Does VAT remittance invariance hold? Evidence from e-commerce

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Very preliminary version, please do not quote

July 2021

Abstract

One of the basic principles on which taxation theory have long relied on states that the economic incidence of taxation does not depend on who has the liability to remit the tax. The most recent theoretical and empirical findings have however pointed into question this result, highlighting that, when the remitting liability is shifted upward in the supply chain, consumer prices will suffer a higher rate of pass-through. The aim of this paper is to test the latter hypothesis, by analysing whether the repeal of the reverse charge mechanism for a sample of items sold through Amazon.it has had any impact on their prices. The empirical analysis is performed using the Bayesian Structural time series method, as suggested by Brodersen et al. (2015) and extended by Schmitt et al. (2018). For each item we predict a counterfactual series representing the outcome that would have occurred had no intervention taken place. Then, the causal effect on prices of the policy change is computed by taking the difference between observed and counterfactual series. Finally, we aggregate the results on each product and infer the average effect of the repeal of the reverse charge using a meta-regression approach. The preliminary results seem to give support to the recent findings, showing that in the post-intervention period the prices applied by Amazon.it significantly increase.

Keywords: tax incidence, remittance liability, VAT pass-through, causal impact

JEL: C11, H22, H26

1. Introduction

Distributional effects of tax policies depend on the extent to which taxes are passed-through prices.

The issue of tax incidence is particularly salient in the case of commodity. Existing empirical evidence usually focuses on the incidence of VAT's rates changes on prices, often finding various rates of pass-through. Based on the degree of market imperfections, in fact, taxes may be fully, over, or under-shifted onto consumer prices.

Textbooks usually assume that, no matter markets are perfect or not, tax incidence is independent of who nominally pays the tax.

The modern taxation theory has pointed into question this "irrelevance" result, highlighting that, since the parties involved in economic transactions may differ in their evasion propensity, the choice of the subject responsible to pay the tax to national authority has a direct effect on the final incidence of taxation. Recent theoretical and empirical findings suggest that when the remittance liability is shifted to a party at a higher level in the supply chain (characterized by a less tax-elastic evasion) consumer prices are likely to experience a higher rate of pass-through (Kopczuk et al. 2016).

Although the literature on tax incidence is vast, there is still scant evidence on the role played by changes in the remittance liability. The aim of this paper is to provide new evidence on this issue. In particular, the empirical analysis focuses on the prices' effect of a shift in the VAT's remittance liability.

The strength of VAT is its self-enforcing nature. Therefore, it is one of the main fiscal instruments for which the remittance liability is key to enforce compliance. It is applied in each stage of the production, implying that each trader has an incentive to ensure that its suppliers have themselves properly paid the tax, in order to be allowed to claim the credit for the tax paid. At the same time, however, the credit refund system may create itself significant opportunities for tax evasion. To deal with the possibilities of VAT frauds, various measures have been proposed, among them the application of the reverse charge. Reverse charging implies a shift in the tax assessment and remittance obligation, from the prime suppliers to the retailer or business customer. Under this mechanism, the wholesaler is allowed to issue a zero-rated invoice to its retailer, which is then liable to spontaneously remit the tax to its own tax administration through periodic returns.

Reverse charge may be particularly useful in industry's activities considered prone to fraud. The EU requires that it can be applied in cross-border business-to-businesses (B2B) transactions and, thus also for intra-community electronic commerce. The increasing amount of business transaction

through the online channel has in fact blurred the concept of geographical distance and administrative location, making it difficult to collect consumption taxes under the destination principle. For this reason, the EU establishes that the remittance liability in the case of online B2B transactions be on the state-resident retailer, and thus on business customer, rather than at the prime wholesaler level.

Prior to the opening of its subsidiaries in some European countries, the reverse charge applied also for one of the world greatest e-commerce company, Amazon. It is, instead, no more an available administrative measure for Amazon starting from May 2015, the date in which it begun to have a fiscal nexus also in the main European marketplaces' countries, and among them Italy.

This paper is aimed to analyse whether the repeal of reverse charging has had any impact on the prices of items sold through Amazon on the Italian market. The empirical analysis relies on a novel approach using the Bayesian Structural time series method, as suggested by Brodersen et al. (2015) and later extended by Schmitt et al. (2018). This allows to compute the causal impact of the policy change by predicting a counterfactual outcome in a synthetic control that would have occurred had no intervention taken place and by taking the difference between observed and unobserved values.

The estimation strategy follows some steps. The tax reform has affected only those items involved in B2B transactions, the identification of which is made by selecting, from a wider sample of goods, those categories that are more likely to be bought by businesses. Treated series are thus the prices applied on the selected products directly by Amazon.it. Then, to construct the counterfactual we match each treated series with a control set. The latter given by the series of prices applied on the same products by third-party sellers on the Amazon's marketplaces. By taking the difference between observed and unobserved (counterfactual) series we are able to infer the causal effect on prices of the repeal of the reverse charge mechanisms for each treatment account. Finally, the overall effect for the sample considered is obtained by aggregating results into a meta-regression analysis.

The analysis is first performed on a sample of 1,458 products observed in a time period ranging from May 1, 2014 to May 01, 2017, with daily frequency. To further restrict the sample and focus on products that are more likely to be bought by business we perform the estimates also on two other subgroups of products.

The preliminary results of the analysis seem to give support to the recent theoretical advances. The overall effect on the samples considered is in fact positive, suggesting that after the repeal of the reverse charge the prices applied by Amazon.it significantly increased. Moreover, since we observe time series until two years after the policy change, we are able to investigate the timing of the effects. In this respect our results highlight that the effects persist not only in the short run, but also in the medium run, and the effect in the second year after the reform is indeed stronger in magnitude

compared to the first year. Thus, based on this preliminary analysis we can assert that the shift in the remittance liability may have significant effects on the real economy.

The rest of the paper is organized as follows. Section 2 reviews the findings by related literature. In Section 3 we discuss the issue of tax administration for e-commerce in the EU. Section 4 describes the estimation strategy and the dataset. Section 5 reports our preliminary results. Finally, Section 6 gives some concluding remarks.

2. Review of related literature

The literature, in particular the optimal taxation theory, has long assumed that the effect of taxes does not depend on the way they are administered. A prominent example is the so called "Law of tax incidence" (Kopczuk et al. 2016) stating that the incidence of a tax is independent of the side of the market which is responsible for remitting the tax to the government.

A series of papers have recently questioned such a common view. One of the main reasons why the independence of economic incidence from the remittance responsibility may break down is the different ability of different parties to evade taxes. If the evasion technology differs among market sides, when a party on the demand side remits the tax, the demand curve experiences a shift, which may be different from the shift in the supply curve caused by the same tax levied on the supply side (Kopczuk et al. 2016).

Slemrod (2008) formalizes in detail the conditions under which the invariance principle fail to exist when standard models are extended to consider various realities of tax implementation, mainly the tax evasion. Later, Kopczuk et al. (2016) extend his framework to consider the extent of tax incidence depending on the remittance responsibility.

Consider a standard economic model with a demand and a supply side, where these can be thought as two different levels of a supply chain, and in particular, here assume that they represent, respectively, retailer and wholesaler. In equilibrium, demand (D) must equal supply (S), and the same condition must hold in the presence of taxation. Assume that an additive per unit consumption tax (t) is introduced and assume that it may be remitted either from the supply or from the demand side. If it is the supplier, the party responsible for the tax remittance, then the equilibrium condition become

$$S(q - t) = D(q).$$

If the tax has to be remitted by the demand side of the economy, then in equilibrium must be that

$$S(q') = D(q' + t),$$

where q and q' are the commodity equilibrium prices paid by the buyer to the seller respectively in the two cases of tax remittance. The equilibrium holds in both the situations as long as $q = q' + t$. When both the demand and the supply functions depend only on the after-tax prices and the market price is completely flexible, if the tax has to be remitted by the demand side (the retailer), he will pay a lower price, but both the supplier and the demander will receive the same after-tax price.

This framework, however, abstracts from the possibility of different avoidance technologies among the subjects in the economy. The equilibrium fails to hold if the avoidance possibilities of the demand and the supply side of the economy are not symmetric. By consequence, this will have implications for the after-tax prices faced by both the parties. Therefore, the choice of the subject who must bear the compliance cost may produce effects on who ends up bearing the burden.

If one relies on the assumption that demand and supply are functions, not only of the relevant prices, but also of the tax rate remitted by each side, denoting by t_w the tax rate that must be remitted by the supplier, for a total tax rate t, the share of tax remitted by the demander, is $t- t_w$. Because of the different evasion possibilities or compliance costs between the two market sides, the supply and demand functions now depend on the remittance responsibility independently of the price. The equilibrium condition become:

$$S(q'', t_w)=D(q'' + t, t-t_w).$$

If the equilibrium condition will be perturbed with respect to variation in t_w then the effect of a change in the remittance responsibility will have impact on the equilibrium price q''. The assumption of the irrelevance of the point of collection holds only in the special case in which the elasticity of both, demand and supply function to the evasion are zero. If, however, being a remitter may create evasion possibilities, then the elasticities of both functions are expected to be positive.

The irrelevance proposition may especially break down when the point of tax collection changes, and in particular in the special case in which the remittance requirement is shifted upstream in the supply chain, from the retailer to the wholesaler. This concern has been particularly echoed in the debate on whether it should be more efficient to levy a carbon tax on upstream suppliers or downstream users (see Niemeier et al. 2008; Metcalf 2009, among others). Kopczuk et al (2016) show that since evasions technologies differ across parties in the supply chain, the final price may significantly change when the tax remittance responsibility shifts. The prices will in particular suffer a higher rate of pass-through when the remittance responsibility is shifted to the sector with less tax-elastic evasion.

In the broader argument of remittance enters the concept of withholding. Tax withholding describe a situation in which the tax liability must be remitted by someone other than the subject statutory

required to pay the tax. Because of the small number of larger remitters, it would facilitate tax administration allowing national authorities to take advantage of economies of scale. Moreover, it is also argued to act as a revenue safeguard, since even when the statutory bearer fails to file the tax obligation, the withholding system ensures that the tax is remitted (Slemrod and Gillitzer, 2013).

Households, meant as employees and consumers, are usually excluded from the withholding remittance responsibility, which is usually restricted to businesses and government agencies. Nowadays, the great part of developed countries adopts withholding for income taxes. In particular, 28 OECD countries allow withholding for employer wages and salaries. Other sources of income taxed under withholding systems are interest and dividends. In Italy, for instance, the main withholding taxes are levied on dividends, interest and royalties.

A key role in facilitating tax enforcement is also played by third-party reporting, verifiable paper trails and whistle-blowers. Kopczuk and Slemrod (2006) argue that many tax policy choices revolve under enforcement issues recognizing that any theoretical model of optimal taxation must rely on the administrative efficiency advantages of business-based tax remittance. In terms of tax enforcement capacity, they point to the lack of equivalence between value added tax (VAT) and retail sales taxes, since VAT is easier to enforce thanks to firms-to-firms transaction information. Focusing on the income taxation, Kleven et al. (2012) show that the tax compliance's improvement is likely to be due to third-party income reporting by employees, especially for large and complex firms. The VAT is the instrument largely believed to facilitate tax enforcement, since the third-party reported paper trail on transactions between firms makes it difficult to hide the transaction from the national tax authority. Pomeranz (2015) investigates the effectiveness of the VAT third-party reporting in facilitating tax enforcement through two randomized field experiments for a sample of firms in Chile. She finds that the VAT paper trail, by facilitating detection of evasion, has a strong positive effect on VAT payment.

Despite the recent theory suggests that statutory and economic incidence are likely to be not independent in the presence of evasion, and although the prominent consideration of this issue in the theory of taxation, the empirical evidence testing the independence assumption in real world markets is still scant. Muysken et al. (1999) estimate that shifting the statutory tax burden from employers to employees in the Netherland leads to a wage cost reduction. In contrast, Saez et al. (2012) find a higher rate of pass-through of labour taxes to wages when the government increase the share of tax remitted by employer. Focusing on state diesel taxes, Kopczuk et al. (2016) empirically examine how shifting the remitting requirement upstream in the supply chain affects tax incidence. Their results suggest a higher pass-through on retail prices when the point of tax collection is at the prime supplier level rather than at the retail level. Since collection upstream has the potential to reduce evasion, their

finding gives support to the claim that retailers have higher avoidance abilities than firms at higher level in the supply chain.

In contrast to the existing literature on national taxation on carbon, fuel or labour markets, the interest of this work is on the value added tax (VAT).

VAT is usually believed to be one of the fiscal instruments better able to facilitate tax enforcement. Due to its application in each stage of the production it is characterized by self-enforcing. Each trader has, in fact, an incentive to ensure that its suppliers have themselves properly paid VAT in order that they can claim an appropriate credit (Keen and Smith, 2006). On the other hand, however, the credit and refund mechanism underlying the VAT may sometimes crate its own opportunities for evasion and fraud.

This is strongly true in the case of cross-border transactions. VAT is applied on a destination basis, in that it is intended to tax consumption, rather than production, taking place within a certain jurisdiction. This, thus, imply that while imports should bring into tax, exports are exempted. The export exemption itself has, however, proved the feature to deliberate VAT fraud. The destination principle of VAT, allowing the zero-rating of exports combined with the 'deferred-payment' mechanism for imports[1] may sometimes result in a VAT fraud that has attracted attention in the European Union for years, the "missing-trader" VAT fraud (or "carousel fraud" (Keen and Smith, 2006)).

To understand how the carousel fraud works consider a simple example. Company A, registered for VAT purposes in a member state, imports good X. On the strength of the deferred-payment mechanism available on imports, A will not pay the VAT in the same moment, but it will account for the tax due in the next period return. Assume, however that company A sells immediately the imported good to company B issuing an invoice comprehensive of VAT, and then it will disappear, failing to remit the tax due. In turn, B will export good X, and because of the VAT-inclusive invoice received from company A, it will claim a refund for a VAT that has not actually been paid. The mechanism in reality is obviously more complex than explained above, but what should be clear is that the fraudulent essence underlying the carousel fraud is the claim for a VAT credit that has actually never been paid.

One proposed policy action to avoid VAT avoidance like the carousel fraud is the reverse charge. This tax administrative measure, regulated by the European Union Directive 2006/112 of 28 November 2006 on the common system of the VAT (EU VAT Directive), establishes, in the case of

[1] Under the deferred-payment system importing firm must remit the tax due not at the time of import but in the next periodic return.

cross-border supplies in business-to-business (B2B) transactions, a shift in the tax assessment and remittance obligation downstream to the business customer.

Under the reverse charge in practice, the prime supplier issues a zero-rated invoice to the business customer who is then liable for correctly assessing and spontaneously remitting the tax due to his own tax administration through periodic returns.[2] No actual tax payment would be made to the tax authority in relation to a cross-border B2B supply if the customer has full right to deduct input VAT. This imply that, since only a business involved in retail sales would actually collect and have obligation to remit the VAT, the opportunity to make fraudulent gains by claiming refunds of VAT that have not actually been paid would be eliminated.

The reverse charge mechanism may be particularly useful in industry's activities considered prone to fraud. The application of the reverse charge may be extended to a number of transaction types, such as the supply of construction work, supplies of gas, heat and cooling energy as well as electricity, game consoles, tablet PCs, laptop, mobile phones, scrap metals and investment gold. In general, the list of goods and services that may be subject to the reverse charge are diverse, even if the EU places various restrictions for its application.

Overall, the distinct feature justifying the reverse charge mechanism is the asymmetry in evasion technologies of subjects involved in large-scale transactions. Given the arguments explained above, therefore, the reverse charge by shifting the remittance obligation to the retailer, may have non-negligible effects on the final incidence of the tax.

Since the analysis in this paper refers to the argument of tax incidence the next subsection reviews some findings about the economic incidence of taxes, with a special focus on VAT.

2.1. Insights on tax incidence

The study of the incidence of taxes in a national context is one of the fundamental questions in public economics. A tax incidence analyst studies the impact of taxes on the final distribution of welfare in a society, taking into account that the fiscal burden is not necessarily born by the same subjects upon whom taxes are levied (Fullerton and Metcalf, 2002). Evidence on the tax incidence abounds in the

[2] Art 196 of the EU VAT Directive (as amended by Council Directive 2008/8) exactly states: *'VAT shall be payable by any taxable person, or non-taxable legal person identified for VAT purposes, to whom the services referred to in Article 44 are supplied, if the services are supplied by a taxable person not established within the territory of the Member State.'*

literature but it usually focuses on perfectly competitive markets, disregarding that, as argued by contemporary economic analysis, firms have market power.

Existing studies assume that the tax incidence relies on some fundamental principles. They recognize that under perfect competition the total tax burden is shared between consumers and producers, and in particular, the economic incidence (I) is given by the burden borne by consumers (denoting it by γ) over the that borne by producers ($1-\gamma$)

$$I=\frac{\gamma}{(1-\gamma)}.$$

γ is what the literature calls the pass-through rate, which depends on the elasticities of supply (η^S) and demand (η^D), as follows:

$$\gamma=\frac{1}{\left[1+\left(\frac{\eta^D}{\eta^S}\right)\right]}.$$

The equation above shows that the pass-through increases in the ratio of the supply's elasticity to the demand's elasticity.

These features, however, hold in the case of perfectly competitive markets. Weyl and Fabinger (2013) focus on the incidence of taxes even when markets are not perfectly competitive. They analyse the fundamental principles of tax incidence under perfect competition and then extend them in the context of markets imperfections. Under monopolistic market, they argue that the total tax burden is no longer simply shared between consumers and producer, but the tax burden raised on consumers and producers is moreover greater than the revenue raised. Thus, the total tax burden is more than fully shared by economic agents. While the monopolist fully pays the tax out of his welfare, consumers also bear an excess burden. In particular, the size of the excess burden of the tax per unit of revenue raised is exactly γ and it is entirely borne by the consumer. This means that in the case of monopolistic markets the economic incidence of the tax is:

$$I=\gamma.$$

A further difference with respect to the perfectly competitive markets relates to the factors influencing the tax incidence. In a monopoly the economic incidence does not depend only on the elasticities of demand and supply, but also on the inverse elasticity of marginal surplus that measure the curvature of the logarithm of demand (η^{ms}) (Fabinger and Weyl, 2012). The formula of tax incidence in this case is:

$$I = \frac{1}{1 + \frac{(\eta^D - 1)}{\eta^S} + \frac{1}{\eta^{ms}}}.$$

Differently from the tax incidence under perfectly competitive markets, now η^D is replaced by (η^D-1). The reason of the latter difference is that under monopoly the elasticity of demand is never below unity, thus, it is better to take elasticity of demand relative to unity rather than zero. Overall, the basic insight on the pass-through under perfect competition carry over, but under monopoly an additional effect may occur because of the inverse elasticity of marginal surplus. In particular, the more positively logarithm curved demand is, the higher the pass-through is.

In the case of symmetric imperfect competition, like the oligopoly, the tax incidence depends mainly by the pass-through rate and by a parameter measuring the degree of firm's market power (θ), which equates the elasticity-adjusted Lerner index. This parameter is equal to one under monopoly and equals zero under perfect competition. As long as $\theta < 1$ firms less than fully bear the tax burden. Whereas, when $\theta > 0$, the cost of the tax borne by consumers more than fully completes that borne by producers.

The only feature assumed to hold irrespective of the degree of market imperfection is that the economic incidence of the tax is independent of physical incidence. The principle pointed into question in this work.

The insight of economic incidence is particularly salient in the case of VAT, which is said to be is *passed forward* when the consumer price rises after a tax increase, or *passed backward* when the tax leaves unchanged consumer prices and are the prices received by the supplier, which are likely to fall. The typical assumption in existing literature is that commodity taxation is usually reflected into consumer prices, however the evidence point to different degree of tax shift since market imperfections could lead to both over and under-shifting of VAT.

The extent of VAT pass-through is, thus, an interesting empirical issue which remain still largely unresolved since existing studies often find evidence of less than full shift while some others find evidence for full or more than full pass-through. Carare and Danninger (2008) study whether the inflation dynamics among the CPI items liable to the VAT reform adjust to tax shocks. They conclude that the overall pass-through from VAT is 73 percent, with about half of this occurring in the run up to implementation and the other half at the time of implementation. On the same conclusion of incomplete pass-through, Andrade et al. (2010) and Kosonen (2015) focused on reforms enacted respectively in France and Finland. Using a novel dataset matching VAT rates and consumption categories for 17 Eurozone countries, Benedek et al. (2015) find a full pass-through for the standard

VAT rate, which significantly decline for reduced rates, at around 30 percent, and when the reform implies reclassification of VAT rates among consumption categories the final pass-through is essentially zero. They also point to significant anticipation effects, together with some evidence of lagged effects in the two years around the reform. Gaarder (2016) points for complete pass-through of a sharp change in the VAT policy on food items in Norway estimating a regression discontinuity

Despite the large interest in the literature on the pass-through of VAT, the question that has not been yet investigated is whether the extent of the effect of this tax on prices is likely to change after a variation in its administration, and in particular, when the remittance responsibility shifts among the parties in the supply chain.

3. VAT administration for e-commerce in EU

The aim in what follows is to investigate whether a reform in the administrative practice underlying the VAT has a direct incidence on the real economy. In particular, the empirical analysis is aimed at analysing the price effect of a shift in the remittance liability from retailers to the prime supplier caused by the repeal of the reverse charge practice.

The analysis refers to a particular and emerging business environment for which the analysis of tax incidence is particularly salient, namely to businesses transactions through the online market.

During the last years, the digital economy and technological advances that facilitates remote transaction, has placed new pressures on the effectiveness of commodity taxation. Many studies point to the presence of a strong economic link between taxation and e-commerce arguing that online transactions are highly sensitive to commodity taxation. Baugh et al (2014) estimate a decline in the share of products purchased on Amazon following the implementation, in some American states, of the so-called ‘Amazon tax’. Using data from Ebay, Einav et al. (2014) find that, on average, the imposition of a 10 percent sales tax leads to about a 15 percent reduction in online purchases. The extent of the online buyers’ response is likely to be even greater for more ‘commodity type’ categories, mainly electronics. The estimated elasticities on the responsiveness of online goods are somewhat greater compared to the estimates of cross-border elasticities. However, what is important to point out is that the former elasticities partially capture substitution effects among online platforms and thus, caution should be taken in their interpretation (Agrawal and Fox, 2017).

In terms of administrative and compliance behaviour, significant differences are likely to exist between the taxation of ‘physical’ and online markets’ commodities. Due to the high sensitivity of

online sales and because of the better ability of buyers to evade taxes on remote rather than on in-store purchases, preferential tax treatment could sometimes occur for e-commerce. Historically the public economics literature has devoted much attention to whether commodities taxes should be levied on a destination or on an origination basis, and thanks to its production efficiency grounds, the destination principle has largely been preferred. However, in the digital-economy era, this principle may be subject to revisions for the online-based transactions, requiring, at least, significant administrative improvements.

The European Union normative still requires that commodity taxes must be levied on a destination basis even for digitalized transactions, however, collection enforcement, especially with respect to online sellers outside the EU, may be somehow uncertain. The increasing amount of cross-border trade relationship caused by the globalisation, improved access to market and deregulation, and the emerging and widespread view of the internet e-commerce as the new business environment, has blurred the concepts of distance and geographical location. This complex evolution in trade flows may have non-negligible effects for providers of digital products, which are required to collect and remit VAT to their suppliers in each jurisdiction under the destination principle.

To simplify the compliance burden with respect to the collection of VAT on electronically supplied services, the EU VAT Directive imposes the use of reverse charge in B2B transactions, and a single registration scheme (the 'one-stop-scheme') in business-to-consumers (B2C) transactions.

Under the one-stop-scheme, also known as 'one-stop-shop', a non-EU supplier selling to EU consumers, may opt to register and reach a VAT identification number in one single Member State, rather than registering in all Member States in which he sells. This means that if one non-EU seller engage in the one-stop-scheme, all the tax requirements will be handled through the administration selected. This simplified scheme makes it possible for suppliers on the digital economy to engage into cross-border transactions with EU consumers without the need to have a physical nexus in the EU. This option is, however, possible for transactions between non-EU suppliers and EU consumers. For B2C intra-community supplies, the VAT operates either on a destination or on origination basis depending on the vendor's turnover (net sales).

Applied in the case of digital B2B flows, the reverse charge, by shifting the liability to assess and remit the tax legally due downstream at the retail level, has the main advantage of effectively reduce suppliers' compliance burden. Moreover, since national tax administrations do not have to handle a consistent number of registrations for just a limited number on taxable supplies in the territory, this mechanism also allows administrative costs' savings.

On the other hand, however, this system may also simplify fraud possibilities. If the prime supplier is not able to catch the real nature of the business customer, the latter may benefit from a credit refund undue. This is the case when business buys items for private consumption but 'misrepresent' them as business inputs and this as items eligible for refunds.

In the past, the reverse charge mechanism for B2B transactions in the EU worked also for one of the giants of the e-commerce, the multinational founded by Jeff Bezos with its headquarters in Seattle, namely Amazon. Prior to 2015, Amazon operated in Europe through its only operational headquarter (with the ensuing liability to remit taxes) in Luxembourg, and all the cross-border transaction were administered with the methods seen above. B2B transactions within the Union were in fact regulated through the mechanism of reverse charge.

The lack of a permanent establishment of Amazon (or in general of digital companies) in countries in which the turnover is non-negligible, has led to think that the digital sector is highly involved in aggressive tax planning practices allowing the biggest companies of the world to get away with the payment to close to zero taxes. In October 2014, the European Commission opened a formal state aid investigation in relation to alleged aid to Amazon via tax ruling. Preliminary findings in January 2015 confirm that a sweetheart deal between Luxembourg and Amazon permitted to the company to pay fewer taxes than it is due and breached the competition rules of the Union. In May 2015, as a direct result of the pressure stemming from the European Commission investigations and to address the OECD Action Plan on Base Erosion and Profit Shifting (BEPS) - requiring a higher transparency and compliance by digital multinationals - Amazon decided to change its administrative structure and has begun to pay taxes in several European countries, such as Italy, United Kingdom, Germany, Spain and France, instead of locating almost all of its sales in Luxembourg.

The fiscal presence of Amazon in the other European countries has produced a direct change on the way the VAT remittance is administered in the case of B2B transactions. In each of the country in which Amazon has a fiscal nexus it may now sell using its VAT identification number, directly applying the VAT rate on its invoices.

Starting from the May 1, 2015, with the opening of the Amazon's subsidiaries in some European countries, and among them, in Italy, the reverse charge system in B2B trade was no more an available policy option. The VAT remittance responsibility has been thus shifted upward in the supply chain and this may have created a direct incidence on the prices applied by Amazon.it.

The aim of the empirical analysis in this paper is to investigate if the prices applied by Amazon have been affected by the repeal of the reverse charge mechanism, and thus whether statutory and economic incidence of taxes are in practice independent.

4. Methodology

The price-effect of the repeal of reverse charging is investigated by inferring the causal effect that the designed tax policy has exerted on the outcome over the time period considered. The causal impact of the intervention is computed as the difference between the observed value of the outcome and the unobserved value that would have been obtained had no intervention taken place. We thus need to be able to compare the outcome reached after the policy change to what would have happened without the intervention.

A novel approach to infer the causal impact of an intervention has been suggested by Brodersen et al. (2015). They use the Bayesian Structural Time Series method (BSTS) (Scott and Varian 2013; Varian 2014) and model averaging to predict the counterfactual outcome in a synthetic control that would have occurred had no intervention taken place. In the empirical analysis they compare a market exposed to a new advertising campaign with a similar control market, in order to produce a counterfactual estimate of clicks per ad during the campaign for the treatment market. By taking the difference between the actual and the counterfactual series they find the estimated impact of the advertising campaign.

The construction of an adequate synthetic control relies on different sources of information, such as the time series of the outcome variable itself prior to the intervention and the behaviour of some control series that can be predictive of the target series prior to the intervention[3]. Moreover, in a Bayesian framework, prior knowledge about the model parameters (as elicited by past analyses) can be helpful for inferring the counterfactual. The value of the target series in the pre-intervention period, along with the values of the controls in the post intervention period are thus used to compute the posterior distribution of the counterfactual time series. Finally, the Bayesian posterior distribution for the causal effect is obtained by subtracting the predicted from the observed series during the post intervention period.

Unlike the impact of a single marketing event, as considered in Brodersen et al. (2015), when the focus is on the price-effect of a designed tax reform, looking at a single good is rarely of much interest.

[3] The selection of the control series is done on the pre-treatment period, but for predicting the counterfactual the estimation strategy lies on their post-treatment behaviour. As long as the control series received no intervention themselves it is often reasonable to assume the relationship between the treatment and the control series that existed prior to the intervention to continue afterwards.

For this reason, to estimate the extent to which the repeal of the reverse charge has been passed through prices we use the methodology proposed by Brodersen et al. (2015) as extended by Schmitt et al. (2018) for the analysis of more than one treated unit.

The analysis proceeds in three steps. We first select the set of treatment accounts. The tax reform analysed in this paper should affect only the goods involved in B2B transactions, however, we are not able to extrapolate from our dataset information on the product purchaser. We thus select, from a wider sample of goods, those categories that are more likely to be bought by businesses. Moreover, on Amazon website the same good can be purchased either from Amazon directly or from third-party sellers on the Amazon marketplaces, but the repeal of the reverse charge applies only to Amazon (and not to the private sellers on the marketplaces). For this reason, our treatment accounts include only the level of prices for the selected products sold and fulfilled by Amazon.it. Each treatment account has then to be matched with a set of control accounts to build a counterfactual series. As outlined by Brodersen et al. (2015) one can use as control set the same product in an area that did not receive the intervention. Thus, we match each treatment account (i.e. each selected product sold and fulfilled by Amazon.it), with a control, given by the series of prices applied by marketplaces' sellers.

In the second step of the analysis, we fit the BSTS model and use it to estimate the average impact of the tax policy on each treatment account. We use dynamic regression coefficients to account for possibly time varying relationship between treated and control series.

Structural time-series models for time-series data can be defined in terms of a pair of equations (Brodersen et al. 2015):

1. $$tr_t = Z_t^T\ \alpha_t + \ \varepsilon_t,$$
2. $$\alpha_{t+1} = T_t\alpha_t + R_t\vartheta_t,$$

where $\varepsilon_t \sim N(0, \sigma_t^2)$ and $\vartheta_t \sim N(0, Q_t)$ are independent of all other unknowns. Equation 1 is the *observed equation*, it links the observed data, tr_t, to a latent d-dimensional state vector α_t, whereas equation 2 is called *state equation.* Z_t is a d-dimensional output vector, T_t is a $d \times d$ transition matrix, R_t is a $d \times q$ control matrix (with $q \leq d$), ε_t is a scalar observation error. The term $R_t\vartheta_t$ in equation 2 allows us to incorporate monthly seasonality in the model.

The most important state component for the aim of this analysis is a regression component that allows to find counterfactual predictions by building a synthetic control based on a combination of time series that are not affected by the policy change. The posterior distribution of the counterfactual is computed by combining information about the treated series and the controls. In particular, the algorithm considers the values of the treated series in the pre-intervention period, along with the

values of the controls in the post-intervention period. Then, by taking the difference between observed (tr_t) and predicted prices ($\widehat{tr_t}$) we obtain the estimated effect of the repeal of the reverse charge on each treated series. When such a policy change causes a price increase (as suggested by the more recent theory) the value of such a difference is positive.

Finally, after the effects of the policy change have been estimated on each treated series, the last step is to obtain an overall summary estimate for the sample considered. The average effect of the repeal of the reverse charge for the entire sample of products considered is estimated using a meta-regression, in the form of:

3. $$y_{i,t} = \theta_{i,t} + e_{i,t},$$

where $y_{i,t}$ denotes the observed effects for the *i*-th treated series, $\theta_{i,t}$ the corresponding (unknown) true effects and $e_{i,t} \sim N(0, v_{i,t})$ the sampling error.[4]

In this context we have an estimate of the precision for each effect given by the highest posterior density credible intervals returned by the BSTS. Each credible interval can be characterized by an estimated variance $v_{i,t}$, which is used to compute weights, $w_i = 1/v_{i,t}$, for each observation. When applying these weights, the meta-regression model provides an estimate of the weighted average of the true effects:

$$\overline{\theta_w} = \frac{\sum w_i \theta_{i,t}}{\sum w_i}.$$

4.1. Dataset

The empirical analysis makes use of a reach dataset on daily price variations for a sample of goods sold and fulfilled by both, Amazon.it and by third-party private sellers operating through the Amazon marketplaces. We focus on a time window covering one year before and two years after the tax-policy. Thus, since the date of the intervention is May 1, 2015 (the date starting from which Amazon operates through its fiscal stance in Italy), our sample period rages from May 1, 2014 to May 1, 2017.

The data used has been obtained from the application programming interface (API) provided by Keepa.com. Keepa is an Amazon Price Tracking tool collecting price data since 2011, allowing users to track in real time prices variation for any given product to help them purchase it possibly at the

[4] The BSTS model has been fitted using the *Causal Impact* R package provided by Google for estimating the effectiveness of marketing campaigns in Brodersen et al. (2015). The meta-regression is performed using the *metafor* R package (Viechtbauer, 2010).

best price. Keepa tracks a large number of products (with the only exception for Amazon Fresh and eBooks) sold through the Amazon website worldwide. To access the historical data, we entered the 'Amazon Standard Identification Number (ASIN)', an alphanumeric string uniquely identifying every product sold on the Amazon website. For this reason, the first step in the construction of dataset was the selection of a list of products, identified by their own ASIN, to be included in the final dataset. To this end, the Keepa *Product Finder* tool has been used to query the product database in order to find products matching some criteria. In particular, using the *HTTP GET request* the tool has been asked to select from the website a list of ASIN for products sold through the Italian Amazon website and that are sold by both Amazon.it and third-party private sellers in the Amazon's marketplace. Different queries have been made based on the root category to which products belong. The root category identifies the Amazon department in which the item can be retrieved.

Once the list of ASINs has been retrieved, the Keepa *Product Request* application has been used to download products information. Amazon product information and history have been accessed using the Python module to interface to Keepa.com (*keepaAPI*). The Product Request tool allows user to get near to real time pricing data. The output is a products field containing an array of products objects with an entry for each ASIN that was requested. The product object contains the price history data and a lot of other product information, as for instance the product's type, the title, description, package quantity, brand, and in general all the information that can be found on Amazon website.

Data relevant for the analysis relates to the price history. The econometric estimation makes in fact use of the time series for the prices applied on each item respectively, by Amazon and by third-party seller operating through Amazon marketplaces.

Raw data first gave information on each price variation within a day, and thus the starting dataset had hourly frequency. To avoid the use of different frequencies we resampled the initial dataset into a daily frequency, by taking the first price value in each day.[5]

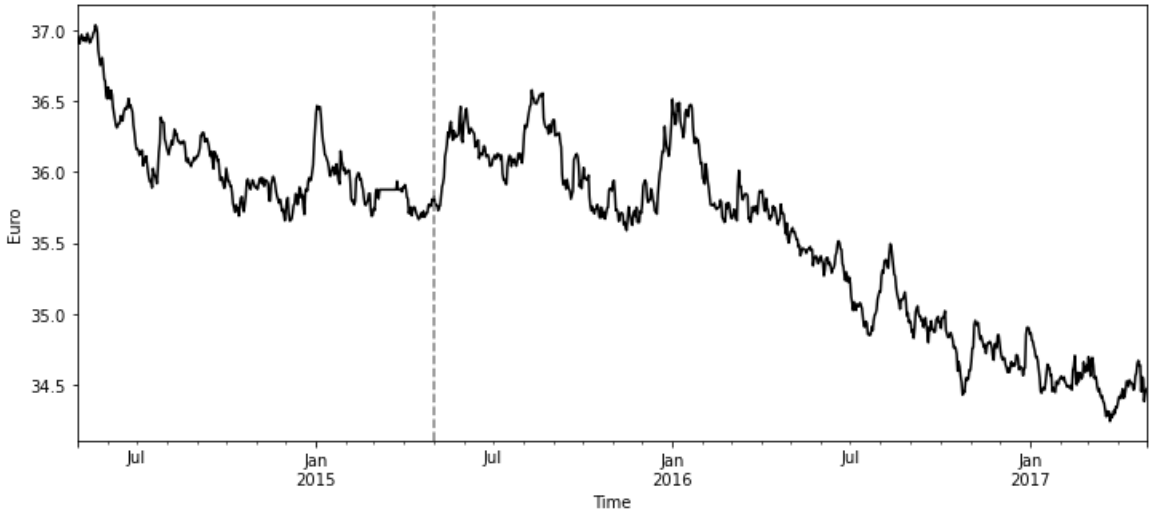
As previously stated, we are interested in those products that are more likely to be purchased by businesses. For this reason, we select a group of items belonging to categories usually containing goods used in the business activity, such as *office products*, *personal computer*, *digital device accessories*, *electronics part*, *biss basic*, *gardening products*, *camera accessories*, *bricolage*, *video accessories*, *house appliances*, *electricity products*, *musical instruments*, and *car parts*. The final sample contains 1,458 products.

[5] Web data extrapolation and data managing have been performed using Python. The dataset has been stored and accessed using MySQL.

Figure 1 and figure 2 below report respectively the average pattern for the potentially treated and control series both in the pre-intervention and post-intervention period.

As the figure 1 shows, the average price applied by Amazon.it experiences a slight increase close to the intervention period, which persists for some months after the shock.

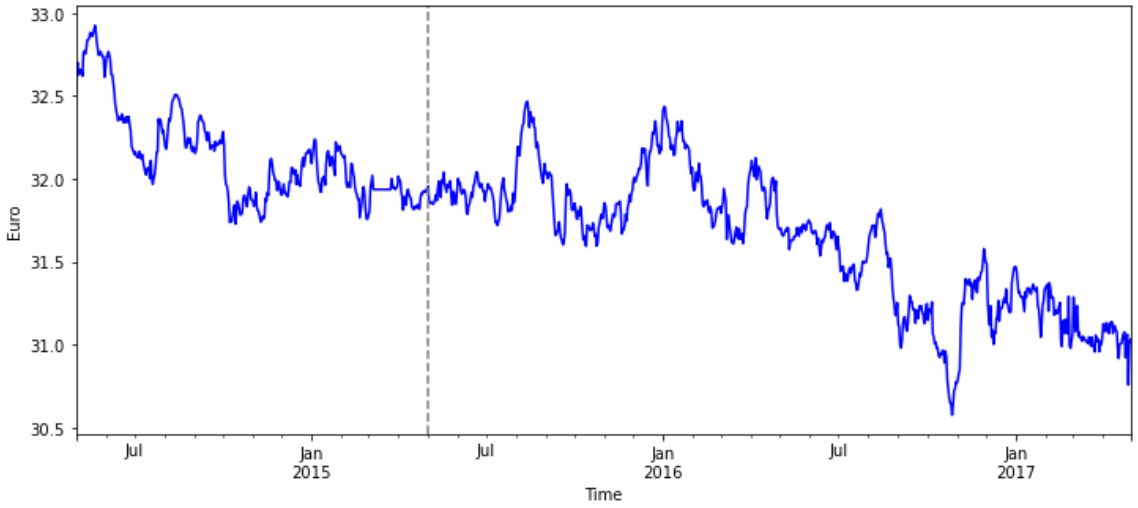
Figure 1. Average prices applied by Amazon.it (treated series)



Note: The figure reports the average prices for the total sample of products sold and fulfilled by Amazon.it. The vertical dotted line denotes the policy-change date.

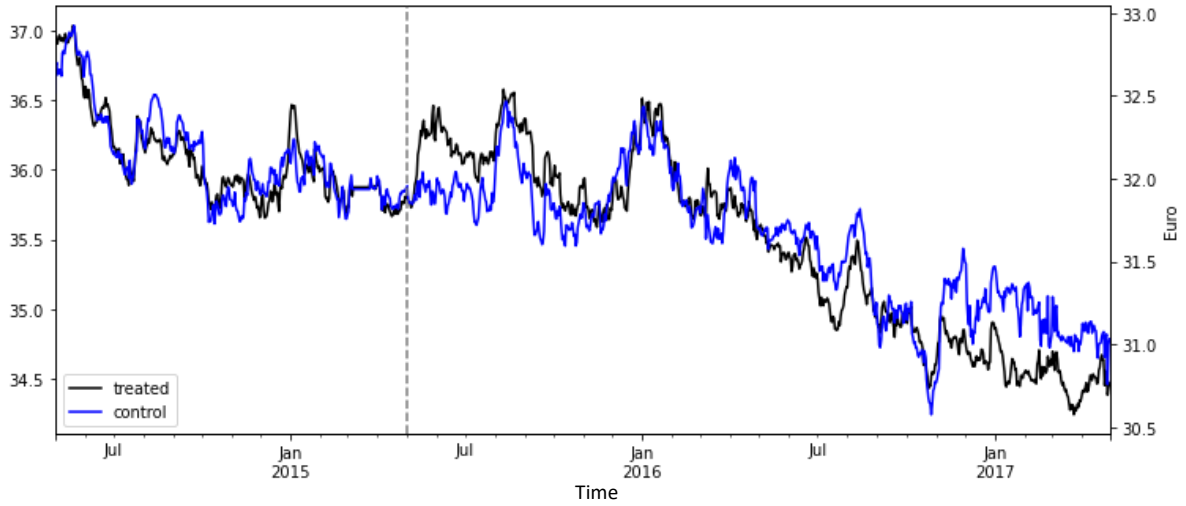
On the other hand, even if the overall trend seems the same also for the control set (which are the series of prices applied by private sellers on the Amazon marketplaces) for the latter we do not observe the same slight increase immediately after the reform date. The difference between treated and control series can be better visually analysed looking at figure 3.

Figure 2. Average prices applied by private sellers on Amazon marketplaces (control series)



Note: The figure reports the average prices for the total sample of products sold and fulfilled by private sellers on Amazon marketplaces in the period considered. The vertical dotted line denotes the policy-change date.

Figure 3. Treated vs Control



Note: The figure reports the average prices for the products sold and fulfilled both by Amazon.it (treated) and by private sellers on the marketplaces (control). The vertical dotted line denotes the policy-change date. The left axis reports prices in Euros for the treated series, whereas the right axis reports prices for the control set.

This visual inspection thus seems to support our estimation hypothesis that the repeal of the reverse charge may have caused some prices increase. Thus, it may be interesting to estimate, using the quasi-experimental approach outlined above, the magnitude of this plausible price increase.

Moreover, to further try to select the main products related to business activity, we perform the empirical analysis on two other sub-samples. The first with 756 items considering *office products*, *personal computer*, *digital device accessories*, *electricity products*, *biss basic*, *and bricolage*, and the

second, which is the most restricted with just 377 goods belonging to the *office products* and *personal computer* categories.

5. Preliminary results

In what follows we report our preliminary results. As outlined in the methodology section, the first step of a causal impact analysis is the estimation of the BSTS model. The latter has been estimated for each treated time series. The model builds a counterfactual looking at the behavior of the observed series in the pre-treatment period, along with the behavior of the controls in the post-treatment period. Dynamic regression coefficients are used to account for possibly time varying relationship between treated and controls. For each treated series the causal impact is computed as the difference between the observed and the counterfactual series. Once the BSTS model is estimated for each item in the sample, products estimates have been aggregated using a weighted meta-regression analysis.

Table 2 reports the average overall summary estimates of the repeal of reverse charging for the three alternative samples considered.

Table 1. Meta-regression results

	Sample 1	**Sample 2**	**Sample 3**
	(1)	**(2)**	**(3)**
$\overline{\theta_w}$	0.5258***	0.5536***	0.3483***
	(0.0051)	(0.0081)	(0.0091)
Observations	1,067,256	553,392	275,964
# Products	1,458	756	377

Notes: overall summary estimates based on the post intervention period ranging from May 1, 2015 to May 1, 2017. Sample 1 includes products belonging to the following root categories: *office products, personal computer, digital device accessories, electronics part, biss basic, gardening products, camera accessories, bricolage, video accessories, house appliances, electricity products, musical instruments* and *car parts*. In sample 2 we instead focus on *office products, personal computer, digital device accessories, electricity products, biss basic,* and *bricolage*. Finally sample 3 includes only *office products* and *personal computer*. Standard errors in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

The table reports the estimated weighted average of the true effect for the samples considered. For all the samples, the preliminary results suggest that in the post-intervention period treated series experienced a significant increase. As far as the wider sample is concerned (sample 1) the prices increase on average by 0.5%. The effect is slightly stronger in magnitude for the products' prices in

sample 2, which increase on average by about 0.55%, whereas, surprisingly, the price increase is lower for the last sample (column 3 of table 2).

In addition to considering our large collection of estimates of the causal effects in their own right, we can also model them to reveal general patterns linking estimated effects to other factors that may have had an impact on the reform effects. In particular, we control for the dates of special sales such as the black Friday and the cyber Monday and for the winter and summer sales. Thus, equation regression (3) has been augmented including first a dummy for the black Friday (*Black Friday*) and cyber Monday (*Cyber Monday*) (columns 1, 4 and 7 of Table 3), then the dummies for winter (*Winter sales*) and summer sales (*Summer sales*) (columns 2, 5 and 8 of Table 3) and finally both together (columns 3, 6 and 9 of Table 3).

Table 3. Meta-regression results: controlling for sales periods

	Sample 1			**Sample 2**			**Sample 3**		
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**
$\overline{\theta_w}$	0.526***	0.525***	0.525***	0.553***	0.551***	0.551***	0.349***	0.353***	0.353***
	(0.005)	(0.006)	(0.006)	(0.008)	(0.009)	(0.009)	(0.009)	(0.010)	(0.010)
Black Friday	-0.047		-0.046	0.003		0.005	-0.124		-0.129
	(0.102)		(0.102)	(0.161)		(0.161)	(0.187)		(0.187)
Cyber Monday	-0.016		-0.015	0.067		0.069	-0.045		-0.049
	(0.102)		(0.102)	(0.162)		(0.162)	(0.188)		(0.188)
Summer sales		0.007	0.007		0.017	0.017		0.081**	0.081**
		(0.018)	(0.018)		(0.028)	(0.028)		(0.030)	(0.030)
Winter sales		-0.001	-0.001		0.009	0.009		-0.19***	-0.19***
		(0.0195)	(0.0195)		(0.0310)	(0.0310)		(0.0367)	(0.0367)
Observations	1,067,256	1,067,256	1,067,256	553,392	553,392	553,392	275,964	275,964	275,964
# Products	1,458	1,458	1,458	756	756	756	377	377	377

Notes: overall summary estimates based on the post intervention period ranging from May 1, 2015, to May 1, 2017. *Black Friday* is a dummy equal to one on November 25, 2015, and November 26, 2016. *Cyber Monday* is a dummy equal to one on November 30, 2015, and November 28, 2016. *Summer sales* and *Winter sales* are dummies equal to one on July and January, respectively. Standard errors in parentheses. * p < 0.05, ** p < 0.01, *** p < 0.001.

The results show that the special sales periods, in general, do not significantly affect our results. Moreover, the overall effects estimated in the baseline specification are robust also to the inclusion of these control variables.

Another interesting issue refers to the possible different effects arising on products with different prices levels. In order to investigate whether the effects depend on the price of goods, we split the total sample into three sub-samples the first one containing products with an average low price, the second with goods with an average price belonging to the central distribution of the total sample and finally, the third with high prices. Results are reported respectively in column 1, 2 and 3 of Table 4.

Table 4. Meta-regression results: low, medium and high prices

	Low prices **(1)**	**Medium prices** **(2)**	**High prices** **(3)**
$\overline{\theta_w}$	0.3873*** (0.0046)	0.5773*** (0.0057)	1.3258*** (0.0469)
Observations	314,028	620,736	132,492
# Products	429	848	181

Notes: overall summary estimates based on the post intervention period ranging from May 1, 2015, to May 1, 2017. In *Low prices* we include products with an average price lower than the 25° percentile of the total sample prices distribution, whereas in *High prices* those with an average price above the 75° percentile. *Medium prices* includes goods with an average price in the central distribution of the total sample. Standard errors in parentheses. * p < 0.05, ** p < 0.01, *** p < 0.001

What is worth noting is that the stronger (in magnitude) effect is observed on products with an average high price. The prices for this sample in fact increase by 1.3 percent because of the policy change. This result is quite comfortable for the hypothesis that this paper aims to test since it is reasonable to assume that goods with higher prices are more likely to be purchased by business rather than by consumers.

Table 5. Meta-regression results: timing of the effects

Period:	**May 1, 2015 – April 30, 2016**			**May 1, 2016 – May 1, 2017**		
	Sample 1 **(1)**	**Sample 2** **(2)**	**Sample 3** **(3)**	**Sample 1** **(4)**	**Sample 2** **(5)**	**Sample 3** **(6)**
$\overline{\theta_w}$	0.4933*** (0.0065)	0.5491*** (0.0104)	0.3204*** (0.0110)	0.5625*** (0.0083)	0.5553*** (0.0130)	0.3716*** (0.0160)
Observations	533,628	276,696	137,982	533,628	276,696	137,982
# Products	1,458	756	377	1,458	756	377

Notes: overall summary estimates based on two sub-samples in the post intervention period, the first ranging from May 1, 2015, to April 30, 2016 and the second from May 1, 2016, to May 1, 2017. Standard errors in parentheses. * p < 0.05, ** p < 0.01, *** p < 0.001.

Finally, we investigate the timing of the effects. In particular, since our sample period cover two years after the policy change, we are able to test whether the effects of the policy last just in the short run,

or instead persist in the medium run. To this end we estimate regression equation (3) for the first year (from May 1, 2015 to April 30, 2016) and for the second year (from May 1, 2016 to May 1, 2017) after the policy change. Results for the three samples of products considered in the analysis are reported in Table 5.

As can be seen from the results, we observe positive and significant effects also in the second year of the reform, and these are even slightly stronger in magnitude compared to the effects in the first year (columns 1, 2 and 3 of Table 5).

Concluding, our preliminary findings seem to provide evidence in support of the most recent taxation theory. The prices of goods sold and fulfilled by Amazon.it and potentially bought by business customers increase when the VAT remittance liability is shifted from the customer to the prime supplier.

6. Concluding remarks

Standard models of optimal taxation have for a long time just focused on what triggers tax liability, largely ignoring some important aspects relating to the tax system, like procedures for ensuring compliance, audit rates, penalties, and reporting requirements. Indeed, the textbooks of taxation theory have long accepted the proposition stating that, regardless of the economic side that has the statutory liability to remit the tax – or as said by Slemrod (2008) that must "write the check to the government" – the economic incidence, and in general all the tax consequences, are the same (Slemrod and Gillitzer, 2013).

The modern taxation theory shows however, that this irrelevance proposition may break down since the parties in the market may substantially differ in their abilities to evade taxes, demonstrating that, in practice, whether the retailer or the wholesaler remits a consumption tax, matters. Moreover, the widespread consideration of withholding and remittance reveals the great importance given to it by every national governments.

The aim of this study has been to provide a new empirical evidence in the analysis of tax incidence trying to cast evidence in support of the modern taxation theory.

The empirical analysis focused on the incidence on prices after a change in the remittance administration rule concerning the VAT. In detail, it referred to a shift in the requirement to pay the

tax upstream in the supply chain, from the business customer to the prime supplier because of the repeal of the reverse charge mechanism.

Our preliminary estimation results show that when the law implies a shift in the remittance liability, then the prices significantly change. In particular, in accordance with previous theoretical findings, when the party responsible to pay the tax is at a higher level in the supply chain, final prices increase.

The main conclusion that could, thus, be drawn from the findings of this preliminary analysis is that the irrelevance proposition of statutory and economic incidence is likely to break down in the case of VAT taxation. Therefore, studies related to optimal taxation should not understate the prominent role played by the remittance system, which may be instead critical to the efficient and equitable operation of a tax system.

References

Abadie, A., Diamond, A., & Hainmueller, J. (2010). "Synthetic control methods for comparative case studies: Estimating the effect of California's tobacco control program." *Journal of the American statistical Association*, *105*(490), 493-505.

Abadie, A., & Gardeazabal, J. (2003). "The economic costs of conflict: A case study of the Basque Country." *American economic review*, *93*(1), 113-132.

Abadie, A. (2005). "Semiparametric difference-in-differences estimators." *The Review of Economic Studies*, *72*(1), 1-19.

Acemoglu, D. and Ventura, J. (2002). "The world income distribution." *Quarterly Journal of Economics*, 117(2): 659-694.

Alesina, A., & Perotti, R. (1995). "Fiscal expansions and adjustments in OECD countries". *Economic policy*, *10*(21), 205-248.

Andrade, P., Carré, M., & Bénassy-Quéré, A. (2010). "Competition and pass-through on international markets: Firm-level evidence from VAT shocks." *Paris: CEPII*.

Benedek, M. D., De Mooij, R. A., & Wingender, M. P. (2015). "Estimating VAT pass through" (No. 15-214). International Monetary Fund.

Brodersen, K. H., Gallusser, F., Koehler, J., Remy, N., & Scott, S. L. (2015). Inferring causal impact using Bayesian structural time-series models. *The Annals of Applied Statistics*, *9*(1), 247-274.

Danninger, M. S., & Carare, M. A. (2008). "Inflation smoothing and the modest effect of VAT in Germany" International Monetary Fund (No. 8-175)..

Fabinger, M., & Weyl, E. G. (2012). "Pass-through and demand forms." *This work is in progress. For a draft of notes, contact Glen Weyl at weyl@ uchicago. edu*.

Fullerton, D., & Metcalf, G. E. (2002). "Tax incidence." *Handbook of public economics*, *4*, 1787-1872.

Gaarder, I. (2018). "Incidence and Distributional Effects of Value Added Taxes." *The Economic Journal*, *129*(618), 853-876.

Ghironi, F. and Melitz, M. (2005). "International Trade and Macroeconomics dynamics with heterogeneous firms." *Quarterly Journal of Economics*, 120(3): 865-915.

Hines Jr, J., & Desai, M. A. (2005). "Value-added taxes and international trades: the evidence." *Unpublished Manuscript*.

Jametti, M.; Redonda, A.; Sen, A. (2013). "The Power to Pass on Taxes - A Test for Tax Shifting Based on Observables". CESifo Working Paper, No. 4265

Keen, M. (2007). “VAT attacks!” *International Tax and Public Finance, 14*(4), 365-381.

Keen, M., & Smith, S. (2006). “VAT fraud and evasion: What do we know and what can be done?”. *National Tax Journal,* 861-887.

Kimbrough, K. P. (1984). “The Corporation Income Tax in the Open Economy”. *International Economic Review,* 391-407.

Kleven, H. J., Kreiner, C. T., & Saez, E. (2016). “Why can modern governments tax so much? An agency model of firms as fiscal intermediaries.” *Economica, 83*(330), 219-246.

Kopczuk, W., & Slemrod, J. (2006). “Putting firms into optimal tax theory.” *American Economic Review, 96*(2), 130-134.

Kopczuk, W., Marion, J., Muehlegger, E., & Slemrod, J. (2016). “Does tax-collection invariance hold? Evasion and the pass-through of state diesel taxes.” *American Economic Journal: Economic Policy, 8*(2), 251-86.

Kosonen, T. (2015). “More and cheaper haircuts after VAT cut? On the efficiency and incidence of service sector consumption taxes.” *Journal of Public Economics, 131,* 87-100.

Krugman, P., & Feldstein, M. (1989). “International trade effects of value added taxation”. National Bureau of Economic Research (No. w3163).

McClelland, R., & Gault, S. (2017). “The synthetic control method as a tool to understand state policy”. *Washington, DC: Urban-Brookings Tax Policy Center.*

Metcalf, G. E. (2009). “Designing a carbon tax to reduce US greenhouse gas emissions.” *Review of Environmental Economics and Policy, 3*(1), 63-83.

Muysken, J., Veen, T. V., & Regt, E. D. (1999). “Does a shift in the tax burden create employment?”. *Applied Economics, 31*(10), 1195-1205.

Niemeier, D., Gould, G., Karner, A., Hixson, M., Bachmann, B., Okma, C., and Del Valle, D. H. (2008). “Rethinking downstream regulation: California's opportunity to engage households in reducing greenhouse gases.” *Energy Policy, 36*(9), 3436-3447.

Pischke, J. S. (2005). “Empirical methods in applied economics.” *Lecture Notes. London School of Economics.*

Pomeranz, D. (2015). “No taxation without information: Deterrence and self-enforcement in the value added tax.” *American Economic Review, 105*(8), 2539-69.

Schmitt, E., Tull, C., & Atwater, P. (2018). Extending Bayesian structural time-series estimates of causal impact to many-household conservation initiatives. *The Annals of Applied Statistics, 12*(4), 2517-2539.

Scott, S. & Varian, H.R. (2013). Predicting the present with Bayesian Structural Time Series. NBER Working Paper.

Slemrod, J. (2008). “Does it matter who writes the check to the government? The economics of tax remittance.” *National Tax Journal*, 251-275.

Slemrod, J., & Gillitzer, C. (2013). *Tax systems*. MIT Press.

Varian, H. R. (2014). Big data: New tricks for econometrics. *Journal of Economic Perspectives*, *28*(2), 3-28.

Viechtbauer, W. (2010). Conducting meta-analyses in R with the metafor package. *Journal of statistical software*, *36*(3), 1-48.

Weyl, E. G., & Fabinger, M. (2013). “Pass-through as an economic tool: Principles of incidence under imperfect competition.” *Journal of Political Economy*, *121*(3), 528-583.