

Assessing the electronic invoicing potential for private sector firms in Belgium

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Abstract. Governments around the world identify the advancement of electronic invoicing in businesses as crucial for tackling administrative burdens. This paper examines, for the first time, the potential cost savings of e-invoicing in Belgium. Our analysis shows that the total cost of invoicing for Belgian private sector businesses in 2014 amounted to €3.47 billion (0.96% of GDP) and could be reduced to €1.46 billion (0.38% of GDP) if all invoices were sent digitally. Furthermore, an analysis of both barriers and enablers of e-invoicing reveals significant concerns that remain regarding the safety of e-invoicing, although a majority of private sector businesses clearly identifies the potential efficiency gains. From our contingent valuation survey among 683 Belgian businesses, we learn that the average willingness to pay (WTP) for the required investments for implementing digital invoicing amounts to €2,380. However, the potential annual cost savings of digital invoicing for the average small business in our sample is over €7,000. Additionally, our linear regression models indicate that the WTP is positively impacted by the perceived time and reduced risk gains of digital invoicing.

Key words: Electronic Invoicing; Willingness To Pay; Belgium; Cost Savings; Barriers and Enablers.

1. INTRODUCTION

In recent years, an increasing amount of scholars has been examining the relationship between administrative burdens and economic performances of countries. Djankov *et al.* (2006) found a positive correlation between less burdensome business regulation and economic growth. Poel *et al.* (2014) examined the relationship between lowering administrative burdens and spurring

economic growth: the results suggest that reducing administrative burdens, as a proxy for institutional quality, does have a significant positive effect on growth. Policy makers are also increasingly focusing on reducing these administrative costs for businesses and have formulated specific burden reduction programmes (Belgian Government, 2014; European Commission, 2007). The European Commission (EC) formulated, as part of the overall reduction programme to cut red tape, the policy goal to make electronic invoicing the predominant method of invoicing by 2020 (2010). Implementing electronic invoicing (hereinafter referred to as electronic invoicing or e-invoicing) is expected to have a significant impact on cutting red tape and thus transaction costs (i.e. the costs associated with performing the actual transaction) for businesses (High Level Group on Administrative Burdens, 2014). The costs of drafting, sending and receiving invoices are classical examples of transaction costs.

Although a significant strand of literature discusses the IT specifications, technology and invoicing management, risks and supply chain aspects of e-invoicing (Baiardi *et al.*, 2011; Brady *et al.*, 2009; Kaliontzoglou *et al.*, 2006; Koutsopoulou *et al.*, 2004), the potential cost savings are rarely examined. Penttinen and Hyytiäinen (2008) state that the cost of an incoming paper invoice amounts to €30-€50 and that electronic invoicing could cut these costs by up to 80%. Moberget *et al.* (2008) looked at the effects of a total switch from paper invoicing to electronic invoicing in Sweden. Although this analysis was carried out from an energy efficiency and greenhouse gas emission point of view, they also studied the amount of invoices and cost savings associated with electronic invoices. They find that there are 1.4 billion invoices in Sweden and that around €400 million could be saved over a 6 year period should all Swedish authorities introduce electronic invoicing. Our paper for the first time assesses the overall administrative costs associated with current invoicing processes (both sending and receiving) in Belgian private sector businesses and the potential costs savings of increasing e-invoicing. In order to do this, we also need to determine the current e-invoicing adoption rates of these firms.

The definition of the European Commission (2014) for e-invoicing is the following: “electronic invoicing – e-Invoicing – is electronic transfer of invoicing information (billing and payment) between business partners (supplier and

buyer).” In contrast to an e-invoice drafted, sent, received and processed by an integrated digital platform, most e-mail invoices are only drafted and sent/received electronically. Although both are included in our cost saving calculations, only the former are included in the regression analyses. For the remainder of this paper, we define e-invoicing as invoicing using a digital platform, unless specified otherwise. A digital platform can be a software package, program or web service that automatically links the drafting, sending or receiving of an e-invoice with the payment and processing of this invoice. In practice, the digital platform is often (an extension of) the firms’ ERP system that is able to process the e-invoice (payment) automatically. When looking at business to consumer activities, the digital platform is often a web service or application that allows the consumer to pay and archive an e-invoice with the simple click of a button.

Recent literature clearly outlines the benefits of e-invoicing over paper invoicing (Koch, 2013; Penttinen and Tuunainen, 2009; Tenhunen and Penttinen, 2010; Zhang and Ibragimova, 2003). First, e-invoicing allows for faster delivery times, shorter payment delays and reduces human error. Second, there is a potential for automation, especially when a structured format is applied to automatically generate and transfer the invoice into the supply chain of the issuer. Furthermore, e-invoicing brings about reduced printing and postage costs (EC, 2010) and enhances convenience for consumers. For example, there is a lower probability that they will forget to pay, which results in fewer fines. Finally, a smaller amount of invoices will need to be printed on paper, bringing about considerable environmental benefits, such as reduced paper consumption and lower energy costs (and thus less greenhouse gas emissions) as these invoices will no longer need to be physically transported from one location to another.

Although there appear to be multiple benefits of e-invoicing, adoption rates in most European countries are lacking behind (Arendsen and van de Wijngaert, 2011; Edelman and Sintonen, 2006). Koch (2013)¹ estimates that there are at least 350 billion invoices globally, which can be divided into 200 billion B2C/G2C

¹Report was sponsored by Billentis and Basware and is not published in an academic journal.

²The surveys were the result of cooperation between the Hasselt University, the Administrative Simplification Agency (ASA), KPMG Belgium and Indigov. The Administrative Simplification Agency (ASA) is part of the Chancellery of The Prime Minister and is the Belgian federal agency responsible for

(respectively, Business to Consumer, Government to Consumer) and 150 billion B2B/B2G/G2B (respectively, Business to Business, Business to Government and Government to Businesses). Koch further estimates the European volume to be at least 33 billion. For Europe, the proportion of electronic invoices was found to be 13% B2C and 20% B2G/B2B. Looking at the European market, some countries are clearly frontrunners (e.g. Sweden, Denmark and Finland) in the adoption rate of e-invoicing, while others are lagging behind (e.g. Italy, Greece and Croatia). However, existing literature provides no insight into the reasons why adoption rates of e-invoices differ between countries and various types of businesses. This paper focuses on the latter difference and assesses the perceived enablers and barriers of e-invoicing by carrying out a detailed survey among private sector businesses located in Belgium. This allows us to construct an e-invoicing index to assess the perception of businesses regarding the implementation of e-invoicing.

Additionally, we are not only interested in the perception towards e-invoicing, but also businesses' real appreciation of the value of e-invoicing. For example, one could imagine that businesses do appreciate the benefits resulting from e-invoicing, but simultaneously fail to make the necessary investments to actually implement e-invoicing themselves. Therefore, we set up a detailed contingent valuation experiment (i.e. payment card) to determine businesses' willingness to pay (hereafter: WTP) for e-invoicing. Furthermore, we can establish the determinants of this WTP, which will allow for evidence based policy recommendations.

To summarize, the research questions of this paper are threefold:

- 1) What are the actual administrative costs of invoicing of Belgian private sector businesses? What is the potential cost saving of e-invoicing in Belgium?
- 2) What are the enablers and barriers of digital invoicing for Belgian private sector businesses? Which factors influence the perception of digital invoicing benefits?
- 3) What is the WTP of Belgian private sector businesses for digital invoicing and what are the determinants of this WTP?

2. METHODS & DATA GATHERING

2.1 Survey

We developed a coherent methodological framework to tackle the research questions. Over the past three years, we conducted an annual survey to assess the invoicing processes in Belgium². While the first two surveys mainly focus on the number of invoices and the methods for creating, sending and receiving invoices, the third survey included elaborated segments on the perceptions of e-invoicing and the willingness to pay for e-invoicing investments. The first survey was conducted between February 19, 2013 and March 12, 2013 and concerned the invoicing of 2012. More than 600 private sector businesses participated. The second survey was performed between December 19, 2013 and December 31, 2013 amongst 847 respondents. The third survey took place between December 17, 2014 and January 12, 2015 and was completed by 794 businesses. The reason for doing three surveys is twofold. First, performing three surveys allows us to validate the results obtained in the first survey. Second, multiple surveys allow for monitoring the evolution in the adoption rate of e-invoicing. Before sending out the final surveys, a test survey was performed on a small panel of businesses to test the validity of the questions.

All three surveys were conducted by using an online B2B panel and were directed at the employees responsible for or involved in the accounting and billing department at the surveyed businesses. The results of the survey were weighted by: (a) the number of private sector businesses per region (Flanders, Wallonia and Brussels) and (b) the number of employees to obtain a representative sample for the business sector in Belgium. Based on these responses, we calculated averages for the different metrics we questioned for four company sizes (sole

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proprietorship, small, medium and large). The data on company size were delivered by the Belgian Directorate-General Statistics (STATBEL).

All surveys contain questions to acquire quantitative information (number of invoices, methods of drafting, sending and processing, etc.) and qualitative information (barriers, enablers, interests, intentions, perceptions, willingness to pay, etc.). The last survey (results for 2014) contains 37 questions of which 7 related to general information (e.g. amount of employees, location, sector, etc.). The remaining questions are divided into three categories: invoicing processes (1), the enablers and barriers of e-invoicing (2) and the willingness to pay (3). The following section discusses these three parts in more detail and elaborates the methods used to analyse the data.

2.1.1. Part 1: Invoicing processes: Standard Cost Model

Questions 8 to 27 of the survey concern quantitative information (number of invoices, number of e-invoices, methods of sending (%), etc.). Using the Standard Cost Model (SCM)³, which is adopted by most EU countries as well as the EU institutions for measuring administrative burdens, the (total) administrative burdens (in terms of costs of invoicing) were estimated for Belgian private sector businesses as well as for citizens. The core equation of the SCM is $\sum P \times Q$, where P stands for Price (tariff * time) and Q stands for Quantity (number of businesses * frequency). In other words, the SCM measures the opportunity cost of complying with information obligations (i.e. the time spent and the hourly tariff) as well as other 'out-of-pocket' costs (e.g. postal costs, printing costs, etc.). Investments in IT are not taken into account. To demonstrate how the SCM calculation works, we give a detailed example of the calculation for one information obligation concerning invoicing. Consider a business that sends 1.000 B2B paper invoices a year. This firm will undertake the following administrative steps: data collection (1), drafting the invoice using accounting software (2), printing the invoice and preparing the envelope (3), sending the invoice by mail (4) and archiving the invoice (5). Assume, the time to complete these 5 steps for one invoice amounts to 8 minutes and the out-of-pocket costs amount to €0.76 per invoice (cost of the postal stamp). At an hourly tariff of €35.21 (overall hourly

³The SCM measures the opportunity cost of time, as well as the out-of-pocket and external costs. More info on the SCM can be found on <http://www.administrative-burdens.com/default.asp?page=122>

wage cost for administrative employee) this leads to the following equations and calculations for sending 1,000 paper invoices:

$$P = \text{Tariff} \times \text{Time} = ((\text{€}35.21 * 8 \text{ min})/60) + \text{€}0.76 = \text{€}5.45$$

$$Q = (\text{Number of businesses} * \text{Frequency}) = (1 * 1,000) = 1,000$$

$$\text{Administrative Burden} = \sum P \times Q = \text{€}5.45 * 1,000 = \text{€}5,455$$

Thus, the administrative burden of sending 1,000 paper invoices for one company amounts to €5,455. The results for the total administrative burdens for private sector firms and citizens are discussed in part 3.1.

2.1.2 Part 2: Enablers and barriers: e-Invoicing Index

Before constructing our survey, we analysed the existing literature on the diffusion and adoption rates of e-invoicing. Penttinen and Tuunainen (2009) looked at the effect of external pressure in information system adoption in the inter-organizational settings of e-invoicing. Organizational readiness, external pressure, perceived benefits, the bandwagon effect and the supplier pressure were found to have a significant effect on adoption of e-invoicing in small and medium sized businesses. However, literature on this topic remains scarce. Therefore, we turned our attention to the literature regarding the diffusion of inter-organizational information systems. In contrast to the rather limited amount of literature on the adoption rates of e-invoicing, there is an entire body of theoretical and empirical research on the factors influencing the adoption and diffusion of inter-organizational information systems [IOS] (of which e-invoicing is an example). This is, amongst others, illustrated by the review of Chatterjee and Ravichandran (2004) of 45 papers on different outlets of IOS. Kreuzer *et al.* (2014) conducted a structured analysis of the scientific literature on three factors that influence the adoption of open standard-based IOS: the organizational, technological and environmental context. Despite the number of papers on this topic, they found that prior studies rarely analysed more than two different types of environmental context characteristics in conjunction. Zhu *et al.* (2006) looked at migration across IOS with different 'degrees of openness'. They found that migrating from an electronic data interchange (EDI, a relatively less open IOS) has a significant negative effect on the adoption costs of a firm. EDI research of Iacovou *et*

al.(1995) further concluded that small businesses have a high resistance to EDI adoption. The major reasons for this are organizational readiness, external pressure and the perceived benefits. Jevarai *et al.*(2006) did a review of 48 empirical studies on individual and 51 studies on organizational IT adoption. They found that the best predictors of individual IT adoption are perceived usefulness, top management support, computer experience, behavioural intention and user support. Furthermore, the scholars found that the best predictors for a successful IT adoption by organisations are top management support, external pressure, and external information.

Starting from the insights of the existing literature concerning e-invoicing benefits (Koch, 2013; Penttinen and Tuunainen, 2009; Tenhunen and Penttinen, 2010; EC, 2010) we tested numerous indicators of e-invoicing adaption rates with our business test panel (section 2.1). In accordance with international literature, the cost and time benefits appeared to be crucial variables. Additionally, our business test panel attached significant importance to the safety and risk aspects of e-invoicing. Most SMEs like to handle their payments and invoicing on paper. Given that they are not so familiar with electronic business methods, they expressed concerns about the safety of e-invoicing. Therefore our e-invoicing index consists of three constructs: the perceived cost savings, the perceived time savings and the perceived risks and uncertainty. Each construct consisted of multiple statements regarding digital invoicing. Respondents were presented a 5-point Likert scale to determine their opinion on eight clear statements about digital invoicing.

To examine and confirm possible factors that influence the enablers and barriers of digital invoicing perceived by these businesses, we developed an 'e-invoicing index'. A score was awarded of respectively "-2", "-1", "0", "+1" and "+2" to the possible answers ("totally disagree", "rather disagree", "agree nor disagree", "rather agree", and "totally agree"). Opt-out responses, i.e. using the "no opinion" option, were excluded from further analyses. Each response was given a score on the index for its overall perception of the barriers and enablers of digital invoicing. The lower and upper bound for this index is -16 (very negative view on e-invoicing) to +16 (a very positive view on e-invoicing). The results of the index are discussed in part 3.2.

2.1.3. Part 3: Willingness to pay: Payment Card

Our survey also assessed the willingness to pay (hereafter WTP) for digital invoicing of Belgian private sector businesses. The WTP questions were asked before the questions concerning the enablers and barriers of e-invoicing to avoid framing. Within the stated-preference methods, the contingent valuation methods are typically used to measure the value of non-market goods. These methods are mostly used in environmental, healthcare and traffic safety studies. More recently, WTP studies have been applied to spam mail, e-government and telephone services (Yoo *et al.*, 2006; Schmid, 2005 and Torero *et al.*, 2002). However, they have not yet been employed to measure the WTP for digital invoicing. One of the reasons to perform a WTP experiment lies in the fact that the intention to adopt, as well as a positive attitude towards an adoption, is not always sufficient drivers to fully adopt a new technology (Juntumaa and Oorni, 2011). The same reasoning appears to hold for the adoption of digital invoicing in Belgium. Further, we wanted to test whether the perception of Belgian businesses regarding the costs savings of digital invoicing matched reality.

There are different methods within the contingent evaluation techniques to measure the WTP: open questioning, a bidding game, a payment card, dichotomous questioning, etc. Bateman *et al.* (2002) extensively examined the advantages and disadvantages of the various contingent evaluation methods. Based on their analysis, they recommend using a payment card or dichotomous questioning to establish the WTP. A problem with the payment card is that the answers of the respondent can be influenced by the values of the scale that is being presented ('scale deviation'). However, compared to the dichotomous questioning, the payment card has no 'yea saying' or 'no saying' deviation. Furthermore, a payment card tends to provide more relevant information of each respondent compared to dichotomous questioning. Therefore, we decided to use a payment card to establish the WTP for digital invoicing. The respondents in our survey were presented a text concerning digital invoicing. In the text, the framing of the questions was described in clear and simple terms. The text was tested multiple times on our small business panel to ensure that the interpretation of the text was correct. The range of the payment card varied between the four business sizes because the preliminary survey showed a lower WTP for smaller businesses

due to a smaller amount of invoices. In order to overcome the potential ‘scale deviation’ we set up a test panel of businesses to retrieve the relevant bidding values for the payment card. We included 18 values for each payment card, meaning that the potential for scale deviation is reduced. Furthermore, results from our initial tests learned that significant differences in responses exist between three groups of business size. Therefore, in our final payment cards we used 18 different values for our respondents based on their business size. The values on the payment cards ranged from €0 to €50.000. Furthermore, 18 values is also the maximum number to enable a clear analysis of the data with our software. Respondents were asked the following question: “How much are you willing to pay (as a one-time investment) to acquire all the necessary hard- and software to receive, process and send your invoices digital?”

The determinants of WTP will be analysed by applying linear survey regressions. The results are discussed in part 3.3.

3. RESULTS

3.1 Invoicing process

3.1.1 Invoicing volumes of Belgium private sector businesses

By extrapolating the results from the first survey we find that the number of invoices sent by private sector businesses in Belgium (B2B/B2C) amounts to around 1 billion (46% B2B and 54% B2C), as shown in Table 1.

	Sole proprietorship (0 employees)	Small (1-50 employees)	Medium (51-250 employees)	Large (>250 employees)	Total
B2B	47,622,591	260,562,997	25,710,883	144,340,095	478,236,566
B2C	28,076,966	157,340,767	8,168,262	368,386,051	561,972,046
Total invoices	75,699,557	417,903,764	33,879,145	512,726,146	1,040,208,612
Total (%)	7.3%	40.2%	3.2%	49.3%	100%
Share of total businesses (%)	75.8%	23.2%	0.5%	0.5%	100.00%

Table 1: Number of invoices sent by private sector businesses in Belgium in 2012

Most invoices are sent by small and large businesses. Although only 7.3% of the invoices are sent by sole proprietorship businesses, STATBEL figures show that they represent the largest share of businesses: 75.78% of the businesses in Belgium resort under the category sole proprietorship. On the other hand, the large businesses (which account only for 0.48% of total businesses), send the most invoices. These are mainly the private telecom and utility providers.

3.1.2 E-invoicing adoption rates

In the surveys, we asked the businesses to assess the share of invoices sent:

- by **paper**;
- by **e-mail** (PDF in attachment or a link to a web portal);
- using an **integrated digital platform**.

This enables us to estimate the adoption rates of e-invoicing by Belgian private sector firms. Furthermore, the adoption rates are necessary to estimate the actual costs of invoicing using the SCM. Concerning e-invoicing, we differentiate between digital invoices and invoices by e-mail, since the former is more cost-efficient than the latter.

Table 2 shows the results of the different methods of sending invoices for the various groups of businesses. The overall results for the distribution over these three methods for the period 2012 -2014 are included in table 3. At the end of 2014, the total percentages of B2B and B2C e-invoices by e-mail and digital platform were respectively 47.66% and 39.09%. The e-invoicing adoption rates of Belgian private sector companies have been rising quite rapidly over the last three years. However, this merely consists of e-invoicing by e-mail.

When only taking into account digital invoices, a mere 7-9% of the invoices are sent electronically, which is substantially less than the 39% - 48% of e-invoicing when combining both digital invoices and e-invoices by e-mail (PDF). However, the European Commission, as well as the Belgian government, do not specify that an e-invoice has to be processed fully automatically (by using a digital platform). Thus, according to these definitions, the Belgian government has already reached its goal of 25% e-invoicing by 2014 (Belgian Government, 2011). The large amount of e-invoices by e-mail is consistent with the findings of

Penttinen and Tuunainen (2009): sending a PDF is one of the most comment methods of e-invoicing in Europe.

Company size	Digital platform			E-mail			Paper invoices			
		2012	2013	2014	2012	2013	2014	2012	2013	2014
Sole proprietorship	B2B	1.4%	2.6%	2.5%	43.0%	40.7%	43.4%	55.6%	56.7%	54.1%
	B2C	0.8%	1.4%	4.5%	31.9%	25.1%	25.9%	67.2%	73.5%	69.6%
Small	B2B	1.5%	4.4%	7.4%	15.8%	18.4%	36.2%	82.6%	77.2%	56.4%
	B2C	0.0%	5.3%	8.2%	14.9%	22.2%	33.0%	85.1%	72.4%	58.8%
Medium	B2B	3.3%	8.7%	16.5%	22.4%	27.9%	32.2%	74.4%	63.4%	51.3%
	B2C	1.5%	12.3%	10.0%	11.4%	19.1%	34.2%	87.2%	68.6%	55.8%
Large	B2B	3.3%	12.3%	15.6%	22.4%	36.3%	45.6%	74.4%	51.4%	39.8%
	B2C	1.5%	12.9%	10.5%	11.4%	32.6%	37.0%	87.2%	54.5%	52.5%

Table 2: E-invoicing volumes (%) Belgian private sector businesses by size (2012, 2013 and 2014)

	Digital platform			E-mail			Total e-invoices			Paper invoices		
	2012	2013	2014	2012	2013	2014	2012	2013	2014	2012	2013	2014
B2B	3.74%	6.02%	8.72%	18.78%	27.42%	38.94%	22.52%	33.44%	47.66%	77.48%	66.56%	52.34%
B2C	2.32%	6.92%	7.58%	16.18%	24.96%	31.51%	18.50%	31.88%	39.09%	81.50%	68.12%	60.91%

Table 3: Overall e-invoicing volumes (%) Belgian private sector businesses in 2012, 2013 and 2014

3.1.3 E-invoicing cost savings (SCM)

Using the Standard Cost Model (SCM), an estimate was made for the (total) amount of administrative burdens (in terms of costs) for Belgian private sector businesses and citizens of invoicing. An example of how the SCM calculation works has been discussed in section 2.1.1. For all four business types,

we have calculated the administrative burdens of all information obligations regarding the sending and receiving of e-invoices and thus calculated the total cost for all Belgian private sector firms and citizens.

In 2014, the actual total cost of invoicing amounts to €4.10 billion and the actual savings of digital invoicing and invoicing by e-mail to €0.93 billion. When looking at the cost for private sector businesses, the current (2014) total annual cost of invoicing for private sector businesses amounts to €3.47 billion (0.96% of GDP) and can be reduced to €1.46 billion (0.38% GDP) if all invoices were to be sent electronically. The potential savings for businesses and citizens of the rather hypothetical situation in which all businesses send each invoice electronically (digital) instead of on paper, amount up to €3.37 billion. Table 4 gives an overview of these costs and cost savings.

Costs 100% paper	Costs 100% electronic	Current costs (2014)	Potential total savings	Actual savings digital and by e-mail (1993-2013)
€5.02 billion	€1.66 billion	€4.10 billion	€3.37 billion	€0.93 billion

Table 4: Total paper and electronic invoicing costs and savings (businesses and citizens)

We also calculated the average cost per B2B and B2C invoice (inbound and outbound). In total, each B2B digital invoice saves €9.01 and each B2C digital invoice saves €5.32.

As mentioned earlier in section 3.1.2, a large amount of e-invoices is sent by e-mail. Although sending an invoice by e-mail costs less than a paper invoice, a company can save more by sending a digital invoice. Sending a B2B invoice by e-mail saves €2.42 compared to sending it on paper. As shown in table 5, when an invoice is sent digitally instead of on paper, the cost savings are €3.24 (€0.82 extra). An inbound B2B invoice by e-mail only saves €0.36 per e-mail compared to €5.77 when sent digitally (€5.41 extra). Also, there are larger cost savings for citizens when they receive a digital invoice. An inbound B2C e-mail invoice saves €1.04 compared to a paper invoice. When sent digitally, the saving amounts to €2.08 (€1.04 extra). So although digital invoices are more cost effective and have more benefits, there still is a partial adoption: the older technology (e-

mail/PDF) and the new technology (digital) still coexist (Juntumaa and Oorni, 2011).

	B2B Invoice	B2C Invoice
Paper outbound	€4.44	€4.44
Electronic outbound (digital)	€1.20	€1.20
Electronic outbound (e-mail)	€2.02	€2.02
Cost savings outbound digital	€3.24	€3.24
Cost savings outbound e-mail	€2.42	€2.42
Inbound paper	€8.04	€2.77
Inbound electronic (digital)	€2.27	€0.69
Inbound electronic (e-mail)	€7.68	€1.73
Cost savings inbound digital	€5.77	€2.08
Cost savings inbound e-mail	€0.36	€1.04
Total cost savings e-invoicing (digital)	€9.01	€5.32
Total cost savings e-invoicing (e-mail)	€2.80	€3.46

Table 5: Paper and electronic invoice cost per unit for our sample

In our sample, the e-mail invoice still represents a higher fraction of the overall invoices compared to the digital invoice. This contradiction (on the one hand lower savings and on the other hand a higher adoption rate of e-mail invoices) is also reflected in the numbers of table 4: Although 39% - 48% of invoices are sent electronically (combining both digital invoices and e-invoices by e-mail), only 27.5% of the potential savings of e-invoicing (€0.93 billion) are actually reached in Belgium due to the higher price of e-mail invoices compared to digital invoices. So in order to reap the full benefit of e-invoicing, e-mail (PDF) can only be a steppingstone towards full digital invoicing.

3.2 Enablers and barriers of e-invoicing

The previous paragraphs have shown that e-invoicing can generate substantial cost savings. Many governments are focussing on increasing the use of e-invoicing. Nonetheless, insight into its enablers and barriers remain scarce. Therefore, we included a set of questions in our survey regarding the barriers and enablers of switching to e-invoicing.

Table 6 shows the results for 2014 for the enablers and barriers of switching to e-invoicing. As mentioned earlier, respondents were presented a Likert scale to determine their opinion on a number of clear statements about e-invoicing.

“To what extent do you agree or disagree with the next statements: compared to paper invoicing, e-invoicing causes in my company ...”

	Totally disagree	Rather disagree	Agree nor disagree	Rather agree	Totally agree	No opinion
reduced printing costs	3.6%	5.2%	14.9%	25.4%	41.1%	9.9%
more efficient storage	4.3%	5.6%	20.2%	29.1%	29.5%	11.3%
timesaving	4.1%	7.2%	23.2%	30.4%	25.1%	10.0%
a better control of my processes	4.8%	9.0%	24.9%	28.6%	22.1%	10.6%
less administrative burdens	5.1%	10.3%	26.1%	29.2%	17.7%	11.7%
higher IT-costs	4.1%	8.1%	30.7%	26.6%	17.3%	13.1%
more safety	5.6%	11.3%	30.8%	24.7%	15.9%	11.6%
a limitation of errors	5.5%	13.0%	28.5%	26.3%	14.8%	11.9%

Table 6: Enablers and barriers of e-invoicing

Logically, the majority of the businesses in our survey confirm that e-invoicing reduces printing costs. Further, they agree with the statements that it enables a more efficient storage and that e-invoicing saves time. However, more than half of the businesses do not agree with the statements that e-invoicing is safer and causes less errors. This is in accordance with our experiences in the business test panel: a significant share of (smaller) businesses has serious doubts about e-invoicing safety. However, results can vary with the size and/or structure of the businesses. Therefore, we distinguish four groups of businesses: sole proprietorship, small, medium and large businesses. The results, included in annex table 1, show that a major difference exists between the large(r) businesses and the businesses, which resort under sole proprietorship: larger businesses generally tend to agree more with the statements.

3.2.1 E-invoicing index

3.2.1.1 Summary statistics

As mentioned in part 2.1.2, we developed an ‘e-invoicing index’ (I) to examine possible factors that influence the enablers and barriers of e-invoicing perceived by Belgian businesses. As shown in table 7, we created three constructs for the e-invoicing Index: costs (I_{cost}), time (I_{time}) and risk and uncertainty (I_{risk}). This will enable us to determine the relative impact of each construct on the perception of e-invoicing. Further, these constructs will also be used as covariates in our WTP analysis (see part 3.3). As a reminder, when mentioning e-invoicing, we mean digital invoicing.

Constructs	Statements
Costs	Reduced printing costs
	Higher IT-costs
	Less administrative burdens
Time	More efficient storage
	Timesaving
	A better control of my processes
Risk and Uncertainty	More safety
	A limitation of errors

Table 7: E-invoicing index constructs

The index (I) is based on the 8 statements concerning the enablers and barriers of e-invoicing shown in table 6. As shown in table 8, the index ranges from -16 to +16. A positive score on the index indicates a positive perception of the benefits of e-invoicing. Almost 81% of the companies in our survey has a positive perception of the e-invoicing benefits. The mean score for the index was 3.53.

Variables	Obs	Mean	Std. Dev.	Min	Max
I	635	3.53	5.81	-16	16
I_{cost}	669	0.98	2.05	-6	6
I_{time}	699	1.41	1.99	-4	4
I_{risk}	681	1.14	2.84	-6	6

Table 8: Summary statistics e-invoicing indexes

3.2.1.2 Estimations

The index scores are analysed by applying linear survey regressions. Independent variables derived from our surveys are included in multivariate regression models: Experience with digital invoicing (Experience), dummies for the enterprise size (Sole Proprietorship (SP), Small, Medium and Large) and a dummy for the type of respondent (Business Owner and Staff):

$$Index = constant + \delta_1 \text{ experience} + \delta_2 \text{ business size} + \delta_3 \text{ type of respondents} + \varepsilon$$

We performed several tests to ensure that the use of a linear regression was appropriate. Both the inter-quartile range (iqr) test and Shapiro-Wilk (Swilk) test for normality both rejected the normality of our residuals. As normality is not required in order to obtain unbiased estimates of the regression coefficients, this is not a major issue for our estimates. Using the White's test, we tested the null hypothesis that the variance of the residuals is homogenous. The p-values for heteroskedasticity were never under 0.10 indicating we could accept the hypothesis that the variance was homogenous. There are indications of skewness in the White tests, as well as from looking at the kernel density plots (see annex 2), but these do not seem to be problematic for our estimations. We also used company sized clustering to automatically add the robust function which corrects for heteroskedasticity (clustering did not significantly change the standard errors). Next, we made sure that there was no multicollinearity by using the VIF scores. Overall, we can safely use linear regression models for our analysis.

Model (1) in table 9 shows the results for the overall Index I. Experience with digital invoicing appears to have a significant positive effect on the overall perception of e-invoicing. This is in line with the findings of Hernandez-Ortega and Jimenez-Martinez (2013). Further, large businesses tend to have a more positive perception of the e-invoicing benefits. Model (2) provides the estimate for the costs Index (I_{cost}). There seem to be no significant effects of experience, enterprise size or type of respondent. Model (3) finds a positive significant effect of large businesses on the perceived time Index (I_{time}). Last, model (4) finds a significant positive effect for experience with digital invoicing and large businesses on the perceived risk and uncertainty index (I_{risk}). Overall, large businesses and prior experience with digital invoicing positively impact the

perception of e-invoicing benefits. Only for the cost index there seem to be no significant determinants.

Explanatory Variables	Model 1 I	Model 2 I _{cost}	Model 3 I _{time}	Model 4 I _{risk}
Experience	1.171** (0.583)	0.138 (0.21)	0.256 (0.197)	0.949*** (0.289)
Small	0.595 (0.727)	0.0314 (0.251)	0.271 (0.243)	0.614* (0.325)
Medium	0.281 (1.177)	-0.474 (0.515)	-0.0203 (0.463)	0.849 (0.52)
Large	2.667*** (0.883)	0.268 (0.297)	1.009*** (0.294)	1.636*** (0.411)
Business Owner	-0.0237 (0.685)	-0.161 (0.236)	-0.00903 (0.232)	0.178 (0.306)
Constant	2.565*** (0.733)	0.959*** (0.249)	1.048*** (0.24)	0.303 (0.326)
N	635	669	699	681

Standard errors in parentheses: * p<0.1, ** p<0.05, *** p<0.01

Table 9: E-invoicing indexes of Belgian businesses, survey linear models (clustered se)

3.3 Willingness to pay (WTP)

3.3.1 General results

As mentioned in part 2.1.3, we used a payment card to establish the WTP for digital invoicing. We used separate scales based on our tests with a small business sample and in order to avoid scale bias for small businesses. Respondents were asked the following question: “How much are you willing to pay (one time = investment) to acquire all the necessary hard- and software to be able to receive, process and send your invoices digital?” As shown in table 10, the mean WTP of all the respondents in the survey is €2,380. Further, the mean WTP for sole proprietorship (WTP_{sp}), small businesses (WTP_s) and medium and large businesses (WTP_{ml})⁴ is respectively €290, € 2,565 and €11,222.

⁴There were only 16 medium sized respondents in the WTP study. Further, STATBEL figures also indicate that most businesses in Belgium are sole proprietorship businesses and small companies. For coherence, we therefore grouped medium and large businesses into one category ‘medium & large’ businesses.

Variable	Obs	Mean	Std. Dev.	Min	Max
WTP	683	2,380.59	5,753.33	50	50,001
WTPsp	299	290.31	503.76	50	3,001
WTPs	320	2,565.26	3,482.61	125	15,001
WTPml	64	11,222.72	13,977.92	250	50,001

Table 10: Summary statistics WTP

3.3.2 Estimations

The average WTP is analysed by applying linear regressions. Consistent with the Index approach, independent variables derived from our surveys are included in multivariate regression models: Experience with digital invoicing (Experience), dummies for the enterprise size (Sole Proprietorship (SP), Small, Medium and Large (Large)) and a dummy for the type of respondent (Business Owner and Staff). Additionally, we added dummies for the region (Flanders, Wallonia and Brussels) and the number of outbound invoices (OI). The dependent variable in these analyses is the log of average WTP. We use the log transformation of the WTP because of the rather large skewness of this variable (see kernel densities WTP and Log WTP in annex 3).

To analyze the impact of our independent variables collected through our survey, we used the following linear survey regression model:

$$\begin{aligned} \text{Log WTP} = & \text{constant} + \delta_1 \text{experience} + \delta_2 \text{region} + \delta_3 \text{index} \\ & + \delta_4 \text{outbound invoices} + \varepsilon \end{aligned}$$

Model (1) in table 11 provides a baseline linear regression that consists only of the basic independent variables derived from our survey as well as our constructed e-invoicing Index (I).

Explanatory Variables	Model (1) log WTP	Model (2) log WTP	Model (3) log WTP	Model (4) log WTP	Model (5) log WTP
Experience	0.168 (0.147)	0.110 (0.145)	0.00440 (0.144)	0.0990 (0.145)	0.0933 (0.146)
Flanders	-0.143 (0.157)	-0.140 (0.152)	-0.0640 (0.149)	-0.0816 (0.153)	-0.0979 (0.154)
Walloon	-0.251 (0.166)	-0.242 (0.162)	-0.228 (0.157)	-0.175 (0.162)	-0.223 (0.162)
Business Owner	-0.780*** (0.127)	-0.779*** (0.124)	-0.375*** (0.134)	-0.738*** (0.127)	-0.679*** (0.129)
I	0.0627*** (0.00917)			0.0797*** (0.0116)	0.0616*** (0.00919)
OI	0.00124*** (0.0000852)	0.00122*** (0.0000827)	0.00103*** (0.0000909)	0.00113*** (0.0000879)	0.000830*** (0.000199)
I _{cost}		-0.0623* (0.0324)	-0.0435 (0.0315)		
I _{time}		0.0955** (0.0425)	0.0944** (0.0410)		
I _{risk}		0.120*** (0.0281)	0.104*** (0.0275)		
SP			-1.417*** (0.487)		
Small			-0.691 (0.463)		
Large			-0.109 (0.472)		
DC				-0.290 (0.403)	
Small2				-0.512 (0.391)	-1.185*** (0.347)
Small2 x Cost				-0.171 (0.416)	
Small2 x OI					0.000375* (0.000221)
Constant	5.429*** (0.160)	5.452*** (0.157)	6.239*** (0.479)	6.168*** (0.383)	6.494*** (0.351)
N	555	555	555	555	555

Table 11: WTP for e-invoicing by Belgian businesses, linear models (clustered se)

The index and the amount of outbound invoices seem to have a significant positive effect on the WTP of businesses for e-invoicing. Naturally, a more positive perception and more outbound invoices increase the businesses' WTP. However, as mentioned earlier, a positive attitude towards an adoption is not always a sufficient driver to fully adopt a new technology (Juntumaa and Oorni, 2011). The dummy for business owners indicated a negative significant effect on the businesses' WTP. As they are the ones that actually have to pay for the

necessary investments, it is logical that they are willing to pay less compared to staff members.

In model (2) we added the three e-invoicing Index constructs (I_{cost} , I_{time} and I_{risk}) to look for potential differences of their impact. All the Index constructs seem to have a significant impact. Surprisingly, the costs Index (I_{cost}) has a negative impact on the willingness to pay. This would mean that respondents with a positive perception of cost savings are willing to pay less for implementing e-invoicing. However, when we add business size in our model (3), we notice a highly negative significant effect of sole proprietorships on the WTP. Simultaneously, the significant negative effect of the costs Index disappears. One reason for the changing effect could be that there is an interaction effect between smaller companies and I_{cost} . Therefore, in column (4) we added a dummy for a positive cost perception (DC) and a dummy for small companies (Small2= SP and S) and included an interaction term Small2 x Cost. We see no effect from these variables indicating that the perception of cost benefits has no significant impact on the small businesses' WTP.

The risk and uncertainty Index in models (2) and (3) is highly positive significant. This was expected when looking at the existing IOS literature. A lot of scholars examined the factors influencing the organizational decisions to adopt IOS (Robey *et al.* 2008; Jeyaraj *et al.* 2006). Most research on IOS adoption is based on the theory of diffusion of innovations of Rogers (1995-2003). According to Rogers (2003), the diffusion of innovations (rate of adoption) is an 'uncertainty reduction process'. Logically, when businesses are more certain that e-invoicing is safe and reduces risks, they are willing to pay more for it.

In the last model (5), we tested the effect of an interaction term of the amount of invoices and small companies. The dummy for small companies is now highly negative significant indicating again that smaller companies are willing to pay less for e-invoicing compared to larger businesses. Here we see that the interaction term (Small2 x OI) has a positive significant effect: if the amount of outbound invoices rises, a smaller business' WTP for digital invoicing will rise relatively more compared to a larger businesses' WTP.

Overall, the amount of outbound invoices and the majority of e-invoicing Indexes (perception of e-invoicing benefits) have a positive significant effect on the WTP. Only the cost Index has no significant effect on the businesses' WTP. Furthermore, in general business owners are willing to pay less for e-invoicing compared to staff members.

3.3.3 Willingness to pay (WTP) vs. Cost Savings

As shown in the analysis in section 3.3.2, the perception of cost benefits of e-invoicing seems to have no impact on the willingness to pay. A possible explanation lies in the fact that businesses do not see the return on investment (ROI) of e-invoicing or that they do not trust e-invoicing. Therefore, governments should provide more information for businesses to clarify the costs, the cost savings and safety of e-invoicing, which could help convince private sector businesses to switch to electronic invoicing.

Using the average amount of invoices of each company and the cost per invoice (determined by the responses and analysis of our first two annual surveys), it is possible to estimate the cost saving of the average firm when implementing e-invoicing. Table 12 gives an overview of the annual cost savings for the average company of the four segments. This calculation shows that a sole proprietorship with on average 120 invoices a year generates rather limited cost savings through e-invoicing. Therefore, efficiency gains as such are often not enough to trigger these businesses to replace paper invoices. The other groups of businesses have larger saving potentials and are hence more incentivised to switch to e-invoicing.

	Sole proprietorship (0 employees)	Small (1-50 employees)	Medium (51-250 employees)	Large (>250 employees)
Average total cost savings per year	€ 389	€ 7,027	€ 23,805	€ 418,762
Average WTP as % of average cost savings	74.55%	36.50%	47.14%	2.68%

Table 12: Average cost savings of e-invoicing by company size

Compared to the potential cost savings (less AB) of e-invoicing, the WTP for each business size is rather limited. As shown in table 10, the WTP for sole

proprietorship (WTPsp), small businesses (WTPs) and medium and large businesses (WTPml) are respectively €290, €2,565 and €11,222. This discrepancy again indicates that there is a wrong perception concerning the costs of e-invoicing. Further, sole proprietorship businesses are willing to pay relatively more for digital invoicing than larger companies compared to the cost savings.

4. CONCLUSION AND DISCUSSION

This paper for the first time assessed the overall administrative costs associated with current invoicing processes (both sending and receiving) in Belgian private sector businesses and the potential costs savings of and increased level of e-invoicing. Further we examined the barriers and enablers of e-invoicing for private sector firms in Belgium, as well as their willingness to pay for e-invoicing techniques.

Implementing e-invoicing is expected to have a significant impact on cutting red tape and thus transaction costs for businesses. The costs of drafting, sending and receiving invoices are a classical example of transaction costs, i.e. the costs associated with performing the actual transaction. By using the SCM, we found that the current (2014) total annual cost of invoicing for Belgian private sector businesses amounted up to €3.47 billion (0.96% GDP) and could be reduced to €1.46 billion (0.38% GDP) if all invoices were sent digitally. However, the actual savings (€ 0.93 billion) remain rather low given the already substantial adoption rates of e-invoicing of Belgian private sector firms (39% – 48% of all invoices). This is due to the relative high proportion of e-mail invoices, which are less cost saving compared to digital invoices. In order to reap the full benefit of e-invoicing, invoices by e-mail (PDF) can only be an intermediate step towards full digital invoicing.

Furthermore, an analysis of both barriers and enablers of e-invoicing revealed that a majority of businesses agrees with the statements that e-invoicing reduces printing costs, saves time, increases storage efficiency and allows for a better control of their processes. However, businesses are not yet fully convinced of all the benefits of e-invoicing since questions remain about the safety of e-invoicing.

Using the information on the e-invoicing statements, we developed an e-invoicing index to examine possible factors that influence the enablers and

barriers of e-invoicing perceived by businesses. Our findings suggested that large businesses and businesses with e-invoicing experience seem to have a more positive perception of the benefits of e-invoicing.

Finally, we used a payment card to establish Belgian private sector businesses' WTP for e-invoicing. The average willingness to pay (WTP) for digital invoicing amounted up to €2,380. In general, the amount of outbound invoices and the e-invoicing indexes (perception of e-invoicing benefits) appeared to have a positive significant effect on the WTP. Compared to the potential cost savings of e-invoicing, the WTP for each business size was rather limited. A possible explanation lies in the fact that businesses do not see the ROI of e-invoicing or that they do not trust e-invoicing.

Based on our results, we identified some policy measures the Belgian government could adopt to increase the usage of electronic and digital invoices. First of all, the results show that e-invoices represent a substantial part of total invoices in Belgium. However, the majority are invoices by e-mail resulting in lower actual cost savings. Although further research is needed, first indications from the field indicate that the initial investment in IT for digital invoicing (e.g. buying access to a digital platform) is perceived as relatively high compared to the potential cost savings, especially for businesses with rather limited amounts of invoices. Introducing a tax reduction for the required investments for digital invoicing could provide the necessary incentive for these firms and is worth exploring in future research. Second, the government should inform companies that digital invoicing does not always require high IT costs. Providing more detailed information and best practices could help convince businesses to switch to digital invoicing. There already exist cost efficient solutions (both transactions based, as well as lump sum payment). Third, Belgian companies are not yet fully convinced of all the benefits of e-invoicing and have serious concerns about the safety of digital invoicing. Therefore, the Belgian government should lead by example. When the government does not use e-invoicing itself, it is hard to credibly stimulate private companies to do so. Just recently (July 17th, 2014), the Belgian federal government has received her first digital B2G invoice and thus still has a long way to go.

Finally, our study also has some limitations. The data for our analysis was acquired through three questionnaires, which bring about possible downsides and uncertainties: biased answers, lack of validity, etc. As there was no detailed information available in previous studies, databases, etc. a questionnaire was the preferred method to gather this data on a large scale. Further, our dataset only spans the 2012-2014 period, which is rather short. Although the time span and the number of respondents (613 - 847) are limited, we do believe that our results are representative: the respondents of the survey were weighted by both the number of private companies per region (Flanders, Walloon and Brussels) and the number of employees to get a representative sample for Belgium. Furthermore, we tried to tackle potential biased answers as much as possible by setting up test panels. Additionally, the same method and questionnaire was used for three years and the results over the years are thus perfectly comparable. Last, this study only covers the Belgian private sector. Although our findings do align with findings of other country specific studies on e-invoicing, one should, however, be careful to extrapolate our findings and government actions to other (EU) countries.

5. ANNEXES

I. Enablers and barriers of e-invoicing by business size

“To what extent do you agree or disagree with the next statements: compared to paper invoicing, in my company e-invoicing causes...”

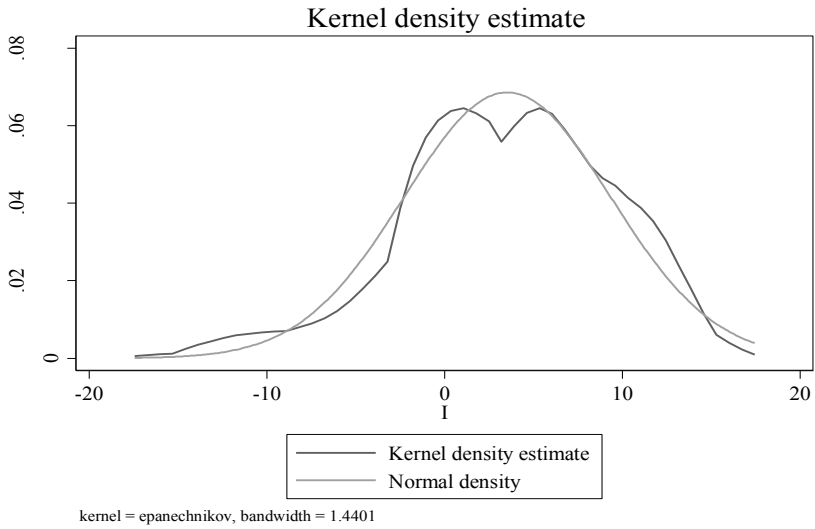
		Sole proprietorship (0 employees)	Small (1-50 employees)	Medium (51-250 employees)	Large (>250 employees)
higher IT-costs	Totally disagree	6.3%	5.2%	4.2%	1.1%
	Rather disagree	8.3%	10.0%	8.4%	5.7%
	Agree nor disagree	29.6%	32.8%	29.6%	29.7%
	Rather agree	23.8%	23.7%	25.4%	32.8%
	Totally agree	16.2%	15.8%	18.9%	19.0%
	No opinion	15.8%	12.4%	13.5%	11.7%
a limitation of errors	Totally disagree	9.7%	5.1%	5.0%	3.4%
	Rather disagree	13.6%	14.0%	14.5%	10.5%
	Agree nor disagree	31.4%	33.4%	26.8%	21.9%
	Rather agree	24.5%	22.4%	19.6%	36.1%
	Totally agree	7.0%	14.7%	19.9%	17.4%
	No opinion	13.8%	10.4%	14.2%	10.8%
reduced printing costs	Totally disagree	5.5%	3.4%	5.1%	1.6%
	Rather disagree	7.5%	6.6%	2.0%	3.9%
	Agree nor disagree	13.2%	18.9%	16.8%	10.2%
	Rather agree	25.0%	24.4%	21.7%	29.0%
	Totally agree	39.8%	36.4%	41.3%	47.3%
	No opinion	9.0%	10.4%	13.1%	7.9%
more safety	Totally disagree	8.8%	5.9%	4.1%	4.0%
	Rather disagree	16.0%	11.8%	13.2%	6.4%
	Agree nor disagree	32.7%	37.2%	25.8%	25.2%
	Rather agree	20.1%	20.6%	23.7%	33.4%
	Totally agree	9.7%	12.8%	18.8%	22.0%
	No opinion	12.8%	11.8%	14.5%	8.9%
a better control of my processes	Totally disagree	9.5%	3.7%	5.0%	2.7%
	Rather disagree	11.5%	12.3%	10.6%	2.5%
	Agree nor disagree	25.6%	29.5%	22.4%	20.6%
	Rather agree	24.2%	26.1%	32.1%	32.5%
	Totally agree	18.4%	17.8%	20.6%	30.5%
	No opinion	10.8%	10.6%	9.4%	11.2%

(...continued)

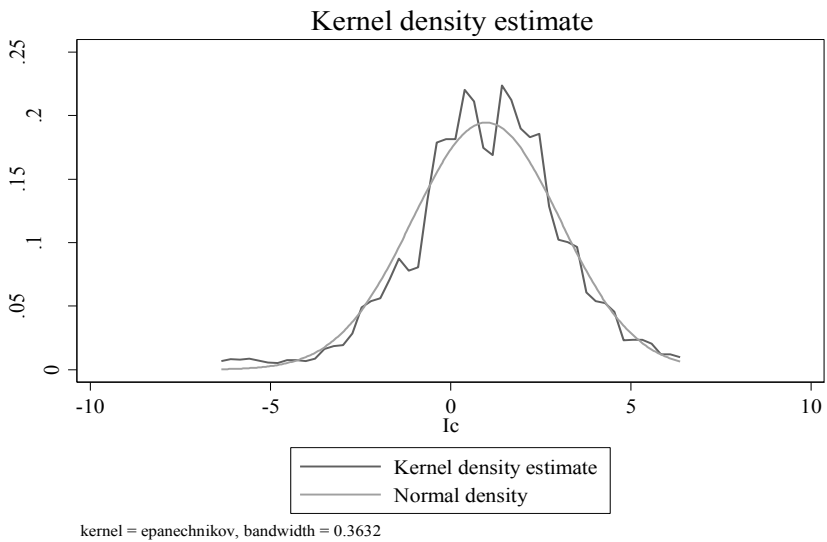
		Sole proprietorship (0 employees)	Small (1-50 employees)	Medium (51-250 employees)	Large (>250 employees)
timesaving	Totally disagree	6.7%	2.9%	6.0%	2.4%
	Rather disagree	8.8%	9.5%	6.4%	3.8%
	Agree nor disagree	29.6%	29.6%	18.7%	13.9%
	Rather agree	22.9%	23.8%	37.7%	39.0%
	Totally agree	21.2%	23.3%	19.8%	33.1%
	No opinion	10.8%	10.8%	11.4%	7.7%
less administrative burdens	Totally disagree	8.5%	5.7%	3.7%	2.8%
	Rather disagree	7.7%	11.3%	12.5%	9.6%
	Agree nor disagree	31.3%	27.7%	22.8%	22.6%
	Rather agree	24.2%	28.8%	30.2%	32.5%
	Totally agree	13.5%	15.6%	18.2%	22.9%
	No opinion	14.7%	10.9%	12.7%	9.7%
more efficient storage	Totally disagree	6.5%	4.8%	4.0%	2.3%
	Rather disagree	7.1%	7.2%	2.6%	4.6%
	Agree nor disagree	24.3%	25.6%	18.2%	12.2%
	Rather agree	26.3%	26.4%	35.1%	30.5%
	Totally agree	21.8%	23.9%	26.9%	43.0%
	No opinion	14.0%	12.2%	13.2%	7.4%

II. E-invoicing indexes: kernel density estimates

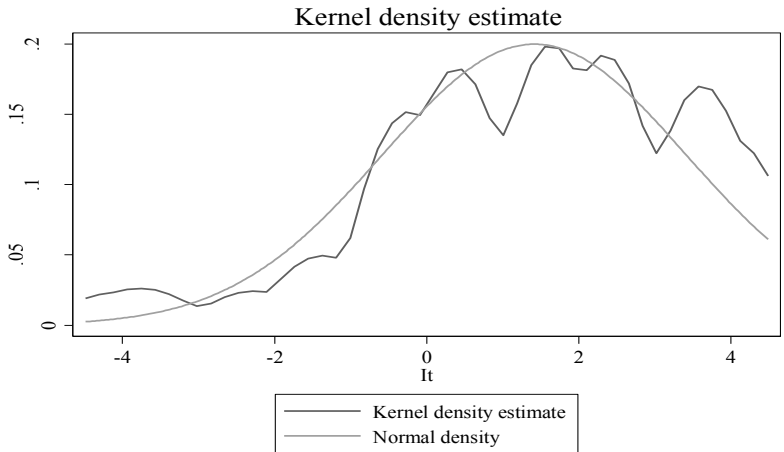
Index I



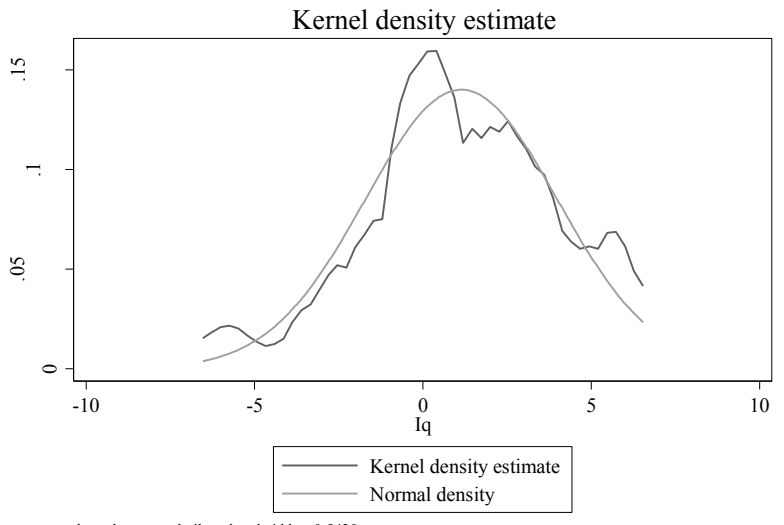
Index I_{cost}



Index I_{time}

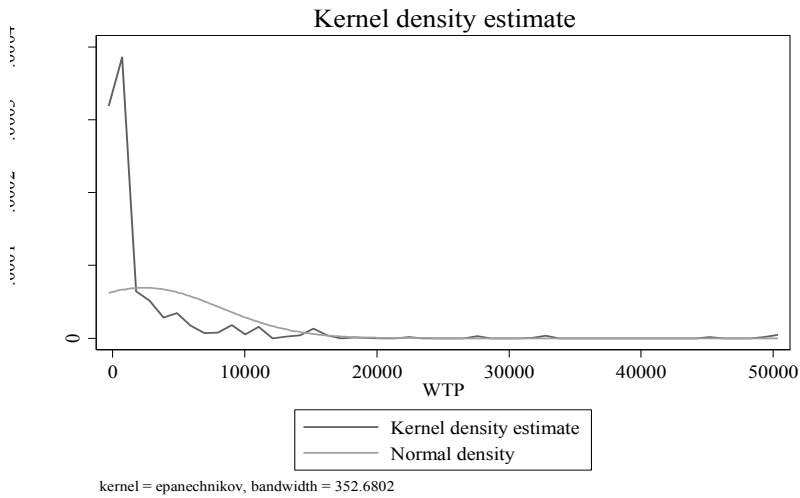


Index I_{risk}

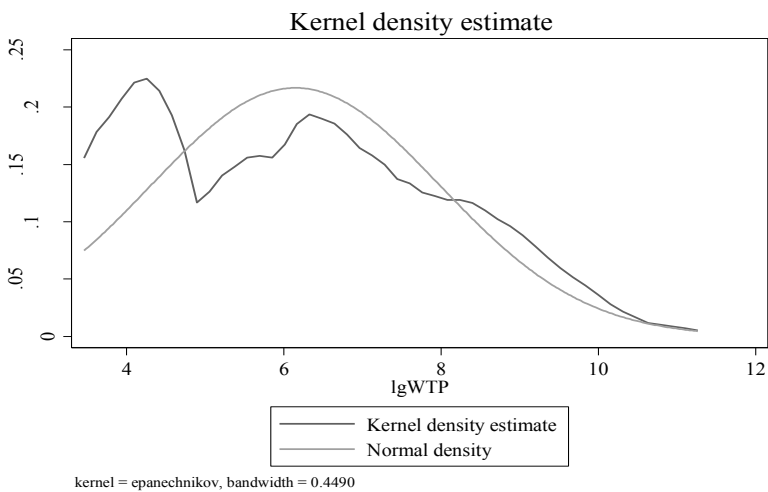


III. E-invoicing WTP and Log WTP: kernel density estimates

WTP



Log WTP



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