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Cashless payments and tax evasion☆

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ABSTRACT

Cashless payments hinder tax evasion because they build a trail for the underlying transactions. Using European data, we find empirical evidence supporting this claim: credit and debit card payments are negatively related to VAT evasion. We also find that using electronic cards to withdraw cash at ATMs, by making cash more abundant, fosters VAT evasion.

1. Introduction

While information technologies and financial markets innovations have increased the predominance of electronic payment systems, they have not been able to make cash disappear altogether. In fact cash use remains heavy, although to differing extents across countries (Drehmann et al. 2002, Bagnall et al., 2014). In this work we show that such differences in cash use are associated with different levels of VAT evasion.

The general idea is that cash settlement of a transaction greatly facilitates tax evasion by allowing the seller to easily conceal the transaction history. Any other payment method, by being traceable, makes evasion more complicated.

To check if there is empirical support for this claim, we construct a panel dataset that matches data on VAT evasion in Europe with the Payment Statistics from the European Central Bank. The empirical challenge is that the choice of payment method is endogenous to tax evasion. For instance, the seller might offer a price discount to the buyer in exchange for paying cash, making cash payments more frequent if tax evasion is widespread. To address this problem, we consider two exogenous instruments, the number of automated teller machines (ATMs) per capita and the number of broadband internet connections per capita. The availability of ATMs affects the cost of cash payments and, therefore, their frequency, but is exogenous to tax evasion because their diffusion is mostly the result of their decreased operative costs (Humphrey et al., 2006). The availability of broadband internet connections affects the diffusion of e-commerce and, therefore, the frequency of electronic payments, but depends on the exogenously determined investments of internet providers.

We find a negative relationship between VAT evasion and payments with debit and credit cards: electronic payments do make VAT evasion more difficult. However we also find a positive relationship between VAT evasion and cash withdrawals at ATMs. In other words, if credit and debit cards are used to withdraw cash, rather than to pay directly, there will be more cash payments and, therefore, more evasion.

The policy implication of our results is that fostering the use of cashless payments might help fight tax evasion. One possibility entails subsidizing credit and debit card use, realized, for instance, via rebates based on the volume of transactions. Importantly,

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since the use of payment cards to withdraw money at ATMs is actually associated with more tax evasion, subsidizing the mere possession of payment cards would not be effective at fighting evasion. Another possibility would be to subsidize investments in broadband infrastructure, thereby promoting e-commerce and, consequently, the use electronic payments.

Although we use estimates of the overall amount of VAT evasion, we do not attempt to fully explain it. Instead, we have a much less ambitious goal, focusing on VAT evasion arising from final sales to consumers, characterized by the frequent use of cash payments. Carousel (or missing trader) frauds-with several professional wholesalers involved in circular, cross border, buy and sell operations- are clearly responsible for a large proportion of VAT evasion but, since they are mostly unrelated to cash payments, we do not account for them. Similarly, electronic ordering systems are also prone to VAT frauds but, again, we do not consider them.

Our analysis highlights a rather unexplored determinant of evasion, namely the diffusion of cash payments[1] and contributes to two separate strands of the economic literature, that on cash use and on VAT evasion. To our knowledge, our paper is the first to show a robust empirical relationship between cash use and tax evasion.

Concerning the first strand, Drehman et al. (2002) and Bagnall et al. (2014) analyze cash use in several countries, showing that it is widespread, especially for low-value transactions, although systematic differences between countries persist. Amromin and Chakravorti (2009) find a decreasing demand for small denomination currency as debit card use increases. Alvarez and Lippi (2009) and Lippi and Secchi (2009) study the relationship between money demand and innovations in money withdrawal technologies. Evans et al. (2013) document an increased cash use in European countries from 2000 to 2012. Rogoff (1998) and Rogoff (2014) shows that the cash circulating in OECD countries is far in excess of what would be necessary to make the legal economy work, and that most of it is held in large denomination bills. Fisher et al. (2004) estimate that the (legal) transaction demand for euros is equal to roughly 30% of total euros in circulation.

Concerning VAT evasion, Agha and Haughton (1996) find, in a cross-section of 17 OECD countries, a higher VAT non-compliance in countries with higher VAT rates. Fedeli and Forte (1999) show that VAT evasion is bigger at lower level of the distribution chain. Berhan and Jenkins (2005) study a refund system conditional on receipts implemented in Northern Cyprus and Bolivia to fight VAT evasion, finding that it is extremely costly. Aizenman and Jinjarak (2008) regress VAT Revenue Ratios (the ratio of actual VAT revenue to the revenue that would be raised if VAT were collected at the standard rate on all consumption with perfect enforcement) on economic and political variables, finding, that they are positively associated with the country's openness to trade, which reflects the importance of border controls for VAT enforcement.

The rest of the paper is organized as follows. The next section summarizes the conceptual framework. In Section 3 we present the data. Section 5 describes the empirical model, presents our empirical results and discusses their robustness. Section 6 concludes.

2. Conceptual framework

We focus on transactions between a seller and a final consumer. An individual who purchases a good or service has at least four major ways to transfer money to the seller: using cash, using a credit or debit card, with a cheque or with a wire transfer. We focus here on the first two instruments, cash and payment cards, because they are the most widely used. They are also related, since they both require the possession of a payment card. A payment card can be either used to pay for a good (direct use), or to withdraw cash which will then be used to pay for a good (indirect use). These two different ways to use payment cards have actually a very important difference: direct transactions can be monitored, while cash is anonymous and very difficult to track, easing tax evasion.

In order to gain intuition on the empirical strategy that we will develop in the next sections, we shortly summarize the basic logic developed by Immordino and Russo (2017), which provides a useful reference model for our core hypothesis. They study an economy composed of price-taking, risk-neutral, sellers, risk neutral buyers and the government. Buyers are heterogeneous with respect to the cost of managing cashless payments and with respect to tax morale (Gordon, 1989; Myles and Naylor, 1996; Orviska and Hudson, 2003; Traxler, 2010; Lago-Penas and Lago-Penas, 2010; Hug and Spörri, 2011; Filippin et al., 2013) while sellers only differ with respect to tax morale. The crucial assumption is that tax evasion is possible only if there is no evidence of transactions, therefore only in case of a cash payment without a receipt. In such a setting, buyers and sellers will bargain over a price discount in exchange for a cash payment without receipt. If they don't reach a deal, there is no tax evasion and the buyer is free to choose between cash or non-cash payment. If they reach a deal, there is cooperative tax evasion and a cash payment is made (see Immordino and Russo, 2017 for a formal treatment[2]). Therefore:

Prediction 1. We expect a negative relationship between the direct use of payment cards and VAT evasion and a positive relationship in the case of indirect use (to withdraw cash).

According to the Baumol-Tobin Theorem (1952 and 1956), which is the most widely used model of money demand, the number of ATMs is negatively correlated with cash payments. The rationale is that the number of ATMs affects the cost of using cash (more ATMs imply that it is easier to get cash) relative to cashless payments. As such:

Prediction 2. We expect a negative relationship between the direct use of payment cards and the prevalence of ATMs.

Finally broadband internet connections significantly ease e-commerce and electronic payments. Assuming that traditional shopping and e-commerce are negatively correlated, more broadband connections should imply less cash being needed for transactions. Therefore:

[1] Surveys of the literature on tax evasion include Cowell (1990), Andreoni et al. (1998), Slemrod and Yitzhaki (2002), Marchese (2004), Slemrod (2007) and Franzoni (2009).

[2] Other related theoretical studies on cooperative tax evasion include Gordon (1990), Boadway et al. (2002), Chang and Lai (2004) and Piolatto (2015).

Table 1
Summary statistics.

	Mean	Std	Median	Qrt1	Qrt3	Min	Max
Gap	17.1	10.8	13	10	24	1	49
Transnum	58.4	52.8	43.8	16.1	88.6	0.1	230
Transvalue	2.1	2.2	1.1	0.4	3.7	0.1	8.5
Withnum	22.8	11.4	21.1	13.1	31.4	1.4	47.8
Withvalue	1.9	1.1	1.7	1.2	2.8	0.1	5.1
Vatrate	20.1	2.6	20	19	22	15	27

Notes: Gap is that measure of VAT tax evasion from the CASE/CPB report divided by the VAT liability VTTL. Transnum is the total number of credit and debit card transactions per capita from the ECB payment statistics. Transval is the value of credit and debit card transactions per capita from the ECB payment statistics. Withnum is the number of cash withdrawals from ATMs per capita from the ECB payment statistics. Withval is the value of cash withdrawals from ATMs per capita from the ECB payment statistics. Vatrate is the regular value added tax rate.

Prediction 3. We expect a positive relationship between broadband connections and the direct use of payment cards.

3. Data and summary statistics

We construct a panel merging the European Central Bank payment statistics with the VAT gap estimates from the recent CASE and CPB report (2014).[3] We have data for 25 European countries from 2000 to 2012.

The VAT gap is defined as the difference between the theoretical VAT liability (VTTL), which depends on the GDP and on the VAT rate, and the actual VAT revenue collected (VATR). The actual computation of each of the components of the VAT gap is however quite involved, since it must take into account, among other things, VAT exemptions, different VAT rates on different goods, and international trade. Details on the country specific computations are available in the recent CASE and CPB report (2014).

We consider two indicators of the direct use of payment cards for purchases of goods and services (from the ECB), namely the total number and the total value of credit and debit card transactions per capita per year. We also consider two indicators of the use of payment cards to withdraw cash (from the ECB), namely the number and value of ATM withdrawals per capita per year. Table 1 reports the summary statistics for these variables, together with the summary statistics of VAT evasion and of the VAT rate.

The average level of VAT evasion, as a percentage of the theoretical VAT liability VTTL, is 17.1%, with a standard deviation of 10.8%, demonstrating significant variability across country-years. The median is actually 13%, considerably lower than the average, which is lifted by a few countries with very high levels of tax evasion in excess of 30%. The average number of credit and debit card transactions per capita per year is 58.4. In other words, there are, on average, 58.4 direct purchases of goods and services settled with payment cards per individual each year, or roughly 4.9 transactions per month. The standard deviation is 52.8, stressing a considerable variability in payment habits across country-years. In value terms, the average is 2.2 thousand euros per capita per year, or roughly 184 euros per month per person of direct credit and debit card purchases. To give a sense of this number, average GDP per capita is approximately 19 thousand euros per year across our sample. Considering that the consumption component of GDP is, on average, 75%, total consumption expenditure per person is roughly 14 thousand euros per year. Therefore card use represents, on average, 16% of total consumption expenditure.

There was a marked increase in the use of electronic payments in most countries in the sample. Just to give a couple of examples, the number of credit and debit card transactions per capita in Belgium increased from 43 in 2000 to 110 in 2012, with a value that increased from 1900 euros to 3880 euros per capita per year (adjusted for inflation); in Germany, over the same period, transactions per capita increased from 67 to 165, with a value that doubled from 1000 to slightly more than 2000 euros (adjusted for inflation).

The average number of cash withdrawals from ATMs in our sample is 22.8 per capita per year, or 1.9 per month. With a standard deviation of 11.8, there is less variability in withdrawal habits as compared to direct credit and debit card payments. In value terms, the withdrawals per capita average 1.9 thousand euros per year, or 160 euros per month The time series behavior of cash withdrawals from ATM is very heterogeneous, both in terms of volumes and in terms of number of transactions. In Finland, Sweden and in the Netherlands, among others, it decreased significantly; in Ireland and in Spain it first increased and then decreased, in the UK and in Italy, among others, it increased.

4. Empirical analysis

We run the following regressions:

$$vatgap_{it} = \beta_0 + \beta_1 pay_{it} + X'_{it}\gamma + \eta_i + \delta t + \varepsilon_{it} \tag{1}$$

where $vatgap_{it}$ is the measure of VAT evasion, pay_{it} is the use of payment cards and X_{it} is a vector of control variables. All regression include fixed country effects η_i and a time trend δt. ε_{it} is a well-behaved error term. We consider four main indicators of payment card use: the number of card transactions per capita; the volume of card transactions per capita; the number of cash

[3] CASE is the Center for Social and Economic Research, CPB is the Netherland Bureau for Economic Policy Analysis. This study was commissioned by the European Commission to quantify the extent of VAT evasion in Europe and carried out by a consortium led by the CPB.

Table 2
Explaining cashless payments.

	Transnum	Transvalue	Withnum	Withval
Broad	1.1810***	0.0382***	−0.1933**	−0.0255**
	(0.4222)	(0.0148)	(0.0951)	(0.0105)
Atm	−0.0918***	−0.0016***	0.0267***	0.0017***
	(0.0244)	(0.0005)	(0.0037)	(0.0003)
Vatrate	0.6324	−0.0362	−0.1673	−0.0551*
	(1.4155)	(0.0341)	(0.3087)	(0.0278)
Unemp	−0.0231	−0.0047	0.0141	−0.0009
	(0.6704)	(0.0154)	(0.1179)	(0.0087)
R^2	0.758	0.748	0.469	0.316
obs	305	276	287	287
countries	25	23	24	24
F	9.9	7.1	38.3	30.8

Notes: Transnum is the total number of credit and debit card transactions per capita from the ECB payment statistics. Transval is the value of credit and debit card transactions per capita from the ECB payment statistics. Withnum is the number of cash withdrawals from ATMs per capita from the ECB payment statistics. Withval is the value of cash withdrawals from ATMs per capita from the ECB payment statistics. Unemp is the unemployment rate from the IFS (International Financial Statistics) online dataset. GDPPC is the GDP per capita at purchasing power parity from the World Bank Development Indicators (WBDI). Broad is the number of broadband internet connections per capita from the WBDI dataset. Atm is the number of ATMs per 1000 inhabitants from the ECB payment statistics. All regression include gdp per capita (nominal), inflation, fixed country effects and a time trend. Robust standard errors clustered at the country level in brackets. F is the F-stat for joint significance of the regressors. *** significant at the 1% level. **significant at the 5% level * significant at the 10% level.

withdrawals from ATMs per capita; the volume of cash withdrawals from ATMs per capita. The control variables are: the VAT rate (from the OECD database), since the gains from tax evasion increase with the VAT rate, which should therefore predict more evasion; the unemployment rate (from the World Bank Development Indicators), to proxy for the business cycle; the nominal GDP per capita (from the World Bank Development Indicators), to control for time varying, cross-country differences in payment habits that depend on the stage of development and on the evolution of income; inflation (from the World Bank Development Indicators), since we have nominal variables in the regressions.

4.1. Instruments

The problem with the above regression is that the choice of payment method is endogenous to tax evasion. For instance, the seller might offer a price discount to the buyer in exchange for paying cash, which facilitates tax evasion. Therefore we should observe more cash payments where this form of collaborative tax evasion is more widespread (see Immordino and Russo, 2017). To overcome this endogeneity, we use an instrumental variables strategy. We need a variable with two requirements: it must affect the use of payment cards without itself being determined by tax evasion and it must affect VAT evasion only through its effect on payment card use. We consider two such instruments, the number of ATMs per capita and the number of broadband internet connections per capita.

As documented by Humphrey et al. (2006) the rapid expansion of ATMs in Europe indicates that, for services such as cash withdrawals, account transfers and balance inquiries, ATMs have replaced the traditional bank teller for a large and growing fraction of depositors. The rationale for using the number of ATMs as an instrument is that they influence the cost of using cash to settle a transaction relative to a cashless payment. In particular, we should observe less (more) direct card transactions where there are more (less) ATMs because it is easier (more difficult) to get cash. Humphrey et al. (2006) also explain that: "As the share of electronic payments in 12 European countries rose from 0.43 in 1987 to 0.79 in 1999 and ATMs expanded, [...] bank operating costs are $32 billion lower than they otherwise might have been, saving 0.38% of the 12 nations GDP." In other words, ATMs are a powerful cost-reducing tool for banks, which means that their adoption and diffusion is mainly due to the development of technology that reduces their installation and management costs. Therefore we exclude the possibility that the diffusion of ATMs is a response to tax evasion. For identification, we also need to exclude a direct effect of ATM availability on VAT evasion other than the one going through the cost of cash withdrawals. We were unable to think of such an effect.

As already said, the rationale for using the diffusion of broadband internet connections as an instrument is that they facilitate e-commerce, which works via electronic payments, so that more (less) broadband connections should predict a more (less) widespread direct use of payment cards for transactions. Since there should be more e-commerce if broadband internet connections are more diffused, there should also be less traditional shopping and, therefore, less need to have cash for transactions. Moreover, a bigger number of broadband connections is also sign of a greater familiarity with digital technologies and, thus, it should be correlated with the use of electronic payments. Exogeneity is reasonable since broadband connections mostly depend on the availability of the infrastructure in a given area, which is not plausibly the result of tax evasion. Even conditioning on infrastructure availability, the decision to connect to the internet does not depend exclusively on the wish to buy goods online, since there are a lot of additional benefits from a fast connection. Indeed, the key for identification is that we are not using data on the diffusion of e-commerce, which might be endogenous to tax evasion. To illustrate this point, we refer again to the collaborative tax evasion model (Immordino and Russo, 2017). In a nutshell, a traditional shop owner might offer a discount to a customer in exchange for a cash transaction, in order to evade with more ease. This discount might actually decrease the price below the on-line price, affecting the volume of on-line purchases. Thus, other things equal, if there is a lot of tax evasion, there might be fewer e-shopping transactions because there are more possibilities to buy the same goods for less in traditional shops.

For identification, we also need to exclude any direct effect of changes in broadband internet connections on tax evasion. This holds if broadband internet connections do not directly allow for a superior or inferior technology to evade taxes or to monitor evaders. Concerning evasion, if there is more e-commerce, fostered by broadband internet connections, it will be more difficult to evade, since e-commerce transactions are difficult to hide. However, the reason why e-commerce transactions are difficult to hide is mostly because they are settled with cashless payments, so the effect goes through the endogenous variable in the regression. As for enforcement, there is no particular reason why the internet should allow for easier monitoring of sellers. Online shops are not, a priori, more or less visible than traditional shops. Furthermore, in the case of VAT evasion, monitoring revolves around missing receipts, and the methods used to demonstrate their absence will not be affected by the availability of a fast internet connection. One possibility is that the diffusion of the internet can signal the availability of more opportunities to transfer profits across national borders, in search of the most convenient tax system. In other words, there might be a direct effect of internet diffusion on tax evasion. However, whilst this would present a problem if we considered income tax evasion, it does not in the case of value-added taxes, which cannot be easily avoided by moving the registered office.

We now turn to the empirical analysis. Table 2 reports the first-stage regression results for the main endogenous variables: the number and value of card transactions per capita and the number and value of cash withdrawals from ATMs per capita. All regressions include fixed country effects and a time trend and control for unemployment, the statutory VAT rate, GDP per capita and inflation.

The instruments are statistically significant determinants of all indicators of payment card use. The signs of the regression coefficients are in line with the intuition. In particular, more broadband connections are associated with a more frequent card use, with a bigger overall value of payment card transactions, a smaller number of ATM withdrawals and a smaller value of ATM withdrawals. Conversely, a bigger number of ATMs predicts a lower number and a lower value of card transactions, and a bigger number and value of ATM withdrawals. Since both instruments are significant, we can also meaningfully test for overidentifying restrictions in all regression specifications.

Table 3
Card transactions, cash withdrawals and VAT evasion. Vat gap over VTTL.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Transnum	−0.0347*	−0.0749**						
	(0.0188)	(0.0342)						
Transval			−0.7596	−4.8115***				
			(0.9736)	(2.4113)				
Withnum					0.2068***	0.2123**		
					(0.0717)	(0.0952)		
Withval							2.6753***	3.9201***
							(0.8216)	1.4808
Vatrate	0.7025	0.6607	0.8359*	0.6304	0.6869	0.6854	0.8203*	0.8554*
	(0.4799)	(0.5031)	(0.5017)	(0.5499)	(0.4468)	(0.4411)	(0.4920)	(0.4755)
Unemp	0.4861***	0.5253***	0.4603**	0.5339***	0.5313***	0.5327***	0.5479***	0.5813***
	(0.1808)	(0.1896)	(0.2022)	(0.2031)	(0.1979)	(0.1969)	(0.1801)	(0.1873)
R^2	0.251	0.233	0.226	0.141	0.279	0.279	0.288	0.281
obs	305	305	276	276	287	287	287	287
countries	25	25	23	23	24	24	24	24
instruments		Broad,Atm		Broad, Atm		Broad, Atm		Broad, Atm
F		9.9		7.1		38.3		30.8
J (p-value)		0.24		0.44		0.15		0.28

Notes: Dependent variable is the vat gap measure of tax evasion from the CASE/CPB report divided by the vat liability VTTL. Transnum is the total number of credit and debit card transactions per capita from the ECB payment statistics. Transval is the value of credit and debit card transactions per capita from the ECB payment statistics. Withnum is the number of cash withdrawal per capita from the ECB payment statistics. Withval is the value of cash withdrawal per capita from the ECB payment statistics. Vatrate is the regular value added tax rate. Unemp is the unemployment rate from the IFS (International Financial Statistics) online dataset. The instruments used for estimation are: Broad, the number of broadband internet connections per 100 residents from the World Bank Development Indicators; Atm, the number of ATMs per 1000 residents from the ECB payment statistics. All regression include gdp per capita (nominal), inflation, fixed country effects and a time trend. Robust standard errors clustered at the country level in brackets. F is the first stage F-stat for instrument validity in the first stage regression. J is the p-value of the Hansen test of overidentifying restrictions. *** significant at the 1% level. **significant at the 5% level * significant at the 10% level.

Table 4
Card transactions, cash withdrawals and VAT evasion. Year dummies.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Transnum	−0.0357*	−0.0726*						
	(0.0191)	(0.0399)						
Transval			−0.4605	−3.4011*				
			(0.9484)	(2.1202)				
Withnum					0.2728***	0.2482**		
					(0.0987)	(0.1288)		
Withval							3.1773***	3.6821**
							(0.8846)	1.6505
Vatrate	0.5747	0.5371	0.6096	0.4741	0.4653	0.4762	0.6618	0.6738*
	(0.4844)	(0.4881)	(0.5296)	(0.5279)	(0.4198)	(0.4174)	(0.4804)	(0.4475)
Unemp	0.3847*	0.4171**	0.3557	0.4091*	0.4494**	0.447**	0.4784**	0.4913***
	(0.2066)	(0.2051)	(0.2348)	(0.2255)	(0.2092)	(0.1967)	(0.1913)	(0.1868)
R^2	0.361	0.346	0.328	0.286	0.414	0.413	0.421	0.419
obs	305	305	276	276	287	287	287	287
countries	25	25	23	23	24	24	24	24
instruments		Broad,Atm		Broad, Atm		Broad, Atm		Broad, Atm
F		9.5		7.5		33.4		35.2
J (p-value)		0.85		0.92		0.56		0.82

Notes: Dependent variable is the vat gap measure of tax evasion from the CASE/CPB report divided by the vat liability VTTL. Transnum is the total number of credit and debit card transactions per capita from the ECB payment statistics. Transval is the value of credit and debit card transactions per capita from the ECB payment statistics. Withnum is the number of cash withdrawal per capita from the ECB payment statistics. Withval is the value of cash withdrawal per capita from the ECB payment statistics. Vatrate is the regular value added tax rate. Unemp is the unemployment rate from the IFS (International Financial Statistics) online dataset. The instruments used for estimation are: Broad, the number of broadband internet connections per 100 residents from the World Bank Development Indicators; Atm, the number of ATMs per 1000 residents from the ECB payment statistics. All regression include gdp per capita (nominal), inflation, fixed country effects and year dummies. Robust standard errors clustered at the country level in brackets. F is the first stage F-stat for instrument validity in the first stage regression. J is the p-value of the Hansen test of overidentifying restrictions. *** significant at the 1% level. **significant at the 5% level * significant at the 10% level.

4.2. Explaining the VAT gap

Table 3 reports the baseline IV regression results for the Vat gap over VTTL measure of evasion, together with the OLS results for reference. Overall, we find support for our main conclusion, namely that cash facilitates tax evasion, while card payments hinder it.

More specifically, we find a negative and significant coefficient on the number of payment card transactions per capita. According to the regression coefficients, 10 more card transactions per capita per year are associated with a 0.69 percentage points smaller VAT gap over VTTL. This means that, in a country like Italy, with an average VAT gap to VTTL ratio of 26%, it is possible to halve VAT evasion with 16 more card transactions per capita per month; a considerable effort, given that the average number of card transaction per capita in Italy in 2012 was 26 per year. Similarly, we find a negative coefficient for the value of direct payment card transactions per capita equal to -4.8. In other words, 200 more euros per capita per year in credit and debit card transactions are associated with a 1 percentage point reduction in the VAT over VTTL. For instance, halving the VAT gap in Italy would require roughly 200 more euros per capita per month in card transactions. Considering that the median card transaction value per month in Italy in 2012 was 78 euros, this would mean increasing 2.5 times. Importantly, we do not reject the overidentifying restrictions (Hansen J statistic) in both empirical models, which confirms the validity of our empirical identification strategy. Moreover, the IV results are different from the OLS confirming the endogeneity of payment habits.

We also find a positive statistical relationship between cash withdrawals and tax evasion, both when we consider their number and their value. If credit and debit cards are used to withdraw cash, rather than to pay directly, there is actually an incentive effect on tax evasion, because cash is more abundant. More specifically, 10 more ATM withdrawals per capita per year are associated with a VAT gap over VTTl 2 percentage points larger. Similarly, 1 thousand euros more in cash withdrawals per capita per year is associated with a VAT gap over VTTL 3.9 percentage points larger.

The coefficient on the VAT rate is positive, in line with Agha and Haughton (1996), but significant only in few regression specifications. The problem with the interpretation of this coefficient, however, is that the VAT rate can be itself endogenous to the VAT gap, along the lines of a Laffer curve type of argument for instance. Moreover, the VAT rate is used in the computation of the VAT gap, the dependent variable of our regression. The coefficient on unemployment, instead, is positive and significant in all regression specifications. Thus VAT evasion tends to increase in recessions when unemployment is high, in line with the evidence discussed in the CASE and CPB report (2014).

Table 5
Card transactions, cash withdrawals and VAT Evasion-vat gap over GDP.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Transnum	−0.0048**	−0.0087***						
	(0.0021)	(0.0033)						
Transval			−0.1651*	−0.7169**				
			(0.0928)	(0.3177)				
Withnum					0.0238***	0.0223**		
					(0.0086)	(0.0117)		
Withval							0.3238***	0.4676***
							(0.0918)	0.1925
Vatrate	0.1779**	0.1739***	0.1966***	0.1686***	0.1758**	0.1762*	0.1916***	0.1956***
	(0.0692)	(0.0677)	(0.0725)	(0.0695)	(0.0686)	(0.0661)	(0.0728)	(0.0718)
Unemp	0.0296*	0.0334*	0.0282	0.0382*	0.0339*	0.0335*	0.0362**	0.0401**
	(0.0171)	(0.0187)	(0.0191)	(0.0212)	(0.0195)	(0.0187)	(0.0177)	(0.0185)
R^2	0.378	0.366	0.373	0.258	0.395	0.395	0.407	0.401
obs	305	305	276	276	287	287	287	287
countries	25	25	23	23	24	24	24	24
instruments		Broad,Atm		Broad, Atm		Broad, Atm		Broad, Atm
F		9.9		7.1		38.3		30.8
J (p-value)		0.09		0.32		0.05		0.06

Notes: Dependent variable is the vat gap measure of tax evasion from the CASE/CPB report divided by nominal gdp. Transnum is the total number of credit and debit card transactions per capita from the ECB payment statistics. Transval is the value of credit and debit card transactions per capita from the ECB payment statistics. Withnum is the number of cash withdrawal per capita from the ECB payment statistics. Withval is the value of cash withdrawal per capita from the ECB payment statistics. Vatrate is the regular value added tax rate. Unemp is the unemployment rate from the IFS (International Financial Statistics) online dataset. The instruments used for estimation are: Broad, the number of broadband internet connections per 100 residents from the World Bank Development Indicators; Atm, the number of ATMs per 1000 residents from the ECB payment statistics. All regression include gdp per capita (nominal), inflation, fixed country effects and a time trend. Robust standard errors clustered at the country level in brackets. F is the first stage F-stat for instrument validity in the first stage regression. J is the p-value of the Hansen test of overidentifying restrictions. *** significant at the 1% level. **significant at the 5% level * significant at the 10% level.

4.3. Robustness

We tried including several additional control variables in the baseline specification. First, since the VAT on imported goods is typically assessed at the border, and tax evasion is consequently more difficult for imports, we included the ratio of imports to GDP (from the WBDI) in the regression. The main results remain robust, and the coefficient on imports to GDP is negative, as expected, in line with Aizenman and Jinjirak (2008). Second, we included the fraction of the population between 20 and 30 years old and the fraction of the population older than 65 (from the Eurostat online database), because young and old individuals might have a different attitude towards evasion and towards cashless payments. We find robust results and coefficients on these additional controls that are not statistically significant. Third, the fraction of the population with tertiary education, and the rural population as a percentage of total population (both from the WBDI), were included in order to respectively account for any correlation between education and tax evasion, and the possibly different behavior of individuals living in cities. In both cases the results were robust and the coefficient not significant. Fourth, we added a dummy equal to 1 if the country is part of the European Union in the given year and a dummy equal to 1 if the country adopts the Euro in the given year. Again we found robust results. Fifth, we included a generic index of the quality of government from the QOG institute (University of Gotheborg), finding again robust results and an insignificant coefficient on the control.

To check the specification of the empirical model, we tried including time dummies instead of the time trend. Overall the results are similar, but the standard errors are, on average, larger, resulting in weaker results, as a result of the bigger number of variables to estimate in each regression. The results are summarized in Table 4. In Table 5 we report instead the results of the regressions of the VAT gap over GDP measure of tax evasion, which are indeed very similar to the baseline regression results.

To further investigate, we tried running the regressions separately for credit and debit cards. We found similar results in the regressions with debit cards. When using credit cards, however, we did not find any statistical relationship, mostly because we have separate data for credit card transactions only for a smaller subsample of countries. We did not find any statistical relationship between the number of payment cards per capita and tax evasion, highlighting the importance of the use of payment cards, rather than the mere ownership of one. The policy implication is that, to fight tax evasion, it is better to subsidize card use for actual payments, and not their mere possession.

We also considered a regression of tax evasion on a different form of cashless payment, namely on the number and value of wire transfers per capita, which includes both direct debits and money transfers. We do not find a significant statistical relationship. We finally considered cheques as an alternative, non-electronic, form of cashless payment. We again found non-significant coefficients.

5. Conclusion

Using a dataset that matches information on VAT evasion with the ECB Payment Statistics, we showed that the direct use of debit and credit cards for payments reduces VAT tax evasion. We also found evidence of a positive statistical relationship between cash withdrawals and tax evasion. Comparing these results, we conclude that cashless payment hinder tax evasion and that it is not the diffusion of payment cards that matters for VAT evasion, but their use: if they are used to withdraw cash, rather than to pay directly, they actually foster tax evasion.

The policy implication of our result is that encouraging the direct use of credit and debit cards for transactions will help curb tax evasion. There are several possible ways this might be achieved. The most obvious is to implement a subsidy for credit and debit card use, perhaps with a rebate based on transaction volume. Importantly, this subsidy must not be based on the ownership of a card; if the card is simply used to withdraw money, the subsidy will in fact foster evasion. A less obvious way to encourage cashless payments is to subsidize broadband investments in order to foster e-commerce. These policies are alternatives to better known approaches aiming at limiting cash. For instance Buiter (2009) discusses a ban on cash transactions above a given (low) threshold. Less obvious alternatives are a proportional tax on cash withdrawals (Benshalom, 2012 and Immordino and Russo, 2017) or supporting an explicit cost-based pricing of payment methods. Indeed under current banking pricing, the fees charged to consumers for cash withdrawals do not cover the full cost of cash, which is recovered through cross-subsidization (Van Hove, 2004).

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