we cannot conclude from these results that a general reverse charge mechanism (De La Feria, 2019) or RC applying to more informal B2C service sectors would also not lead to more VAT evasion.

Interaction with missing-trade fraud Another point concerns the interaction between retailers and missing-trader (MT) fraud, the type of cross-border VAT fraud that has been tackled with the introduction of reverse charge (Buettner and Tassi, 2023). If a retailer is involved in MT fraud, they might be consciously colluding or be inadvertently involved in the scheme. In either case, we would expect to observe a (fully) compliant retailer—which reports, remits or claims VAT—as the downstream transactions of the MT have to appear legitimate in order to better conceal the scheme. If reverse charge is introduced and MT fraud stops, we would expect an inadvertently-involved business to change supplier. This might have short-term effects on the retailer's performance until a new supplier is found. We do not observe a short-term drop in sales in the analysis, nonetheless. If instead the retailer was purely set up to participate in the fraud scheme, we would observe them to disappear once RC is introduced. Such retailers would not even show up in the analysis with the balanced panel, however, but at the same time firm exit is not significantly affected by RC in the unbalanced panel analysis.

Policy implications For a comprehensive evaluation of RC we would need to consider the overall tax revenue effects of RC, due to stopping cross-border fraud and perhaps facilitating VAT evasion at the retail stage. The findings from this study suggest that RC does not aggravate B2C VAT evasion. If we consider them together with the evidence on cross-border fraud presented in Buettner and Tassi (2023), who show that fraudulent input VAT claims decline after the introduction of RC, we could conclude that the implementation of RC as of today does not reduce, but likely increases VAT collection in Germany. We would also expect similar findings for developed countries with comparable institutions and enforcement levels. Moreover, existing evidence from cross-country studies does not support the concern that VAT revenues decline as a consequence of RC (Madzharova, 2020; Holá, Arltová, and Zídková, 2022; Bohne et al., 2025).

Future research Future research might be guided by the limitations of the current analysis. In the paper, we have highlighted the existence of a threshold for the application of RC in B2B transactions. The threshold was mainly introduced not to cause a disproportionate increase in compliance costs for small firms (European Commission, 2010). The role of the threshold as a policy instrument is an aspect that could be further investigated, with more suitable data at transaction level. Using transaction-level data could also be useful to distinguish between B2B and B2C transactions, which is a limitation of the current data set. Even though this analysis focuses on retailers, these firms may still sell some products to other firms rather than only to final consumers. While we present some suggestive evidence for this argument, we remain agnostic about whether or not some firms maliciously misreport their sales, declaring to have B2B sales while they only sell to final consumers, hereby committing a different type of VAT evasion.

8 Conclusion

In this paper, we investigate whether the last-mile problem—that is, VAT evasion enabled by the lack of third-party reporting at the retail stage—is quantitatively important in a particularly high-enforcement and low-informality setting in which consumers are not enlisted in tax enforcement.

We exploit a reform of VAT rules whereby retailers do not only remit taxes on the value-added they generate themselves (unlike under standard VAT rules), but on the value-added created along the entire supply chain, akin to a retail sales tax. The gain and thus the incentive to evade increase under this regime (called the reverse charge, RC). To evade, retailers under-report their sales to avoid remitting the collected VAT.

Leveraging a firm-level data set that covers the universe of German VAT declarations over 2002-2017, we investigate the effect of the implementation of RC to specific products on reported sales by retailers selling these products. To identify the causal effects of RC, we employ an instrumental variable approach exploiting the institutional variation in the adoption of RC based on the staggered introduction of RC in certain industries. Our results show that RC-affected retailers do not report lower sales, suggesting that firms do not engage in more evasion despite increased incentives to do so. This indirectly indicates that the last-mile problem is not quantitatively important in this high-enforcement and low-informality setting.

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ONLINE APPENDIX

VAT collection only at the retail stage: Evidence on tax compliance

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Contents

A Data

The data set used in this study is based on items reported by firms on the VAT advance returns (*Umsatzsteuer-Voranmeldungen*), shown in Figures A1 and A2. A slightly simplified translation of the returns is provided in Figures A3 and A4. The single items are typically not available in the data set, as they are usually aggregated. The full details are available in Destatis (2021), while here we focus on the description of variables that we use.

- *Domestic Sales* is a variable that we construct starting from firm's *Total Sales* (the variable is called $ef7$ in Destatis (2021)). From *Total Sales*, we deduct exports to EU countries (items 41 and 44; the variable is called $ef13$ in Destatis (2021)) and other tax-free sales (including exports to third countries, item 43 of the tex returns. The variable is called $ef14$ in Destatis (2021)). *Domestic Sales* thus includes items 35, 42 (included only until 2006), 48, 81, 76, 77 (from 2011), 86, 60, and 68. Thus, *Domestic Sales* include sales at different VAT rates, sales under reverse charge, as well as some tax-exempted sales.
- *Sales at 19%* is used as given in the data set (the variable is called $ef9$ in Destatis (2021)). It correspond to item 81 from the VAT advance returns. Note that this variable corresponds to sales at 16% until 2006, since VAT was increased to 19% in 2007, but it applies to the same tax base.
- *RC sales* is a variable we construct by subtracting *Sales at 19%* and *Sales at 7%* from *Domestic Sales*, it does not capture exclusively sales subject to reverse charge, but it is rather a residual part of sales not subject to the standard or reduced VAT rates; items 35, 42, 48, 60, 68, 76, and 77. Thus this variable captures the residual sales, once subtracting sales at 19% and 7% from domestic sales. It also includes tax-free sales and sales at other VAT rates. It does therefore not exactly capture sales subject to reverse charge, but they are indeed an important component of these residual sales. For example, from the VAT data for Germany in 2017 (Destatis, 2019), we can estimate that 53% of the sales in this variable are subject to reverse charge. Due to the data processing and the fact that the agricultural sector is not included, we expect the coverage of RC sales to be even better as compared to economy-wide data.
- *Input VAT* is used as given in the data set (the variable is called $ef19$ in Destatis (2021)). It includes items 61, 62, 63, 64, 66, and 67 from the VAT advance returns.
- *RC input* is constructed by subtracting deductible input VAT for deliveries and services (items 62, 63, 64, 66) and input VAT on EU imports (61) from *Input VAT*. Thus, it corresponds to item 67.
- *RC intensity* is constructed as the share of inputs subject to RC with respect to all inputs ($\frac{\text{RC input}}{\text{Input VAT}}$).
- *VAT-exempted sales* correspond to $ef15$ in Destatis (2021) and include the tax-free sales of goods and services without credit for VAT on inputs (exempt goods and services).

Figure A1: VAT return form – Page 1.

- Bitte weiße Felder ausfüllen oder ☒ ankreuzen, Anleitung beachten -

2017

Fallart	Steuernummer	Unterfallart
11		56

30 Eingangsstempel oder -datum

Finanzamt

Unternehmer – ggf. abweichende Firmenbezeichnung –
Anschrift – Telefon – E-Mail-Adresse

Umsatzsteuer-Voranmeldung 2017

Voranmeldungszeitraum

bei **monatlicher** Abgabe bitte ankreuzen

bei **vierteljährlicher** Abgabe bitte ankreuzen

17 01	Jan.		17 07	Juli		17 41	I. Kalendervierteljahr	
17 02	Feb.		17 08	Aug.		17 42	II. Kalendervierteljahr	
17 03	März		17 09	Sept.		17 43	III. Kalendervierteljahr	
17 04	April		17 10	Okt.		17 44	IV. Kalendervierteljahr	
17 05	Mai		17 11	Nov.				
17 06	Juni		17 12	Dez.				

Berichtigte Anmeldung (falls ja, bitte eine „1" eintragen) 10

Belege (Verträge, Rechnungen usw.) sind beigefügt bzw. werden gesondert eingereicht (falls ja, bitte eine „1" eintragen) 22

I. Anmeldung der Umsatzsteuer-Vorauszahlung

		Bemessungsgrundlage ohne Umsatzsteuer volle EUR	Ct		Steuer EUR	Ct
Lieferungen und sonstige Leistungen (einschließlich unentgeltlicher Wertabgaben)						
Steuerfreie Umsätze mit Vorsteuerabzug						
Innergemeinschaftliche Lieferungen (§ 4 Nr. 1 Buchst. b UStG) an Abnehmer **mit** USt-IdNr.	41		—			
neuer Fahrzeuge an Abnehmer **ohne** USt-IdNr.	44		—			
neuer Fahrzeuge außerhalb eines Unternehmens (§ 2a UStG).	49		—			
Weitere steuerfreie Umsätze mit Vorsteuerabzug (z.B. **Ausfuhrlieferungen**, Umsätze nach § 4 Nr. 2 bis 7 UStG)	43		—			
Steuerfreie Umsätze ohne Vorsteuerabzug Umsätze nach § 4 Nr. 8 bis 28 UStG	48		—			
Steuerpflichtige Umsätze (Lieferungen und sonstige Leistungen einschl. unentgeltlicher Wertabgaben)						
zum Steuersatz von 19 %.	81		—			
zum Steuersatz von 7 %.	86		—			
zu anderen Steuersätzen	35		—	36		
Lieferungen land- und forstwirtschaftlicher Betriebe nach § 24 UStG an Abnehmer **mit** USt-IdNr.	77		—			
Umsätze, für die eine Steuer nach § 24 UStG zu entrichten ist (Sägewerkserzeugnisse, Getränke und alkohol. Flüssigkeiten, z.B. Wein) . . .	76		—	80		
Innergemeinschaftliche Erwerbe						
Steuerfreie innergemeinschaftliche Erwerbe Erwerbe nach §§ 4b und 25c UStG	91		—			
Steuerpflichtige innergemeinschaftliche Erwerbe zum Steuersatz von 19 %.	89		—			
zum Steuersatz von 7 %	93		—			
zu anderen Steuersätzen	95		—	98		
neuer Fahrzeuge (§ 1b Abs. 2 und 3 UStG) von Lieferern **ohne** USt-IdNr. zum allgemeinen Steuersatz	94		—	96		
Ergänzende Angaben zu Umsätzen						
Lieferungen des ersten Abnehmers bei **innergemeinschaftlichen Dreiecksgeschäften** (§ 25b Abs. 2 UStG)	42		—			
Steuerpflichtige Umsätze, für die der **Leistungsempfänger** die **Steuer nach § 13b Abs. 5 Satz 1 i.V.m. Abs. 2 Nr. 10 UStG schuldet**	68		—			
Übrige steuerpflichtige Umsätze, für die der **Leistungsempfänger** die **Steuer nach § 13b Abs. 5 UStG schuldet**	60		—			
Nicht steuerbare sonstige Leistungen gem. § 18b Satz 1 Nr. 2 UStG	21		—			
Übrige nicht steuerbare Umsätze (Leistungsort nicht im Inland)	45		—			
Übertrag . . . . zu übertragen in Zeile 45						

USt 1 A – Umsatzsteuer-Voranmeldung 2017 – (10.16)

Figure A2: VAT return form – Page 2.

– 2 –

Steuernummer:

		Bemessungsgrundlage ohne Umsatzsteuer volle EUR		Steuer EUR	Ct
Übertrag					
Leistungsempfänger als Steuerschuldner (§ 13b UStG)					
Steuerpflichtige sonstige Leistungen eines im übrigen Gemeinschaftsgebiet ansässigen Unternehmers (§ 13b Abs. 1 UStG)	46		47		
Andere Leistungen eines im Ausland ansässigen Unternehmers (§ 13b Abs. 2 Nr. 1 und 5 Buchst. a UStG)	52		53		
Lieferungen sicherungsübereigneter Gegenstände und Umsätze, die unter das GrEStG fallen (§ 13b Abs. 2 Nr. 2 und 3 UStG)	73		74		
Lieferungen von Mobilfunkgeräten, Tablet-Computern, Spielekonsolen und integrierten Schaltkreisen (§ 13b Abs. 2 Nr. 10 UStG)	78		79		
Andere Leistungen (§ 13b Abs. 2 Nr. 4, 5 Buchst. b, Nr. 6 bis 9 und 11 UStG)	84		85		
Steuer infolge Wechsels der Besteuerungsform sowie Nachsteuer auf versteuerte Anzahlungen u. ä. wegen Steuersatzänderung			65		
Umsatzsteuer					
Abziehbare Vorsteuerbeträge					
Vorsteuerbeträge aus Rechnungen von anderen Unternehmern (§ 15 Abs. 1 Satz 1 Nr. 1 UStG), aus Leistungen im Sinne des § 13a Abs. 1 Nr. 6 UStG (§ 15 Abs. 1 Satz 1 Nr. 5 UStG) und aus innergemeinschaftlichen Dreiecksgeschäften (§ 25b Abs. 5 UStG)			66		
Vorsteuerbeträge aus dem innergemeinschaftlichen Erwerb von Gegenständen (§ 15 Abs. 1 Satz 1 Nr. 3 UStG)			61		
Entstandene Einfuhrumsatzsteuer (§ 15 Abs. 1 Satz 1 Nr. 2 UStG)			62		
Vorsteuerbeträge aus Leistungen im Sinne des § 13b UStG (§ 15 Abs. 1 Satz 1 Nr. 4 UStG)			67		
Vorsteuerbeträge, die nach allgemeinen Durchschnittssätzen berechnet sind (§§ 23 und 23a UStG)			63		
Berichtigung des Vorsteuerabzugs (§ 15a UStG)			64		
Vorsteuerabzug für innergemeinschaftliche Lieferungen neuer Fahrzeuge außerhalb eines Unternehmens (§ 2a UStG) sowie von Kleinunternehmern im Sinne des § 19 Abs. 1 UStG (§ 15 Abs. 4a UStG)			59		
Verbleibender Betrag					
Andere Steuerbeträge					
In Rechnungen unrichtig oder unberechtigt ausgewiesene Steuerbeträge (§ 14c UStG) sowie Steuerbeträge, die nach § 6a Abs. 4 Satz 2, § 17 Abs. 1 Satz 6, § 25b Abs. 2 UStG oder von einem Auslagerer oder Lagerhalter nach § 13a Abs. 1 Nr. 6 UStG geschuldet werden			69		
Umsatzsteuer-Vorauszahlung/Überschuss					
Abzug der festgesetzten **Sondervorauszahlung** für Dauerfristverlängerung (nur auszufüllen in der letzten Voranmeldung des Besteuerungszeitraums, in der Regel Dezember)			39		
Verbleibende Umsatzsteuer-Vorauszahlung . . . . . **(bitte in jedem Fall ausfüllen)** **Verbleibender Überschuss** - bitte dem Betrag ein Minuszeichen voranstellen -			83		

II. Sonstige Angaben und Unterschrift

Ein Erstattungsbetrag wird auf das dem Finanzamt benannte Konto überwiesen, soweit der Betrag nicht mit Steuerschulden verrechnet wird. **Verrechnung des Erstattungsbetrags erwünscht / Erstattungsbetrag ist abgetreten** (falls ja, bitte eine „1“ eintragen) Geben Sie bitte die Verrechnungswünsche auf einem gesonderten Blatt an oder auf dem beim Finanzamt erhältlichen Vordruck „Verrechnungsantrag“.	29
Das **SEPA-Lastschriftmandat** wird ausnahmsweise (z.B. wegen Verrechnungswünschen) für diesen Voranmeldungszeitraum **widerrufen** (falls ja, bitte eine „1“ eintragen) Ein ggf. verbleibender Restbetrag ist gesondert zu entrichten.	26
Über die Angaben in der Steueranmeldung hinaus sind weitere oder abweichende Angaben oder Sachverhalte zu berücksichtigen (falls ja, bitte eine „1“ eintragen) Geben Sie bitte diese auf einem gesonderten Blatt an, welches mit der Überschrift **„Ergänzende Angaben zur Steueranmeldung“** zu kennzeichnen ist.	23

Hinweis nach den Vorschriften der Datenschutzgesetze:
Die mit der Steueranmeldung angeforderten Daten werden auf Grund der §§ 149, 150 der Abgabenordnung und der §§ 18, 18b des Umsatzsteuergesetzes erhoben. Die Angabe der Telefonnummern und der E-Mail-Adressen ist freiwillig.

Bei der Anfertigung dieser Steueranmeldung hat mitgewirkt:
(Name, Anschrift, Telefon, E-Mail-Adresse)

Datum, Unterschrift

- nur vom Finanzamt auszufüllen -

11		19	
		12	

Bearbeitungshinweis

1. Die aufgeführten Daten sind mit Hilfe des geprüften und genehmigten Programms sowie ggf. unter Berücksichtigung der gespeicherten Daten maschinell zu verarbeiten.
2. Die weitere Bearbeitung richtet sich nach den Ergebnissen der maschinellen Verarbeitung.

Datum, Namenszeichen

Kontrollzahl und/oder Datenerfassungsvermerk

Figure A3: VAT return form – Page 1 – ENG.

– Page 1 of 2 –

[Field 11] – Tax ID

[Field 30] – Date of receipt or submission

To the Tax Office:

[Enter company name, address, phone number, email address]

VAT Advance Return 2017

□ Monthly submission
□ Quarterly submission
Rectified submission? [Field 10]
Documents attached? [Field 22]

I. Declaration of VAT Payment

Supplies of goods and other services

Tax-exempt sales with input tax deduction

[Field 41] Intra-community supplies (§ 4 No. 1 letter b VAT Act) to recipients with VAT ID
[Field 44] – New vehicles to buyers without VAT ID
[Field 49] – New vehicles to non-businesses (§ 2a VAT Act)
[Field 43] – Other tax-exempt sales with input tax deduction, like exports outside EU (§ 4 No. 2 to 7 VAT Act)
[Field 48] – **Tax-exempt sales without input tax deduction** (§ 4 No. 8 to 28 VAT Act)

Taxable sales

[Field 81] – Taxable sales at standard rate (19%)
[Field 86] – Taxable sales at reduced rate (7%)
[Field 36] – Taxable sales (other rates) and [Field 35] relative tax
[Field 77] – Sales by agricultural and forestry businesses under § 24 VAT Act to recipients with VAT ID
[Field 76] – Other taxable sales under § 24 VAT Act (e.g., alcohol, beverages, etc.)

Intra-Community Acquisitions

[Field 91] – Tax-exempt intra-community acquisitions (§§ 4b and 25c VAT Act)
[Field 89] – Taxable intra-community acquisitions at standard rate (19%)
[Field 93] – Taxable intra-community acquisitions at reduced rate (7%)
[Field 95] – Taxable intra-community acquisitions at other rates and [Field 98] relative tax
[Field 94] – New vehicles (§ 1b No. 2 and 4 VAT Act) from sellers without VAT ID and [Field 96] relative tax

Additional Information on Sales

[Field 42] – First buyer's intra-community triangular transactions (§ 25b No. 2 VAT Act)
[Field 68] – Taxable sales under reverse charge mechanism (§ 13b No 5.1 and 2.10 VAT Act)
[Field 60] – Other taxable sales under reverse charge mechanism (§ 13b No 5 VAT Act)
[Field 21] – Non-taxable other services (§ 18b 1 No. 2 VAT Act)
[Field 45] – Other non-taxable sales (place of service not in Germany)

Figure A4: VAT return form – Page 2 – ENG.

– Page 2 of 2 –

Acquisitions under reverse charge mechanism (§ 13b VAT Act)

[Field 46] – Other services by businesses based in another EU country (Sec. 1) and [Field 47] relative tax

[Field 52] – Other services by foreign businesses (Sec. 2 No. 1 and 5 letter a) and [Field 53] relative tax

[Field 73] – Supply of goods provided as security (Sec. 2 No. 2 and 3) and [Field 74] relative tax

[Field 78] – Supply of mobile phones, tablets, integrated circuits, game consoles (Sec. 2 No. 10) and [Field 79] relative tax

[Field 84] – Other services (Sec. 2, No 4, 5 letter b, 6-9, and 11) and [Field 85] relative tax

[Field 65] – Tax due to change of taxable form and additional tax on taxed payments etc. due to tax rate change

VAT due

Deductible Input Taxes

[Field 66] – Input taxes from invoices by other businesses (§ 15 sec. 1 sentence 1 No. 1 VAT Act), from services as per (§ 15 sec. 1 sentence 1 No. 5 VAT Act) and from triangular transactions (§ 25 sec. 5 VAT Act)

[Field 61] – Input tax from intra-community acquisitions (§ 15 sec. 1 sentence 1 No. 3 VAT Act)

[Field 62] – Input tax from import VAT (§ 15 sec. 1 sentence 1 No. 2 VAT Act)

[Field 67] – Input tax under reverse charge mechanism (§13b VAT Act)

[Field 63] – Input taxes computed according to the average VAT rates (§§ 23 and 23a VAT Act)

[Field 64] – Correction of the input tax deduction (§15a VAT Act)

[Field 59] – Input tax for intra-community acquisitions of new vehicles (§2a VAT Act) as well as for small businesses (§15 sec. 4a VAT Act)

Other tax amounts

[Field 69] – Wrongly declared VAT from invoices (§14c VAT Act) or VAT due by stock removal or storage company (§13a sec. 1 No. 6 VAT Act)

VAT advance payment or credit

[Field 39] – Deduction of the agreed-upon special advance payment for permanent extension (only in the last period before the end of the fiscal year, normally December)

[Field 83] – Advance payment amount or credit (negative amount = credit)

II. Other Information and Signature (summary)

[Field 29] – Refund requested? Yes/No.

[Field 26] – SEPA direct debit mandate active but not to be used for this declaration? Yes/No

[Field 23] – Additional notes or remarks? Yes/No.

-To be filled out by the tax authority-

Signature, Date

B Additional tables and figures

Table B1: VAT chain – A simple illustration.

Agent	Sales	Purchases	VAT paid	Input VAT	Remittance
Producer	p_P				τp_P
Wholesaler	p_{WS}	p_P	τp_P	τp_P	$\tau p_{WS} - \tau p_P$
Retailer	p_R	p_{WS}	τp_{WS}	τp_{WS}	$\tau p_R - \tau p_{WS}$

Notes: For simplicity we can assume that only one unit of the good x is sold or purchased. Therefore, "sales" indicates the price at which the firm sells the good. "Purchases" indicates the price at which the firm buys the good. "VAT paid" (on purchase) represents the VAT liability. "Input VAT" is the VAT rebate that the firm is entitled to. "Remittance" indicates the VAT remitted to the tax authorities. τ is the tax rate, p_P is the producer's price, p_{WS} is the wholesaler's price, and p_R is the retailer's price.

Table B2: VAT chain with Reverse Charge – A simple illustration.

Agent	Sales	Purchases	VAT due	Input VAT	Remittance
Producer	p_P				
Wholesaler	p_{WS}	p_P	τp_P	τp_P	$\tau p_P - \tau p_P = 0$
Retailer	p_R	p_{WS}	τp_{WS}	τp_{WS}	$\tau p_R + \tau p_{WS} - \tau p_{WS} = \tau p_R$

Notes: For simplicity we can assume that only one unit of the good x is sold or purchased. Therefore, "sales" indicates the price at which the firm sells the good. "Purchases" indicates the price at which the firm buys the good. "VAT due" (on purchase) represents the VAT liability. "Input VAT" is the VAT rebate that the firm is entitled to. "Remittance" indicates the VAT remitted to the tax authorities. τ is the tax rate, p_P is the producer's price, p_{WS} is the wholesaler's price, and p_R is the retailer's price.

Table B3: Industries affected by reverse charge.

Industry	**NACE Rev. 2**	**NACE Rev. 1.1**	**Identification through...**
Retail sale of computers, peripheral units and software in specialised stores	47.41.0	52.49.5	NACE Rev. 2
Retail sale of telecommunications equipment in specialised stores	47.42.0	52.49.6	NACE Rev. 2 or NACE Rev. 1.1
Retail sale of hardware, paints and glass in specialised stores	47.52.1	52.46.1	NACE Rev. 2 or NACE Rev. 1.1
Retail sale of watches and jewelry	47.77.0	52.48.5	NACE Rev. 2 or NACE Rev. 1.1

Notes: NACE Rev. 2 refers to the industry classification implemented from 2009. NACE Rev. 1.1 refers to the industry classification in place between 2002 and 2008. The column "Identification through..." specifies which industry classification we use to identify firms affected by reverse charge. We only use NACE Rev 2. when the corresponding NACE Rev. 1.1 code, though unique, contains multiple industries among which some are not affected by reverse charge. For example, (NACE Rev. 1.1) industry "Retail sale of computers, peripheral units and software in specialised stores" also includes "Assembling of computers for private clients (configuration according to client's wishes)," which corresponds to the NACE Rev. 2 code 26.20.0. We use NACE Rev. 2 or NACE Rev. 1.1 for identification, when both codes refer to exactly the same industry, without including any other industries.

Table B4: Descriptive statistics.

	Mean	SD	N
Panel A - Retailers subject to RC			
Domestic sales (in €)	716,817	3,200,649	108,448
Sales at 19% (in €)	691,590	3,051,696	108,356
RC sales (in €)	21,231	420,676	108,448
Input VAT (in €)	99,393	545,776	107,886
RC input (in €)	2,540	104,761	107,886
RC intensity	0.008	0.070	107,886
Employees	4.263	16.379	81,899
Panel B - Other retailers			
Domestic sales (in €)	1,276,681	11,545,437	1,140,992
Sales at 19% (in €)	1,143,143	11,195,286	1,131,747
RC sales (in €)	5,590	203,785	1,140,992
Input VAT (in €)	174,594	1,733,379	1,131,297
RC input (in €)	1,356	81,041	1,131,297
RC intensity	0.003	0.030	1,131,297
Employees	7.287	78.917	905,846

Notes: amounts in € in prices of 2017. Data refer to 78,090 firms. Annual observations for the years 2002-2017. SD stands for standard deviation and N stands for number of observations. *Panel A* shows the average values for firms in the 4 industries subject to reverse charge. *Panel B* shows the average values for all the retailers excluding these 4 industries.

Table B5: RC effects on sales – No controls.

	Domestic sales	Sales at 19%	RC sales
	(1)	(2)	(3)
RC input	0.027	-0.160***	4.388***
	(0.055)	(0.053)	(1.674)
N	1239110	1229835	1239110
First Stage			
RCPI	0.522***	0.519***	0.522***
	(0.080)	(0.081)	(0.080)
F-stat 1^{st}	42.119	41.197	42.119
AR F-test	0.254	7.108	5.803
AR p-value	0.614	0.008	0.016

Notes: The table shows the estimated coefficients of Equation 1, but without control variables. The dependent variable is reported in the column header. The first stage regressor, RCPI, is a binary variable reflecting the institutional variation of RC. The dependent variables are in inverse hyperbolic sines. Robust standard errors clustered at the industry level and at the firm level in parentheses. AR F-Test refers to the Anderson-Rubin (AR) F-test, robust to weak instruments (Baum, Schaffer, and Stillman, 2007). One (*), two (**), or three stars (***) indicate statistical significance at 10%, 5%, and 1% levels.

Table B6: RC effects on sales – TWFE and reduced form.

	Domestic sales		Sales at 19%		RC sales	
	(1)	(2)	(3)	(4)	(5)	(6)
RC input	0.030***		0.025***		0.196***	
	(0.002)		(0.002)		(0.025)	
RCPI		0.005		-0.092***		2.322**
		(0.027)		(0.030)		(0.945)
N	1238994	1249330	1229719	1239947	1238994	1249330

Notes: The table shows the TWFE estimated coefficients of Equation 1 and the estimates from the reduced form, i.e., regressing the outcome variables on the policy indicator RCPI. The dependent variable is reported in the column header. The dependent variables are in inverse hyperbolic sines. Robust standard errors clustered at the industry level and at the firm level in parentheses. One (*), two (**), or three stars (***) indicate statistical significance at 10%, 5%, and 1% levels.

Table B7: RC effects on sales – Alternative outcomes.

	VAT-exempted sales	Residual domestic sales	Input VAT
	(1)	(2)	(3)
RC input	-0.065	0.050	-0.090
	(0.433)	(0.147)	(0.084)
N	66453	1238994	1238994
First Stage			
RCPI	0.514***	0.514***	0.675***
	(0.073)	(0.073)	(0.258)
F-stat 1^{st}	6.862	49.507	49.507
AR F-test	0.025	0.120	0.968
AR p-value	0.875	0.731	0.330

Notes: The table shows the estimated coefficients of Equation 1. The dependent variable is reported in the column header. The first stage regressor, $RCPI$, is a binary variable reflecting the institutional variation of RC. The dependent variables are in inverse hyperbolic sines. Robust standard errors clustered at the industry level and at the firm level in parentheses. AR F-Test refers to the Anderson-Rubin (AR) F-test, robust to weak instruments (Baum, Schaffer, and Stillman, 2007). One (*), two (**), or three stars (***) indicate statistical significance at 10%, 5%, and 1% levels.

Table B8: RC effects on sales – Robustness tests using RC intensity.

	No outliers			Inverse hyperbolic sine transf.		
	Domestic sales	Sales at 19%	RC sales	Domestic sales	Sales at 19%	RC sales
	(1)	(2)	(3)	(4)	(5)	(6)
RC intensity	0.856	-14.359***	355.694**	0.611	-15.202***	374.312**
	(4.204)	(4.850)	(167.876)	(4.382)	(5.350)	(184.142)
N	1237421	1228066	1237648	1238994	1229719	1238994
First Stage						
RCPI	0.007***	0.007***	0.007***	0.006***	0.006***	0.006***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
F-stat 1^{st}	42.741	45.501	42.699	33.089	34.958	33.089
AR F-test	0.042	9.498	6.019	0.020	9.573	6.039
AR p-value	0.837	0.002	0.014	0.888	0.002	0.014

Notes: The table shows the estimated coefficients of Equation 1. The dependent variable is reported in the column header. The first stage regressor, $RCPI$, is a binary variable reflecting the institutional variation of RC. The dependent variables in columns (1) and (2) are in logs; in columns (3)-(6) in inverse hyperbolic sines. In columns (1)-(3) observations with negative RC intensity or RC intensity > 1 are excluded. Robust standard errors clustered at the industry level and at the firm level in parentheses. AR F-Test refers to the Anderson-Rubin (AR) F-test, robust to weak instruments (Baum, Schaffer, and Stillman, 2007). One (*), two (**), or three stars (***) indicate statistical significance at 10%, 5%, and 1% levels.

Table B9: Effects on sales – Sample including industry switchers.

	Domestic sales	Sales at 19%	RC sales
	(1)	(2)	(3)
RC input	0.016	-0.179***	4.465***
	(0.052)	(0.050)	(1.588)
N	1244751	1235471	1244751
First Stage			
RCPI	0.513***	0.510***	0.513***
	(0.083)	(0.083)	(0.083)
F-stat 1^{st}	38.589	37.772	38.589
AR F-test	0.101	9.377	6.154
AR p-value	0.751	0.002	0.013

Notes: The table shows the estimated coefficients of Equation 1. The dependent variable is reported in the column header. The first stage regressor, $RCPI$, is a binary variable reflecting the institutional variation of RC. The dependent variables are in inverse hyperbolic sines. Robust standard errors clustered at the industry level and at the firm level in parentheses. AR F-Test refers to the Anderson-Rubin (AR) F-test, robust to weak instruments (Baum, Schaffer, and Stillman, 2007). One (*), two (**), or three stars (***) indicate statistical significance at 10%, 5%, and 1% levels.

Table B10: RC effects on sales – Invariant industry.

	Domestic sales	Sales at 19%	RC sales
	(1)	(2)	(3)
RC input	0.007	-0.184***	4.541**
	(0.073)	(0.066)	(2.232)
N	1238994	1229719	1238994
First Stage			
RCPI	0.514***	0.511***	0.514***
	(0.073)	(0.075)	(0.073)
F-stat 1^{st}	49.507	46.793	49.507
AR F-test	0.011	5.951	3.866
AR p-value	0.919	0.019	0.055

Notes: The table shows the estimated coefficients of Equation 1. The dependent variable is reported in the column header. The first stage regressor, $RCPI$, is a binary variable reflecting the institutional variation of RC. The dependent variables are in inverse hyperbolic sines. Robust standard errors clustered at the industry level (based on the 2010 industry code) and at the firm level in parentheses. AR F-Test refers to the Anderson-Rubin (AR) F-test, robust to weak instruments (Baum, Schaffer, and Stillman, 2007). One (*), two (**), or three stars (***) indicate statistical significance at 10%, 5%, and 1% levels.

Table B11: RC effects on sales – Standard errors clustered at firm level.

	Domestic sales (1)	Sales at 19% (2)	RC sales (3)
RC input	0.007	-0.184***	4.541***
	(0.012)	(0.017)	(0.246)
N	1238994	1229719	1238994
First Stage			
RCPI	0.514***	0.511***	0.514***
	(0.027)	(0.027)	(0.027)
F-stat 1^{st}	364.042	358.763	364.042
AR F-test	0.374	207.526	1677.580
AR p-value	0.541	0.000	0.000

Notes: The table shows the estimated coefficients of Equation 1. The dependent variable is reported in the column header. The first stage regressor, RCPI, is a binary variable reflecting the institutional variation of RC. The dependent variables are in inverse hyperbolic sines. Robust standard errors clustered at the firm level in parentheses. AR F-Test refers to the Anderson-Rubin (AR) F-test, robust to weak instruments (Baum, Schaffer, and Stillman, 2007). One (*), two (**), or three stars (***) indicate statistical significance at 10%, 5%, and 1% levels.

Table B12: RC effects on sales – restrictions in time and scope.

	4-year time window			Excl. gold		
	Domestic sales (1)	Sales at 19% (2)	RC sales (3)	Domestic sales (4)	Sales at 19% (5)	RC sales (6)
RC input	0.030	-0.193***	5.614***	-0.031	-0.137**	0.650
	(0.056)	(0.054)	(2.147)	(0.060)	(0.062)	(0.439)
N	825584	820023	825584	1191509	1182283	1191509
First Stage						
RCPI	0.356***	0.355***	0.356***	0.490***	0.484***	0.490***
	(0.099)	(0.100)	(0.099)	(0.134)	(0.134)	(0.134)
F-stat 1^{st}	12.803	12.749	12.803	13.361	13.116	13.361
AR F-test	0.265	8.231	3.164	0.240	4.666	2.382
AR p-value	0.607	0.004	0.076	0.624	0.031	0.123

Notes: The table shows the estimated coefficients of Equation 1. The dependent variable is reported in the column header. In columns (1)-(3) the sample is restricted to the 4 years around RC implementations, in columns (4)-(6) the retail sale of jewelry and watches in excluded. The first stage regressor, RCPI, is a binary variable reflecting the institutional variation of RC. The dependent variables are in inverse hyperbolic sines. Robust standard errors clustered at the industry level and at the firm level in parentheses. AR F-Test refers to the Anderson-Rubin (AR) F-test, robust to weak instruments (Baum, Schaffer, and Stillman, 2007). One (*), two (**), or three stars (***) indicate statistical significance at 10%, 5%, and 1% levels.

Table B13: RC effects on sales – dummy second stage & RC electronics.

	Dummy second stage			RC electronics		
	Domestic sales	Sales at 19%	RC sales	Domestic sales	Sales at 19%	RC sales
	(1)	(2)	(3)	(4)	(5)	(6)
I(RC input > 0)	0.066	-1.208***	30.214***			
	(0.346)	(0.314)	(8.586)			
RC input				0.003	-0.175***	4.206**
				(0.051)	(0.051)	(1.689)
N	1249330	1239947	1249330	1238994	1229719	1238994
First Stage						
RCPI	0.077***	0.076***	0.077***	0.519***	0.516***	0.519***
	(0.015)	(0.015)	(0.015)	(0.081)	(0.082)	(0.081)
F-stat 1^{st}	27.401	26.650	27.401	40.857	39.857	40.857
AR F-test	0.037	9.340	6.035	0.003	8.894	5.344
AR p-value	0.847	0.002	0.014	0.953	0.003	0.021

Notes: The table shows the estimated coefficients of Equation 1. The dependent variable is reported in the column header. The first stage regressor, $RCPI$, is a binary variable reflecting the institutional variation of RC. The dependent variables are in inverse hyperbolic sines. In columns (1)-(3), instead of RC input, the explanatory variable is an indicator for having positive RC inputs. In columns (4)-(6), the RCPI switches to 1 in 2011 instead of 2014 for retailers selling computers as they might also sell telecommunication equipment, already affected by RC in 2011. Robust standard errors clustered at the industry level and at the firm level in parentheses. AR F-Test refers to the Anderson-Rubin (AR) F-test, robust to weak instruments (Baum, Schaffer, and Stillman, 2007). One (*), two (**), or three stars (***) indicate statistical significance at 10%, 5%, and 1% levels.

Table B14: RC effects on sales – untransformed dependent variables.

	Domestic sales	Sales at 19%	RC sales
	(1)	(2)	(3)
RC input	-21.120	-31.085	12.803
	(30.209)	(36.376)	(10.606)
N	1238994	1229719	1238994
First Stage			
RCPI	2774.437	2765.032	2774.437
	(2333.858)	(2336.259)	(2333.858)
F-stat 1^{st}	1.413	1.401	1.413
AR F-test	1.167	2.676	21.621
AR p-value	0.280	0.102	0.000

Notes: The table shows the estimated coefficients of Equation 1. The dependent variable is reported in the column header. The first stage regressor, $RCPI$, is a binary variable reflecting the institutional variation of RC. The dependent variables are in levels. Robust standard errors clustered at the industry level and at the firm level in parentheses. AR F-Test refers to the Anderson-Rubin (AR) F-test, robust to weak instruments (Baum, Schaffer, and Stillman, 2007). One (*), two (**), or three stars (***) indicate statistical significance at 10%, 5%, and 1% levels.

Table B15: Effects on sales – Unbalanced panel.

	Domestic sales	Sales at 19%	RC sales	Domestic sales	Sales at 19%	RC sales
	(1)	(2)	(3)	(4)	(5)	(6)
RC input	0.104	-0.119	3.484*	0.099	-0.125	3.487*
	(0.070)	(0.106)	(1.803)	(0.066)	(0.098)	(1.803)
Startup				-0.609***	-0.656***	0.512
				(0.045)	(0.049)	(0.396)
Startup × RC				0.029	0.026	-0.043
				(0.100)	(0.077)	(0.336)
N	3746633	3669164	3746633	3746633	3669164	3746633
First Stage						
RCPI	0.459***	0.456***	0.459***	0.459***	0.455***	0.459***
	(0.092)	(0.091)	(0.092)	(0.091)	(0.090)	(0.091)
F-stat 1^{st}	25.143	24.901	25.143	12.438	12.327	12.438
AR F-test	1.897	1.334	3.243	1.180	0.979	4.488
AR p-value	0.169	0.248	0.072	0.308	0.376	0.012

Notes: The table shows the estimated coefficients of Equation 1. The dependent variable is reported in the column header. The first stage regressor, RCPI, is a binary variable reflecting the institutional variation of RC. The dependent variables are in inverse hyperbolic sines. Robust standard errors clustered at the industry level in parentheses. AR F-Test refers to the Anderson-Rubin (AR) F-test, robust to weak instruments (Baum, Schaffer, and Stillman, 2007). One (*), two (**), or three stars (***) indicate statistical significance at 10%, 5%, and 1% levels.

Table B16: RC effects on sales – Including VAT groups.

	Domestic sales	Sales at 19%	RC sales
	(1)	(2)	(3)
RC input	0.014	-0.180***	4.408***
	(0.052)	(0.051)	(1.569)
In VAT group	0.548***	0.723***	-3.550*
	(0.070)	(0.076)	(1.816)
N	1260734	1251433	1260734
First Stage			
RCPI	0.517***	0.514***	0.517***
	(0.085)	(0.086)	(0.085)
F-stat 1^{st}	36.751	35.966	36.751
AR F-test	0.071	9.404	6.122
AR p-value	0.790	0.002	0.014

Notes: The table shows the estimated coefficients of Equation 1. The dependent variable is reported in the column header. The first stage regressor, RCPI, is a binary variable reflecting the institutional variation of RC. The dependent variables are in inverse hyperbolic sines. Robust standard errors clustered at the industry level and at the firm level in parentheses. AR F-Test refers to the Anderson-Rubin (AR) F-test, robust to weak instruments (Baum, Schaffer, and Stillman, 2007). One (*), two (**), or three stars (***) indicate statistical significance at 10%, 5%, and 1% levels.

Table B17: RC effects on sales, by exporting status.

	Non-Exporters		Exporters	
	Sales at 19%	RC sales	Sales at 19%	RC sales
	(1)	(2)	(3)	(4)
RC input	-0.223***	5.715***	-0.231**	2.305**
	(0.059)	(1.683)	(0.113)	(0.955)
N	1124788	1133427	104820	105456
First Stage				
RCPI	0.439***	0.443***	0.459**	0.462**
	(0.083)	(0.082)	(0.200)	(0.200)
F-stat 1^{st}	28.050	29.027	5.236	5.323
AR F-test	9.767	6.479	9.212	6.363
AR p-value	0.002	0.011	0.003	0.012

Notes: The table shows the estimated coefficients of Equation 1. The dependent variable is reported in the column header. The first stage regressor, $RCPI$, is a binary variable reflecting the institutional variation of RC. The dependent variables are in inverse hyperbolic sines. Robust standard errors clustered at the industry level and at the firm level in parentheses. AR F-Test refers to the Anderson-Rubin (AR) F-test, robust to weak instruments (Baum, Schaffer, and Stillman, 2007). One (*), two (**), or three stars (***) indicate statistical significance at 10%, 5%, and 1% levels.

Table B18: RC effects on sales, by size (sales volume).

	S		L	
	Sales at 19%	RC sales	Sales at 19%	RC sales
	(1)	(2)	(3)	(4)
RC input	-0.115	6.789***	-0.068***	1.527***
	((0.078)	(1.402)	((0.023)	(0.514)
N	300465	304091	311252	311556
First Stage				
RCPI	0.230***	0.234***	1.652***	1.654***
	(0.057)	(0.055)	(0.383)	(0.381)
F-stat 1^{st}	16.503	17.816	18.602	18.806
AR F-test	1.957	6.682	9.587	5.634
AR p-value	0.163	0.010	0.002	0.018

Notes: The table shows the estimated coefficients of Equation 1. The dependent variable is reported in the column header. The first stage regressor, $RCPI$, is a binary variable reflecting the institutional variation of RC. The dependent variables are in inverse hyperbolic sines. S represents small firms below the 25th percentile of the distribution of sales in 2010 and L stands for large firms (with $> p(75)$ sales). Robust standard errors clustered at the industry level and at the firm level in parentheses. AR F-Test refers to the Anderson-Rubin (AR) F-test, robust to weak instruments (Baum, Schaffer, and Stillman, 2007). One (*), two (**), or three stars (***) indicate statistical significance at 10%, 5%, and 1% levels.

Table B19: RC effects on sales, by legal form.

	INC		PAR	
	Sales at 19%	RC sales	Sales at 19%	RC sales
	(1)	(2)	(3)	(4)
RC input	-0.057	2.533*	-0.244***	5.665***
	(0.045)	(1.472)	(0.054)	(1.392)
N	169412	169835	1060144	1068996
First Stage				
RCPI	0.558***	0.560***	0.448***	0.451***
	(0.142)	(0.141)	(0.077)	(0.077)
F-stat 1^{st}	15.379	15.804	33.688	34.543
AR F-test	1.397	2.509	12.595	7.768
AR p-value	0.238	0.114	0.000	0.006

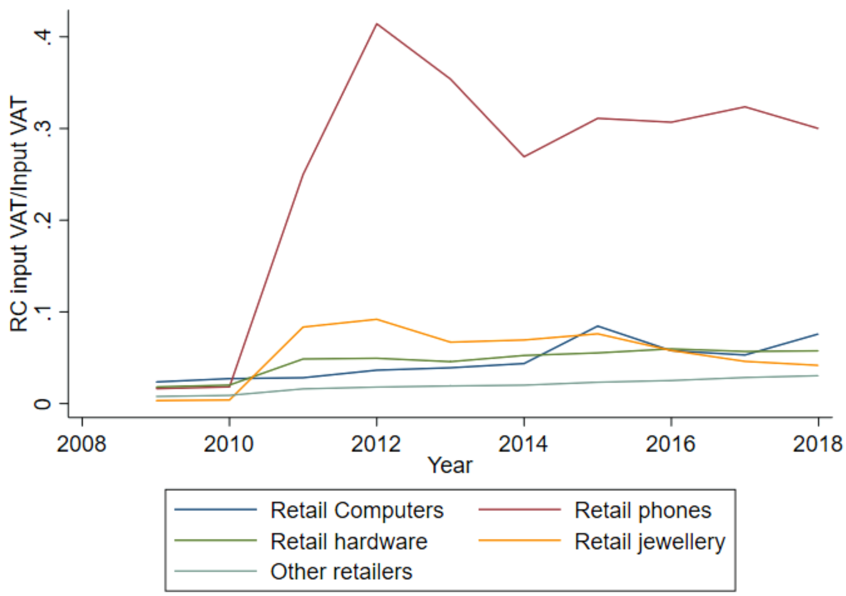
Notes: The table shows the estimated coefficients of Equation 1. The dependent variable is reported in the column header. The first stage regressor, $RCPI$, is a binary variable reflecting the institutional variation of RC. The dependent variables are in inverse hyperbolic sines. "INC" stands for incorporated, while "PAR" stands for partnership. Robust standard errors clustered at the industry level and at the firm level in parentheses. AR F-Test refers to the Anderson-Rubin (AR) F-test, robust to weak instruments (Baum, Schaffer, and Stillman, 2007). One (*), two (**), or three stars (***) indicate statistical significance at 10%, 5%, and 1% levels.

Table B20: RC effects on sales, by size (number of employees).

	Small			Large		
	Domestic sales	Sales at 19%	RC sales	Domestic sales	Sales at 19%	RC sales
	(1)	(2)	(3)	(4)	(5)	(6)
RC input	0.100*	-0.177***	5.706***	-0.006	-0.055**	1.884**
	(0.054)	(0.057)	(1.896)	(0.030)	(0.026)	(0.820)
N	243671	241287	243671	222192	221931	222192
First Stage						
RCPI	0.416***	0.414***	0.416***	1.317***	1.316***	1.317***
	(0.061)	(0.060)	(0.061)	(0.334)	(0.333)	(0.334)
F-stat 1^{st}	47.160	46.777	47.160	15.589	15.580	15.589
AR F-test	3.362	7.957	6.551	0.038	3.696	4.612
AR p-value	0.068	0.005	0.011	0.845	0.055	0.033

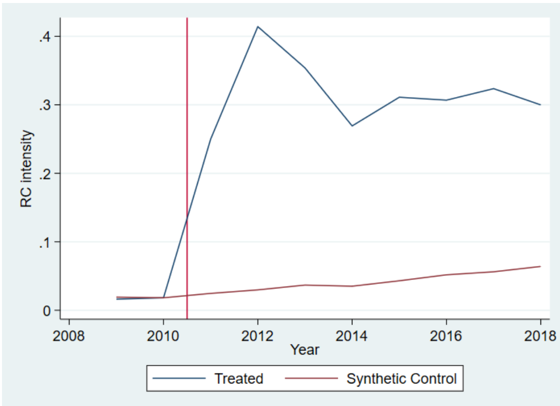
Notes: The table shows the estimated coefficients of Equation 1. The dependent variable is reported in the column header. The first stage regressor, $RCPI$, is a binary variable reflecting the institutional variation of RC. The dependent variables are in inverse hyperbolic sines. Small firms below are those in the bottom quartile of the distribution of employees and large firms are those with $\geq p(75)$ employees. Robust standard errors clustered at the industry level and at the firm level in parentheses. AR F-Test refers to the Anderson-Rubin (AR) F-test, robust to weak instruments (Baum, Schaffer, and Stillman, 2007). One (*), two (**), or three stars (***) indicate statistical significance at 10%, 5%, and 1% levels.

Figure B1: RC intensity.

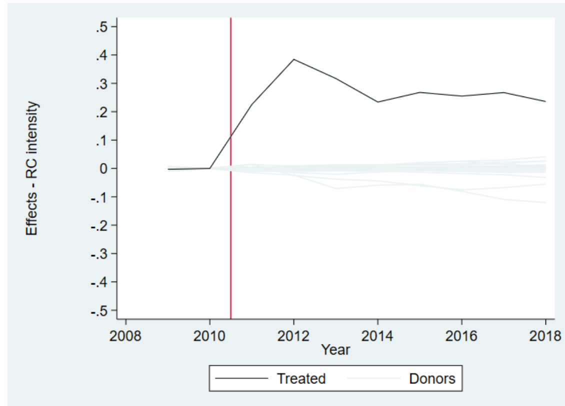


Notes: The figure shows the average RC intensity, as described on the y-axis, for retailers that are affected by RC (see Table B3) and retailers who are not. This figure is based on the VAT advance returns data, at industry level.

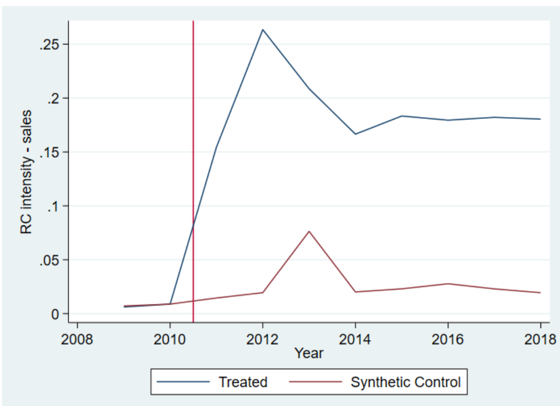
Figure B2: RC effects on the mobile-phone retail sector.



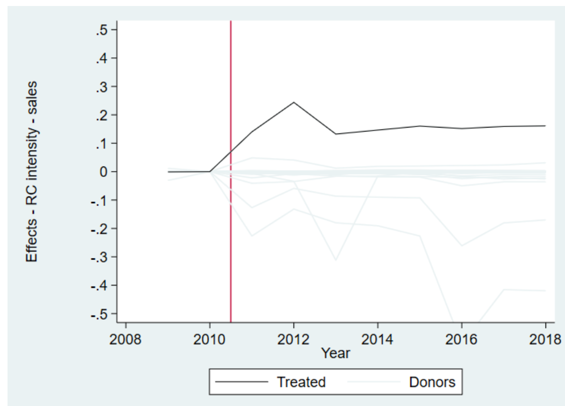
(a) Development of share of RC inputs



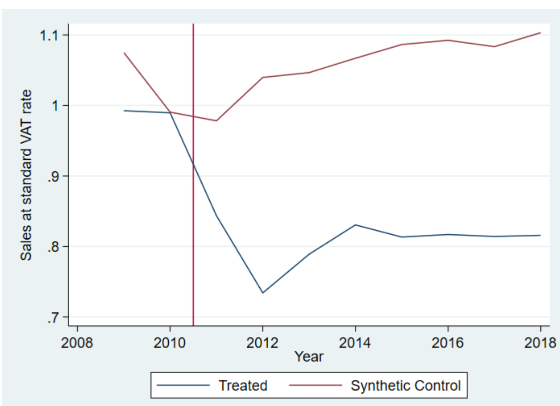
(b) Effects on share of RC inputs



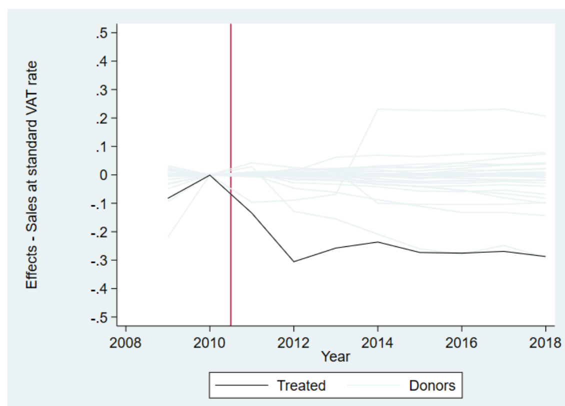
(c) Development of share of RC sales



(d) Effects on share of RC sales



(e) Development of share of sales at 19%



(f) Effects on share of sales at 19%

Notes: The figure uses industry-level data for retailers (2009-2018). These figures result from applications of the synthetic control method. There are 26 donor industries. The dependent variables are in logs and are reported under the respective figures. The red vertical line represents the introduction of reverse charge for mobile phones. Figures B2a, B2c, and B2e respectively show the share of inputs and sales subject to reverse charge, and sales at 19% for the treated industry and the synthetic control. Figures B2b, B2d, and B2f show the effects of RC on the treated industry (retailers of telecommunication equipment), dark line, and placebo treatments on the donor industries (lighter lines).

C VAT remittance by retailers

In this section, we describe the transactions and VAT remittance by retailers before and after the introduction of reverse charge under different assumptions. Let us start from the simplest case, in which a perfectly competitive retailer buys inputs at value $p_{WS}z$, where p_{WS} is the price charged by the wholesaler (the supplier) and z is the volume of the goods. Under the VAT regime, the retailer pays $\tau p_{WS}z$ to the wholesaler, where τ is the tax rate. The retailer then sells z to final consumers for $(1+\tau)p_R z$, where p_R is the price charged by the retailer, remitting $\tau p_R z - \tau p_{WS} z = \tau z \underbrace{(p_R - p_{WS})}_{margin}$ to the tax authorities. Let us now assume that reverse charge applies to z. The retailer no longer pays VAT to the wholesaler; it sells z to the final consumer and remits $\tau p_R z - \underbrace{\tau p_{WS} z}_{deductible\ input\ VAT} + \underbrace{\tau p_{WS} z}_{retailer's\ VAT\ liability\ under\ RC} = \tau p_R z$ to the tax authorities.

The retailer's liability as a purchaser cancels out with the deductible input VAT. By taking the difference between the two remittances we get

$$\Delta = \tau p_R z - \tau p_R z + \tau p_{WS} z = \tau p_{WS} z > 0. \tag{A.3}$$

This implies, that under RC the net VAT payment by the retailer should increase.

Next, we allow the retailer to be vertically integrated and to sell x to consumers and y to businesses. Since the firm is classified as a retailer, we can assume that $x > y$, so that most of the firm's activity is at the B2C level. Under VAT, the retailer remits $\tau p_R(x+y) - \tau p_{WS}(x+y)$. Under RC, the same retailer would not be liable for the VAT on its B2B sales. The retailer would remit $\tau p_R x - \underbrace{\tau p_{WS}(x+y)}_{deductible\ input\ VAT} + \underbrace{\tau p_{WS}(x+y)}_{retailer's\ VAT\ liability\ under\ RC} = \tau p_R x$.

By taking the difference between the two remittances we get

$$\Delta = \tau p_R x - (\tau p_R x + \tau p_R y - \tau p_{WS} x - \tau p_{WS} y) = \tau p_{WS} x - \tau y \underbrace{(p_R - p_{WS})}_{margin} > 0, \tag{A.4}$$

since $y < x$ and assuming that the margin is small.

Finally, we allow for behavioral responses whereby the retailer under-reports sales x at the value x' when RC applies ($x' < x$), whereas B2B sales remain unaffected. Under VAT, the retailer remits as before $\tau p_R(x+y) - \tau p_{WS}(x+y)$. Under RC, the retailer remits $\tau p_R x'$. Therefore, the difference between the two remittances is

$$\Delta = \tau p_R x' - (\tau p_R(x+y) - \tau p_{WS}(x+y)) = \underbrace{\tau p_R(x'-x)}_{<0\ since\ x'<x} + \underbrace{\tau p_{WS} x - \tau y(p_R - p_{WS})}_{mechanical\ effect\ as\ in\ A.4}. \tag{A.5}$$

The change in VAT net payment is negative if and only if the behavioral response is larger than the positive mechanical effect in Equation A.5.