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WHY ARE PAYMENT HABITS SO HETEROGENEOUS ACROSS AND WITHIN COUNTRIES? EVIDENCE FROM EUROPEAN COUNTRIES AND ITALIAN REGIONS

by Guerino Ardizzi* and Eleonora Iachini*

Abstract

In Italy the use of cash is still predominant; the number of cashless transactions per capita has increased over the last few years, but it is still below the European average. Moreover, the use of payment instruments is quite diversified across the Italian regions. The aim of this work is to arrive at a better understanding of the underlying reasons for the slow adoption of electronic payment instruments in Italy by comparison with the other European countries and to evaluate whether the territorial duality that characterizes the Italian economy can explain the extensive use of cash. To this end we use different models for cash, electronic payments, payment cards and e-commerce. Our findings indicate that a pivotal role in explaining Italy's lag in abandoning cash is played by development factors, such as innovative capability and income per capita. Surprisingly, although the shadow economy is important, it is not decisive in explaining the limited use of electronic retail payment instruments.

JEL Classification: E26, E41, E42.
Keywords: payment instruments, cash demand, financial inclusion, retail payments.

Summary

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1. Introduction

Electronic payment not only facilitates and speeds commercial exchanges but brings substantial cost savings for the whole society. Empirical studies have found that in the industrialized countries the social cost of the production and use of cash is still the largest component of the total cost of retail payment services. Furthermore, the substitution of electronic for cash transactions will foster transparency in exchange and shrink the so-called "shadow economy".

Nevertheless, cash payments still account for around 70 per cent of face-to-face payments in Europe, albeit with significant differences between countries. In Italy the use of electronic instruments, such as the payment cards, is limited and use of cash, at 90 per cent of all payments, is higher than the European average. Moreover, the dualism that characterizes the Italian economy is reflected in the payment habits. Electronic payment instruments are used more commonly in the northern than in the southern regions, but even the North lags behind the European average.

The differences between countries cannot be explained by divergences in payment habits alone. The diffusion of a particular instrument depends, in fact, also on the supply structure, which determines accessibility and usability, and the supply structure in turn is influenced by demand characteristics and consumers' habits.

Many studies of the determinants of payment options focus either on country-level determinants or on international comparisons. The former use only microeconomic data drawn from ad hoc surveys at national level, while the latter use aggregate data analysed only at macro level for each of the countries examined.

We analyze the diffusion of electronic payment instruments using macro data, both for the international comparison and for the intger-regional analysis within Italy. We have chosen to use aggregated data, as at present neither surveys comparable among all the countries we are interested in nor ad hoc surveys permitting the development of behavioural models for Italy are available.

The study contributes to the discussion on the diffusion of retail electronic payment instruments by answering the following questions: Why is the use of cashless payment instruments in Italy so low by international standards? Can Italy's North-South gap explain this low use?

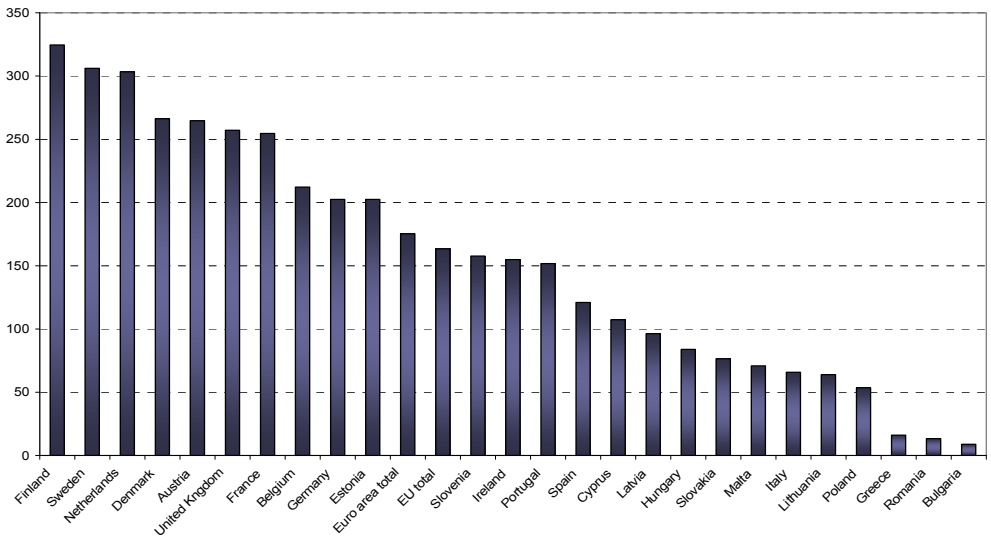
After a brief overview of the diffusion of payment instruments in some European countries (section 2), we survey the literature (section 3) and illustrate our model (section 4). Section 5 identifies the areas of differentiation among countries and then defines a series of demand equations for the different payment instruments to determine which common factors may affect payment decisions. Once these factors are identified we test the extent to which they explain the level of demand for cash or electronic instruments using uniequational multivariate models. Finally, the equations developed for the international comparison are used for territorial analysis within Italy (section 6). Section 7 concludes with some policy suggestions.

2. Reference framework

Italy lags considerably behind most European countries in the use of the electronic payment instruments, gauged by number of transactions per inhabitant (fig. 1). Even considering only the most developed parts of Italy (the Center and North), the gap with respect to the European average remains large .[2]

Figure 1

Number of transactions by electronic payment instruments per capita
(2009)



Source: Bank of Italy and ECB Blue Book.

The breakdown by payment instrument within each country reveals not only differences but also similarities in preferences (see Figure 2 and Table 1 of the Appendix). Almost everywhere the most widely used instruments are cards and credit transfers. Germany, Austria and Spain are exceptions, with an incidence of direct debits significantly higher than the EU average (14 per cent). In Denmark, Portugal, Sweden, Spain, Greece, Finland and the UK payment cards are prevalent (56 per cent on average), while the Eastern European countries are characterized by greater use of credit transfers (61 per cent). Italy is in the group of "card-based" countries, with an incidence of 37 per cent in 2009, higher than the average for the euro area and slightly lower than the average for all the EU countries (respectively 33 and 38 per cent).

The possible factors in these discrepancies are numerous: level of economic development, education, relative size of the informal economy, level and nature of entrepreneurial activity, degree of banking presence, diffusion of ATMs and POS terminals, and fragmentation of commercial distribution, among others. Understanding how they influence payment preferences can provide useful indications on the reasons why Italy, and certain regions within Italy, lag behind in cashless payment instruments.

[2] In 2009 the number of non-cash transactions per capita was 65 in Italy and 164 in the EU as a whole; in the Centre-North and in the South of Italy the figures were 76 and 46 respectively.

Figure 2

Relative importance of payment instruments: international comparison
(in percentage, year 2009)

Source: ECB Blue Book.

3. The Literature

The first theoretical models to analyze the determinants of money demand were developed in a context in which money was conceived of mainly as a means for facilitating trade in goods and identifying the connection with the general level of prices (the quantity theory of money).

The intensification of trade and the financialization of the economy led to the development of models that take individuals' reasons for holding money into account. These models brought a direct connection with income and the interest rate into the money demand function, overcoming the mechanical layout of the quantity theory, and at the same time paved the way for more micro-founded models. Two different transaction-demands functions for money supply have been defined: 1) those inspired by the Allais-Baumol-Tobin model which, given the positive relationship (but with elasticity less than one) between cash holdings and total income, is based both on the "opportunity cost" of holding non-interest bearing assets (i.e. cash) and on the trade-off between this opportunity cost and the "transaction costs" related to cash withdrawals from current accounts; 2) those inspired by Friedman's formulation, by which the demand for money depends not so much on the interest rate as on the individual's total wealth or permanent income as well as his preferences. Even though these models enrich the analysis of transaction demand for money, "they have ended up neglecting the problems connected with the circulation of money, so as to focus on those related to its possession" (Giannini 2004, p. 396).[3]

[3] As Giannini (2004) has pointed out: "until the 80s the monetary analysis has increasingly shifted its emphasis away from the role of the money as a medium of exchange to that of store of value". The overcoming of the quantity theory of money demand and the transition towards the first micro-founded models has reflected a significant conceptual

Only since the early '90s has the empirical literature devised demand equations for payment instruments, which factor in the data on purchase transactions (flows), the supply structure of the banking system and payment technologies. The development of cashless payment instruments, in fact, has made the interactions among the variables more complex and so altered the income elasticity and interest rate elasticity of demand. In response, analysts have increasingly distinguished between the demand for cash and that for other payment instruments. The diffusion of the latter, in fact, implies a reduction in the former (Boeschoten and Hebbink, 1996). In addition, empirical studies have shown that financial innovation, hence the use of electronic instruments, has reduced the interest-rate elasticity of the demand for money (Moghaddam 1997).[4] Nevertheless, the studies establishing a relationship between the demand for money and the use of alternative payment instruments are rare (Rinaldi, 2001), owing among other things to the lack of reliable data on the volumes of cash transactions. [5]

Empirical studies document the substitution effect between cash and payment cards (Duca and Whitesell, 1995; Blanchflower et al., 1998). Most of these studies report significant contractions in the demand for cash, but with some exceptions. In general, the authors ascribe the differences in substitution to differences in the development of card payment infrastructures: the greater their development, the higher the replacement rate.

Boeschoten (1992) and Humphrey et al. (1996) were among the first to develop indicators of the demand for money and for payment instruments based more on the intensity of flows than money balances (detention). Humphrey et al. (1996), using an international comparison, formalize the demand for payment instruments - measured by the number of transactions per capita – as a function of the instrument price (P), real per capita income (GDP), numbers of POSs and ATMs per capita, the use of the instrument in the previous year ("memory effect"), cash holdings in real terms (CASH), prevalence of violent crimes (CRIME) and the concentration ratio (the asset market share of the top five banks in each country, CR5). In formal terms, the demand function of each instrument *i* thus becomes:

$$I_i = f(P, GDP, POS, ATM, I_{t-1}, CASH, CRIME, CR5)$$

The dependence of demand on the price, or cost of use, and on income derives directly from the theory of money demand. However, the canonical relationships between the variables do not always obtain. Humphrey et al. (1996) point out that for most people the marginal cost of an additional transaction is close to zero, and in many countries the price of payment instruments tends to change very little over time. As to the relationship with income, a sample study by Avery et al. (1986) shows that the higher the real income, the greater is people's propensity to use electronic payment instruments. More recent studies, based on surveys designed to detect the consumers' payment habits, confirm this relationship, showing that low income levels combined with high concentration of income

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shift: the transition from the concept of the money as a "flow" –in the quantity theory, the gross amount of transactions – to the concept of the money as a "fund" or "money balance" held on the basis of a rational choice of the individual. See also Arcelli 1996, page 73 and page 419.

[4] The interest rate should capture the opportunity cost of holding money in explaining people's management of cash and other bank payment instruments. Nevertheless, high interest rates could even exert a positive influence on cash flows, as by inducing resort to alternative forms of fund-raising outside the banking channel. Several studies on the role of technological innovation in Italian households' demand for currency have argued that while the empirical results on interest-rate elasticity of money demand are partly consistent with Baumol-Tobin's theory (minus sign), better transaction technologies (ATMs, POS, internet banking, etc.) can greatly reduce or almost nullify the impact of the interest rate on the transaction demand for money (for Italy, see Ardizzi and Tresoldi, 2003; Lippi and Secchi, 2008; Alvarez and Lippi, 2009. However, we cannot rule out in advance that the interest rate on bank deposits may play some role in the relative propensities to withdraw cash and to use alternative payment instruments.

[5] Precisely because of the lack of detailed and public data on the payment choices of individual consumers the literature on consumers' behaviour and payment choices is rather limited (Schuh and Stavins, 2009).

result in low use of electronic instruments and a greater propensity to use cash (Stix, 2004; Schuh and Stavins, 2009; Jonker, 2005; Brits & Winder, 2005). But per capita GDP also captures an effect linked to both education and financial development (so-called financial literacy), as is shown in a World Bank report (2005).

The expected effect of the diffusion of ATMs on the use of electronic instruments is ambiguous, in that it may lead on the one hand to a reduction in cash provisions but on the other to an increase in the velocity of circulation. The effect of POS terminals is positive, even though the rise of the electronic payment transactions is conditioned by individuals' payment habits and willingness to change. The degree of banking concentration should be positively correlated with the spread of cashless instruments. Regarding the illicit or illegal activities, the expected sign may be ambiguous: on the one hand, the underground criminal economy implies irregular anonymous exchanges that increase the use of cash, but on the other some illegal or illicit activities may involve the banking channel for money laundering. Banking concentration favours the development of a network for centralized management of payments, in which all operators participate.

The discussion on why people prefer one instrument to another was enriched in the '90s, thanks mostly to studies conducted in Europe by Norway, Finland and the Netherlands and in the U.S. by the Federal Reserve.[6] These studies explain differing propensities for the use of different payment instruments with reference to three sets of factors: socio-demographic, technological, and transaction-related (type and size).[7] Perceived security is another of the factors affecting choice of payment instrument (Berndsen and Buitenkamp, 2009; Commission, 2004).[8] Sullivan (2010) finds that the differences between levels of fraud in different countries depend on many factors, including: technology, safety standards, laws and regulations establishing liability for the unauthorized payments, the structure of the payments industry, and consumers' preferences.

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[6] Bolt (2006).

[7] Mantel (2000) and Stavins (2001) focus on the first set of factors, and find that in the United States demographic features and personal preferences influence choices. Boeschoten (1998), starting with a panel survey of the payment habits of Dutch people for the period 1990-1994, proves that the transaction amount is extremely important. Hayashi and Klee (2003) find not only that the propensity to use electronic instruments is closely linked to the utilization of new technologies by the consumers of the United States, but also that the selection of the instrument depends on the features of the transaction (value and payment modalities offered by the merchant, presence or lack of a cashier). More recent studies build on these works to better evaluate the influence of the features of the transaction, which now include both the value and the type of the item purchased, the type of shop, the link modalities (distance-selling, face-to-face, etc.) and supply-side constraints (e.g. limited choice of accepted instruments). Bonnie and François (2006) use an ad hoc survey of a representative sample of French consumers to show that the features of the transaction have a strong impact on the choice of instrument (cash included). They find evidence for a specialization effect related to the type of good, the place of purchase and the contact. The effect of supply-side constraints on use of cash is also significant. Von Kalckreuth, Schmidth and Stix (2009) achieve similar results, observing that in Germany transaction types exercises considerable influence on the choice of instrument. They also show that the differences in preferences in the context of cash use observed among individuals depend on a feature of cash that is significant for those who use it: its information content (von Kalckreuth, Schmidt and Stix, 2011). That is, for some consumers cash represents an essential instrument of budget control. Changing payment instrument would necessitate learning new expenditure control methods, which could give rise to resistance.

[8] The EU Commission's communication on the negative impact of frauds on consumers' confidence in payment systems emphasizes that for many people the risk of fraud in payments is one of the main impediments to the expansion of e-commerce.

4. The model

The most frequently suggested determinants of the propensity for cashless payment instruments range from the "subjective" (e.g. socio-cultural reasons), to the perceived security of the instruments, level of economic development and diffusion of infrastructures, and hence the presence or absence of supply-side constraints. The findings of empirical studies are not unanimous, and ion any case only a few involve international comparisons, among other reasons for lack of data. One relatively neglected aspect with sometimes divergent results is the price elasticity of the demand for payment instruments. This determinant will not be considered here, in part for the scarcity of data but above all because the empirical studies to date show that the elasticity of the demand for payment instruments is low[9]. The model used here is based on Humphrey et al. (1996). The demand function constructed for the international comparison has been used for the Italian regional analysis as well.

In order to measure the relative importance of the variables, the estimation results are given in terms of beta coefficients, which allow a comparison between the coefficients of the independent variables. The beta coefficients are determined by linear regression of standardized data.

5. Cross-country analysis

After a brief analysis of the differences that emerge from the comparison among European countries and a description of the database and methodology, we identify the possible causes for the differences in the demand for the various payment instruments.

5.1. Database and methodology

The data on the payment instruments, drawn from the Blue Book of the ECB, cover 25 European countries beginning in 2000. They are characterized by several discontinuities. Similar problems are present in the other databases that we use, from Eurostat and OECD. Accordingly we set a one-year time limit on the cross-country analysis, which gives us nearly complete information for the countries surveyed.

The data on the payment instruments include information that proxies for the characteristics of both demand (use and dissemination of the various payment instruments) and supply (diffusion of current accounts and ATMs and POS). For a description of the variables, sources and descriptive statistics, see tables 2 and 3 of the Appendix. The data have been supplemented with demographic and socio-economic information: variables relating to the level of economic development (GDP per capita, number of industrial and service companies per capita and the ratio of R&D expenditure to GDP) and the security of instruments (percentage of cards that use chip technology). We have also added an

[9] Humphrey et al. (1996) find values of elasticity that are negative but close to zero. We therefore think it is likely that the cost of instruments and cash is not, in fact, perceived by the people who use the cashless instruments, as the cost is often included among the bank account fees, and it is not always clear how much of merchants' costs for payment cards is passed on to the sale price. Moreover, the empirical studies show that other factors are more important in the choice of payment instrument, such as user's income (Snellman, Vesala and Humphrey, 2001) and social-economic, institutional and technological variables that facilitate access and usability (BUBA, 2010; Humphrey at al., 1996). The low responsiveness of demand to price changes can also be explained through the specificities of the payments industry that make it hard to define an appropriate cost indicator able to orientate users' choices (given network externalities, information asymmetries and the range of types of user, this is a two-sided market).

indicator of the GDP share of the informal economy[10] and two proxies: one for social cohesion (number of crimes per capita) and one for social inclusion (index of income concentration).

The comparison between countries is performed in stages: 1) verification of the differences between payment habits (see Figure 1 and Table 4 in the Appendix) and factor analysis to identify the main determinants of payment choices; 2) estimation of alternative demand models for the main instruments (cash, cards, bank transfers), in order to verify how the relevant factors determine payment choices.

5.2. Main differences among European countries

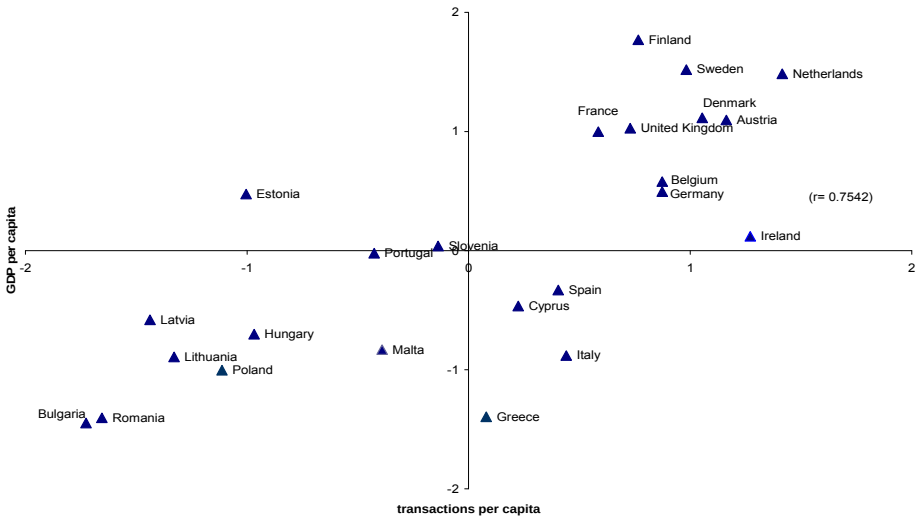
The countries included in our sample were initially divided into two largely homogeneous groups by cluster analysis referring to such structural variables as GDP and number of transactions per capita, whose correlation coefficient is positive and significant (0.75), while the share of variation in one of the two variables accounted for by variations in the other variable is 57 per cent (figure 3) [11].

The first group consists of the countries with above-average income and especially with strong reliance on non-cash instruments (Austria, Belgium, Germany, Denmark, Finland, France, United Kingdom, Ireland, the Netherlands, and Sweden). The second group consists of the countries below-average income and low use of electronic payments (Bulgaria, Cyprus, Greece, Hungary, Lithuania, Latvia, Malta, Poland, Portugal, Romania, Slovakia, and Slovenia). Estonia, Spain and Italy, which have some peculiar features, were also included in this group. Estonia, for instance, has higher-than-average transactions per capita despite lower income, while Italy has above-average per capita GDP but relatively fewer transactions, also in comparison with Spain, which has slightly lower income (figure 3).

Figure 3

CLUSTER ANALYSIS

(standardized variables)



Source: Based on ECB data.

[10] The indicator of the share of the informal economy is that elaborated by Schneider (2010).

[11] For the clustering we applied Ward's hierarchical method on standardised data and Euclidean distances. The optimal number of clusters was determined by the Calinski-Harabasz pseudo-F index (1974).

Italy's relative backwardness may be due to differences in income concentration. Compared to the other main European countries with above-average per capita GDP, the negative relationship between the electronic transactions and income concentration, which corresponds to the findings of a number of empirical studies, is more pronounced in Italy (Figure 4). But income concentration cannot entirely explain Italy's backwardness in the use of electronic instruments: Spain and the UK, for instance, have both greater income concentration and more transactions in innovative instruments than Italy.

Figure 4

Income concentration and use of electronic payment instruments

(percentages and thousands)

Sources: Based on data from the OECD and the ECB.

The analysis of the differences between the payment habits of the two groups consists in a comparison (uising Student's t test) between the variables at country level (see Table. 4 in the Appendix). Given the small sample, the validity of the results has been tested through recalculation of the difference between means by a non-parametric bootstrap[12]. To deal with the problems associated with the use of confidence intervals based on the normal-theory and of the percentile confidence intervals, our confidence intervals are corrected to take account of the for the limited sample and the acceleration adjusted bias (Bias-corrected and accelerated, i.e. adjusted for the rate at which the standard errors converge as N increases[13]).

The bootstrap estimates confirm that the differences in payment habits (replacement rate of cash, number of cards in circulation and number of electronic payments) between the two groups are statistically significant (see Appendix, Table 11), while the two groups do not differ significantly in some structural (or supply) features. In fact, the numbers of current accounts and of ATMs and POS

[12] With the non-parametric bootstrap one can estimate the sample distribution of a statistic without making assumptions about the distribution within the population and without drawing inferences about the sample distribution.

[13] The confidence interval satisfies the first order and second order conditions for the accuracy of estimations: they are in fact invariant with respect to any transformation of the parameter we are interested in and the error term tends to zero at a rate equal to 1/n. For a comprehensive discussion of *bootstrapped* confidence intervals, see Efro and Tibshirani (1993) and Keele L. (2008).

terminals in relation to population do not appear to constitute an element of differentiation, although this does not necessarily imply their irrelevance to payment choices. However, differences in POS diffusion in relation to number of firms are significant[14].

With regard to the indicators of "context" (GDP per capita, R&D spending/ GDP, and weight of the informal economy), the differences between the two groups are significant. However, this tells us nothing about which of the factors considered play a role in determining the areas of differentiation.

The analysis of the relative weight of the various payment instruments at country level shows the distinction between the "innovative" countries and those with little propensity to use electronic instruments. Presumably there are latent factors explaining the relative propensity to innovate, which are themselves influenced by the variables considered.

We accordingly performed a principal component factor analysis, which identifies two sets of relevant factors that we label structural factors and development potential (see Figure 5 and Appendix, tables 5-7). Their identification depends on the interaction among the main variables explaining the differences between countries, in conjunction with other variables that, while not statistically significant, are representative of demographic structure and the payment system (ageing index, number of ATMs and POS terminals) and could therefore be relevant to national payment choices.

The structural factors are: number of firms in the industrial and service sectors, number of ATMs and POS terminals, size of the underground economy, population ageing index. Large numbers of firms do not necessarily represent a positive factor; in Italy, for instance, the large number of firms is associated with small size. The same is true of ATMs and POS terminals: a large number of ATMs indicates broad diffusion of access points but also a strong propensity to use cash, while a large number of POS terminals does not necessarily imply intensive use of cards (again, Italy is a case in point) [15].

Development potential is gauged by GDP per capita, total number of overall transactions per capita, number of card transactions per capita and incidence of public sector and private sector R&D spending on GDP. The correlation coefficient (0.88) shows a strong positive link between R&D and electronic payment transactions.

Plot the country scores, we see that the countries can be divided into four main groups:

- quadrant I, characterized by negative deviations from the mean of the structural factors (essentially number of industrial and service enterprises, number of ATMs and POS terminals, size of the informal economy and sometimes population ageing) and positive deviations from the mean of development potential and its causal variables;
- quadrant II, characterized by positive deviations of both indicators;

[14] This indicator captures both the differences between the production structures (higher or lower weight of the industrial and service sector and/or higher or lower share of small and medium-sized enterprises) and the relative diffusion of the access points for card payments. Indirectly, it also fills an information gap in our dataset, capturing the diffusion of POS among service and commercial companies.

[15] In the Nordic countries the banks charge a commission for cash desk transactions and are inclined to offer discounts for internet or phone transactions. These countries accordingly have comparatively fewer cash desks and ATMs in relation to population, while consumers make heavy use of remote payment transactions (World Retail Banking Report 2004 by Cap Gemini Ernst & Young).

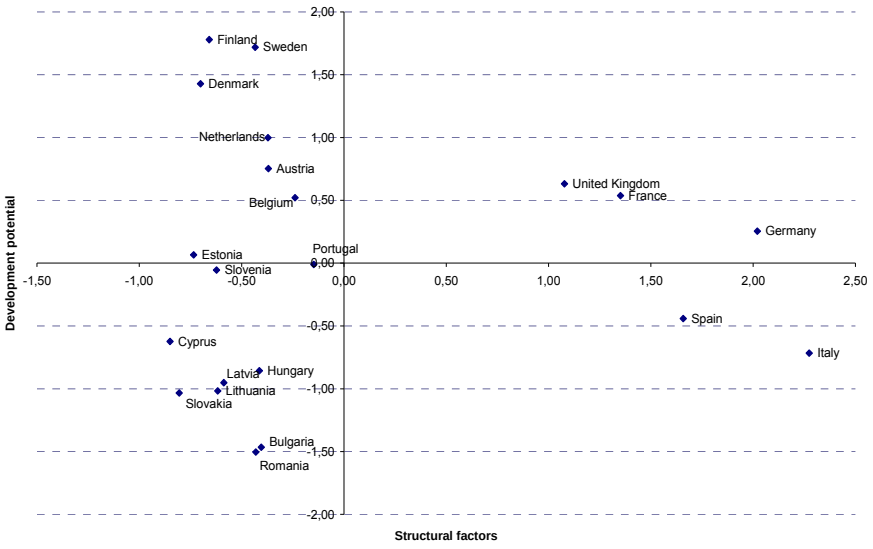
- quadrant III, with positive deviations of the first indicator and negative deviations of the second: strong rigidities and low development potential. Italy and Spain are located in this group;
- quadrant IV, countries with negative deviations of both indicators, i.e. backwardness both in the structure of the payment system and in the structure of the production system and hence in the factors in development potential.

The optimum area is obviously the upper left-hand quadrant: countries with high propensity to innovate and greater use of electronic instruments[16].

Figure 5

Relevant factors

(standardized variables)



Source: Based on ECB data.

5.3. The demand for the various payment instruments

Having identified the relevant factors is a good starting point for formulating payment instrument demand functions that are indistinctly applicable to various countries. We have estimated three different demand models: for electronic instruments, payment cards and online purchases. As for cash, because of the lack of sufficient data on domestic demand in the various countries, we have estimated the "utilization" rate, i.e. the ratio of ATM withdrawals to the number of ATM and POS transactions[17].

[16] For a ranking of the Europe's most innovative countries see the Regional Innovation Scoreboard (RIS, 2009) published by the European Commission.

[17] Strictly speaking, ATM withdrawals are not the only means of cash provision. In Italy, a substantial share of cash withdrawals from banks and post offices are effected at the traditional counters. Nevertheless the cash card ratio, an indicator constructed on the basis of the cash flows arising from payment card transactions, allows closer observation of

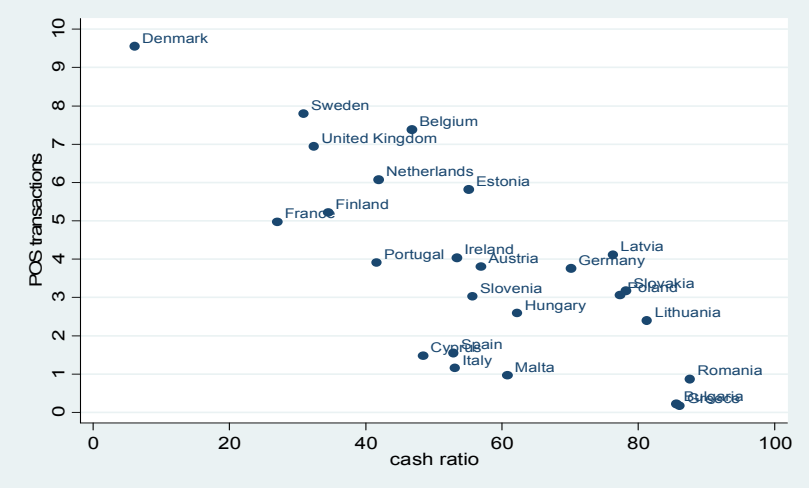
5.3.1. Demand for cash by means of electronic instruments

At European level, as in Italy, the use of cash remains heavy and continues to grow, despite the recent increase in the use of electronic instruments, especially credit cards. However, there are significant differences between countries. For our sample there are two distinct groups of countries: those with lower use of cash and heavy use of electronic payments and those with modest electronic and heavy cash payments (see Figure 6).

To explain the differences, we must identify the determinants of the demand for cash by means of electronic instruments (ATM withdrawals) and of the demand for electronic payment instruments as such. The use of cash depends on several factors. Given alternative instruments, the propensity to use cash is presumably influenced by the availability and ease of use of the electronic instruments. The empirical evidence shows that the cash and electronic instruments are not perfect substitutes. For our sample countries the degree of correlation between the rate of the "cash changeover" (here gauged by the cash card ratio of ATM withdrawals to total ATM and POS transactions) and the number of transactions by electronic payment instruments per capita is in fact equal to -0.81.

Figure 6

Cash card ratios (percentage values) and POS transactions (thousands)



Source: Based on ECB data.

Another factor is the shadow economy, which many analysts consider as one of the main reasons for use of cash. Figure 7 shows that where the incidence of the informal economy is lower, the propensity for cashless instruments is greater (r = -0.79).

The model used to define the "electronic" demand for cash (CASHRATIO, ratio of withdrawals from ATMs to total number of ATM and POS transactions) is therefore:

$$CASHRATIO = \alpha_0 + \beta_1 YPC + \beta_2 POSENTERP + \beta_3 SHADOWMLN + \varepsilon \qquad [1]$$

the behaviour of those who elect to use their electronic payment instruments to withdraw cash. In the in-depth analysis carried out in the section 6.3.2.4 we examine a model that takes account of all the cash withdrawals from the banking and postal system.

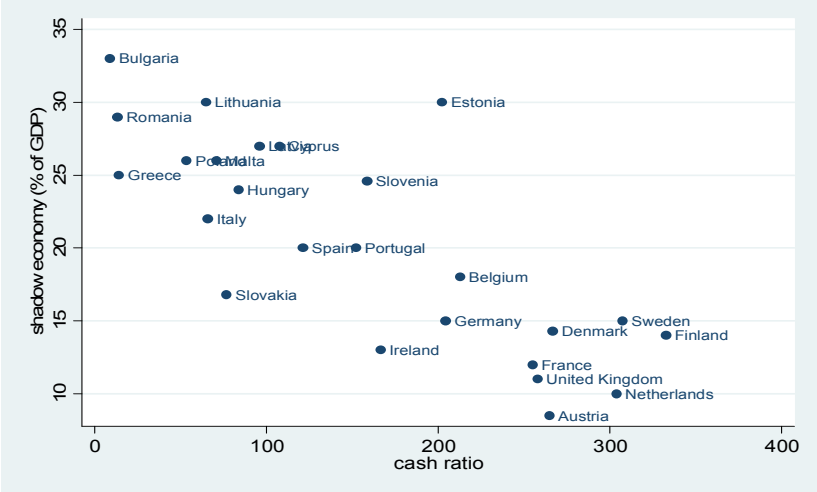
where: YPC is per capita GDP; POSENTERP is the number of POS terminals per enterprise (a proxy for diffusion of card access points, which takes into account the production structure and in particular the presence of micro-enterprises); SHADOW09MLN is the size of the underground economy[18]; ε is the error term[19].

Only the first two variables appear to affect the demand for cash negatively, as expected: the higher the GDP and the number of access points, the lower the use of cash and the greater the use of payment cards; the shadow economy seems to have a positive, but not significant, impact on the cash ratio. In the Appendix we show the results of standardized coefficients, which allow comparison among the several coefficients (see Table. 8 of Appendix). The most important factor affecting the cash ratio is per capita GDP. Since the number of observations is low we have again used the bootstrap test of reliability; the estimates confirm the significance of all the variables except underground economy (see Appendix, Tables 9-10).

Figure 7

Transactions per capita and shadow economy

(*numbers and percentage values*)



Source: Based on ECB data.

5.3.2 Electronic instruments

As to electronic instruments (credit transfers, direct debits and payment cards) the estimated equation is:

$$SEPAPOP = \alpha_0 + \beta_1 YPC + \beta_2 POSENTERP + \beta_3 SHADOWMLN + \beta_4 RD + \varepsilon \qquad [2]$$

where: SEPAPOP is the number of transactions by SEPA electronic payment instruments per capita and RD is the ratio of R&D spending to GDP. All the variables make a significant contribution.

[18] This evaluation of the size of the underground economy is drawn from the work of Schneider (2010).

[19] We also include also the population share of people high school graduates (EDUCATION) which, for constant significance of the other variables, is significant and positive. This counter-intuitive result presumably depends on the fact that the model focuses only on card-based cash withdrawals, already a somewhat "advanced" measure.

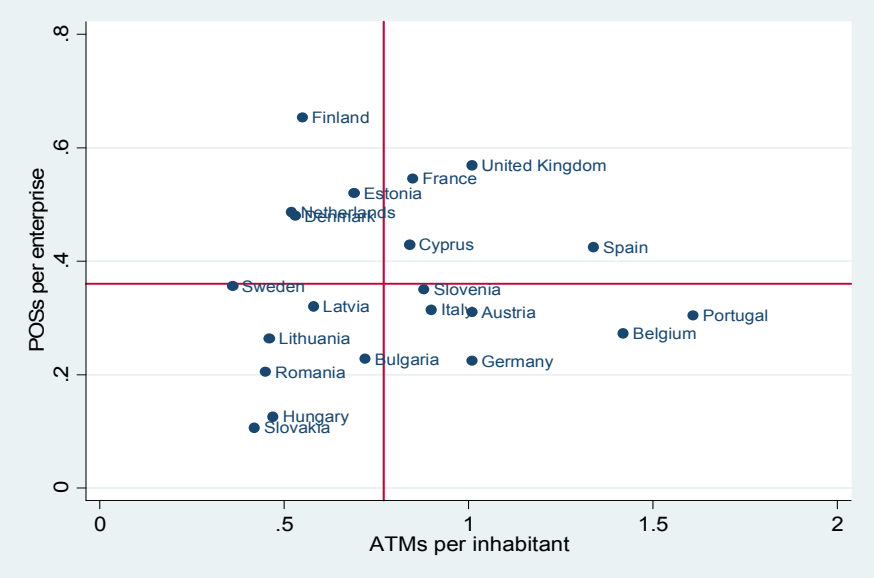
The bootstrap estimates confirm the reliability of all the coefficients except those for per capita income and underground economy.

Italy is among the countries with below-average number of card payments and much more limited diffusion of POS terminals than such countries as Finland, France and the United Kingdom.

Figure 8 shows the number of ATMs per inhabitant and the number of POS terminals per enterprise; for Italy, only the former is slightly above average.

Figure 8

Diffusion of ATMs (per inhabitant) and POS terminals (per enterprise)



Source: ECB Blue Book.

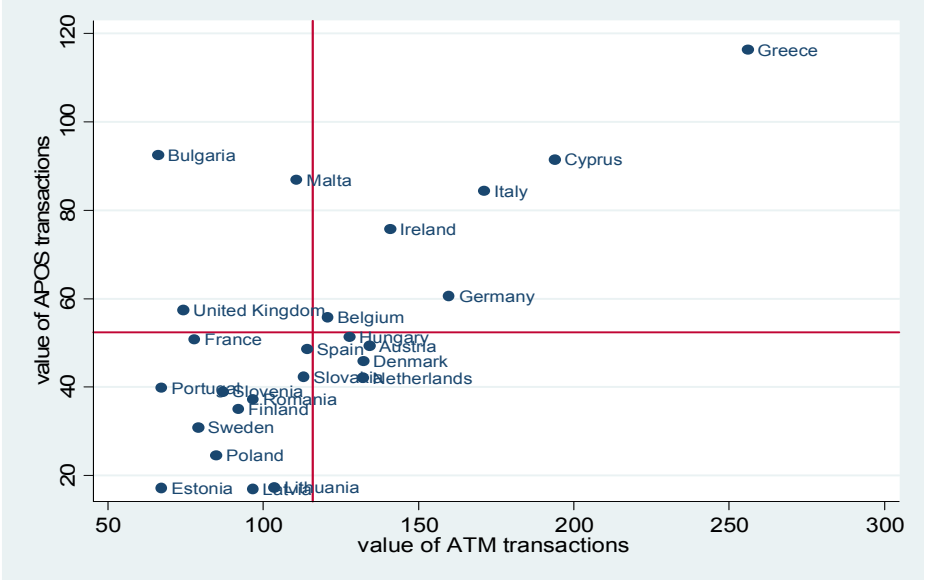
The diffusion of ATMs and POS terminals in relation to population not only offers a gauge of accessibility of these instruments but also provides information on the supply structure, which is frequently influenced by payment habits. Snellman and Viren (2009) find a strong and positive relationship between the number of ATMs and the number of networks for the management of ATMs; nevertheless the results of the estimation of the impact of ATMs on the amount of cash held are ambiguous. In general, the countries characterized by a high use of cash have relatively far-flung ATM networks, while those where electronic instruments prevail have less extensive ATM networks and more extensive POS networks. There is a positive correlation (0.66) between the average value of ATM transactions and that of POS transactions (Figure 9). The average value of ATM withdrawals and POS payments in Italy is much higher than the average for our sample countries; and considering euro-area countries alone, the gap is wider. The equation for number of payment card transactions per capita is the same as the foregoing, with the addition of an Italy dummy.

$$CARDPOP = \alpha_0 + \beta_1 YPC + \beta_2 POSENTERP + \beta_3 SHADOWMLN + \beta_4 RD + \delta_{ITA} + \varepsilon \qquad [3]$$

The estimates show a significant and positive contribution of the increase of the number of POS terminals per firm (confirmed by bootstrap estimates) and weak significance of the informal economy (-) and of the R&D expenditure (+), but these latter findings are not confirmed by the bootstrap estimates. No country effect is captured by the Italy dummy.

Figure 9

Average value of ATM and POS transactions (1)



Source: ECB Blue Book.
Note: The red lines represent the average values of the variables.

5.3.3 Payments over the Internet

The spread of Internet purchases and hence of the relevant electronic instruments (credit cards, prepaid cards and credit transfers) is expected to be closely related to population characteristics. The model estimated considers both education and population age:

$$INTERNETPURCH = \alpha_0 + \beta_1 YPC + \beta_2 EDUCATION + \beta_3 AGEING + \beta_4 RD + \varepsilon \quad [4]$$

The estimates show a significant and negative impact of population ageing (the share of population older than 65) on the Internet purchases, while the contribution of per capita income and R&D spending is positive. Given the small number of observations, the bootstrap estimates do not confirm the significance observed.

6. Inter-regional comparison within Italy

6.1 Extension of the quantitative analysis

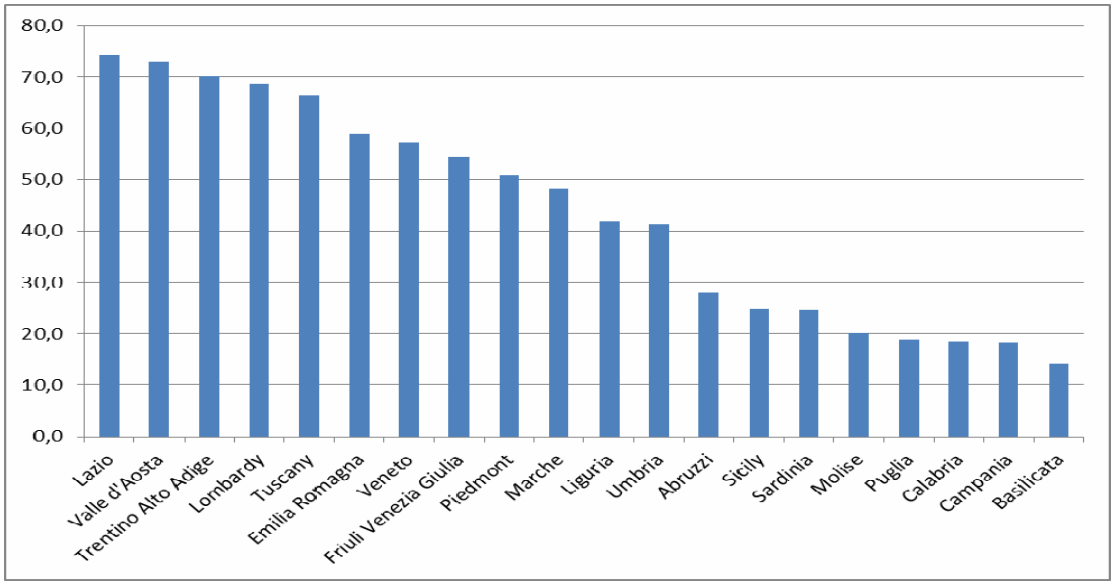
The regional disparities in number of electronic payments per capita win Italy are still large, nearly as great as the international disparities (Figure 10).

The number of electronic payments (by card, credit transfer and pre-authorised debit) is three times as high in the Centre and North as in the South (59 per person per year as against 21). Hence, in relative terms, the gap between the Italian regions is comparable to that between countries within Europe[20].

The territorial differences are also evident in cash use as measured by the cash card ratio, which stands at 65 percent in the South and 51 percent in the Centre-North. That is, by contrast with most euro-area countries, where the cash card ratio averages 35 percent, in Italy debit cards are used primarily (more than 56 percent of all the transactions) to make ATM cash withdrawals[21].

Figure 10

Number of electronic payments per capita at regional level



Source: Bank of Italy, reports of the intermediaries in 2009.

6.2 The provincial database

The information on payment instruments (the number of transactions) and the degree of bank service with areas (current accounts, ATMs, POS terminals, online network connections for e-banking) are drawn from the reports of banks and other intermediaries to the Bank of Italy, as are the indices of "security" (i.e. the share of chip cards) and "risk" (i.e. card frauds). These data have only been available at provincial level for the entire banking and postal system since 2009, so like the international comparisons this cross-sectional study refers to that year: all the Italian provinces are considered, and the range of variables is wider than in the international comparison.

The territorial database has been enriched with "standard" socio-economic data (income, population ageing, graduates, businesses in the area, etc..) as reported by the Italian National Institute

[20] The coefficient of variation – measuring the dispersion of the data on the number of electronic payments per inhabitant – among Eurosystem countries is 0.5, that among regions in Italy is 0.4.

[21] Including credit card transactions as well, the ratio in Italy is about 51 percent. Although it is trending down (from 60 per cent in 2002/2003), in recent years it has decreased more slowly or practically stabilized.

of Statistics and available for 2009.[22] Finally, for the underground economy we also consider the province-level assessments of the Finance Police on the share of people employed in sectors where the presence of irregular workers is highest (agriculture and construction) and on the crimes reported annually to the judicial authorities, published by ISTAT[23].

The analytical description of the variables, the descriptive statistics, and the various data sources are reported in the Appendix (Tables 11 and 12).

6.3 Models of demand for payment services

6.3.1 The determinants of demand

The analysis in section 5.2 divides the factors relevant to payment service demand functions into "development" and "structural" factors.

For Italy, we again take income and propensity to innovate as the relevant "development" factors. The former is proxied by per capita GDP, and the expected effect on the demand for electronic instruments is positive: the higher the standard of living, the lower the use of cash and therefore the higher the demand for alternative payment instruments. But as per capita GDP may also depend on general and above all "financial" literacy, we also include a proxy for the level of education (the percentage of graduates in the province), on the assumption that a higher level of education produces a lower propensity to use cash.

The propensity for innovation is not measured by R&D expenditure, as in the international comparison, because these data are available only at regional, not provincial, level and because this variable plays a minor role in inter-regional comparisons. Other technological variables related to the security and the use of electronic channels are used to capture the impact of innovation on the demand for electronic payments[24].

Our "structural" factors comprise a range of indicators of the diffusion of "traditional" banking and postal products (current accounts, ATMs, POS terminals), of the economic structure (number of firms), and of demographics (the old-age ratio). As in the international comparison, some of these factors are characterized by a certain "rigidity" or "inertia" in the short term.

We also include a set of variables that have explanatory power in the context of the underground economy. Their expected sign is negative, with the caveat that some illicit or illegal activities may also result in the use of the banking channels for money laundering.

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[22] This macro-aggregate province-level analysis of payment services is a first in the literature; national surveys mainly use on sample data, due to the lack of alternative sources.

[23] The crime data are for 2008 (http://giustiziaincifre.istat.it).

[24] We refer to proxies of the level of technological innovation in the field of payment services: the diffusion of innovative channels, measured by the number of online connections per inhabitant or the share of the total value of transactions effected online; the diffusion of prevention and security technologies (proxied by the migration to chip cards in payment networks) and the incidence of the number of blocks (prevention) of the cards owing to anomalies. The expected signs of these variables are positive: as the accessibility of innovations increases, demolishing physical barriers, cutting costs and the risk of fraud, the propensity to use of electronic instruments in place of cash increases.

6.3.2 Electronic payment instruments

6.3.2.1 The equation of the overall demand for electronic instruments

The lag in the adoption of electronic payment instruments emerges not only between Italy and the other European countries but also between Italian regions. Again we can devise a base equation model of the demand for electronic payment instruments at province level involving the explanatory variables outlined above: demand is defined as the number of transactions per inhabitant effected using instruments other than cash, cheques and bank receipts (SEPAPOP).

The base model of demand for electronic payments is:

$$SEPAPOP = \alpha_0 + \beta_1 YP + \beta_2 EBANKP + \beta_3 POSENTERP + \beta_4 SHADOW1 + \varepsilon \qquad [1a]$$

The equation is similar to that for the international comparisons, with some adjustments: a different proxy for technological innovation, i.e. the number of e-banking connections per inhabitant (EBANKP), and specific territorial indicators of the size of the underground economy (SHADOW1)[25]. The degree of penetration of POS terminals among firms (POSENTERP) is again taken into account through its inclusion among the control variables of the supply of banking products and as a proxy of the accessibility of electronic payment instruments.

An alternative specification of equation [1a] provides for: 1) a different proxy for the level of economic and financial development, strongly correlated with per capita GDP, namely the number of bank current accounts per inhabitant (ACCOUNTPC) and 2) an alternative proxy of the size of the underground economy, given by the share of people employed in agricultural and construction (SHADOW2), where the main risks of exploitation of off-the-books labour and hence of using non-traceable instruments are mostly concentrated. The demand equation of the alternative model is:

$$SEPAPOP = \alpha_0 + \beta_1 ACCOUNTPC + \beta_2 POSENTERP + \beta_2 EBANKP + \beta_6 SHADOW2 + \varepsilon \qquad [1b]$$

The estimation of the coefficients in [1a] and [1b] is by OLS and is robust to heteroskedasticity. In order to make the coefficients comparable, in this case the estimates refer to the standardized variables; the results are shown in Table 13 in the Appendix.

The results confirm the significant contributions of all the variables examined and the assumptions underlying the models. In particular, the demand for electronic payment instruments is positively related to the degree of development (YP variables, ACCOUNTPC, POSENTERP) and to innovation (EBANKP). The impact of the "underground" variable on the electronic instruments (SHADOW1 or SHADOW2) is negative and more significant than in the international comparison[26].

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[25] SHADOW1 is the number of targeted tax audits carried out by the Finance Police throughout the country. Targeted audits bear on taxpayers (firms) who are presumed – based on information and inquiries – to be involved in irregularities while carrying out particular operations (payment of wages) and in irregularities concerning one single item (income and social security taxes. This variable is standardized by dividing it by the number of inhabitants, so that scale factors become irrelevant and then weighted by a GDP concentration index (calculated as the ratio of provincial GDP to the sample mean). This permits a comparison of the phenomenon among provinces that also takes into account the relative level of economic development, and so avoids inferring misleading indications of the presence of a higher level of evasion as a result of the detection of a higher than average number of checks.

[26] The negative coefficient of the number of targeted tax audits in model [1a] - SHADOW1 – is smaller than that of the share of employment in the "critical" sectors (SHADOW2 in model [2b]). However, this last variable is not only an

As in the international comparison, the relative size of the underground economy cannot explain the persistent inter-regional disparities, which instead are explained mainly by the indicators of economic-financial development (YP, ACCOUNTPC, EBANKP , POSENTERP).

The effect of socio-demographic factors, such as the percentage of graduates (EDUCATION) and the old age index, was also examined, and a control variable (CRIME), equal to the number of crimes reported per capita, has been added. The results, reported in the Appendix, show no significant coefficients. We have also controlled for other territorial discontinuity factors that may have been omitted by inserting the territorial dummy "SUD" in all the models. The coefficient does not prove to be significant, and the dummy is strongly correlated with the variables capturing the local level of development (GDP per capita, diffusion of banking).

Finally, a further robustness check of demand models [1a] and [1b] taking as dependent variable the number of payment transactions per current account instead of per inhabitant, in order to better control for the marginal impact of the explanatory variables – given the degree of bank diffusion – on demand behaviour (YPC, POSENTERP, EBANKP, SHADOW). The relationships found above and the significance of the estimates are confirmed (see Table 13 in the Appendix)[27].

6.3.2.2 Payments via the Internet

The dependent variable here is the provincial share of electronic transactions via the Internet. The explanatory variables include two indicators of economic and financial development: per capita GDP (YPC) and the number of current accounts per inhabitant (ACCOUNTPC)[28]. The diffusion of online accounts – which is strongly correlated (0.76) with the diffusion of current accounts overall (ACCOUNTPC) – has not been included among the explanatory variables for reasons of endogeneity, in that it is itself influenced by the socio-demographic variables.

Finally, as in the international demand equation, we also include the socio-demographic variables EDUCATION and AGEING (the share of people over the age of 65).

The equation is then specified as:

$$INTERNETSHARE = \alpha_0 + \beta_1 YP + \beta_2 ACCOUNTPC + \beta_3 AGEING + \beta_4 EDUCATION + \varepsilon \qquad [2a]$$

The estimation results are shown in Table 13 in the Appendix. The estimated coefficient of the old age ratio (AGEING) is negative and significant, as in the cross-country analysis. In addition, the demographic factor is now also robust in explaining the lower propensity for innovative technologies[29] in this case by comparison with the earlier analysis.

(indirect) gauge of the "shadow" economy but also reflects other factors correlated with the demand for non-electronic but not necessarily irregular instruments (e.g. a higher propensity to use paper instruments, such as the cheques).

[27] The diagnostic tests reject the hypotheses of multicollinearity of the regressors, serial correlation of the residual terms, and omitted relevant variables. The standard errors of the estimates of the coefficients for calculating the p-values are robust to heteroskedasticity. The R-squared lies between 55% and 65%.

[28] The international analysis considered only GDP, as the small sample forced greater parsimony of variables and above all because of problems of international comparability among different types of money market accounts.

[29] These results are confirmed when we consider an alternative demand model (model 2b in the Appendix, Table 13), in which the dependent variable is the number of online accounts per inhabitant.

As expected, the relationship between online payments and per capita income (YPC) or the degree of banking presence (ACCOUNTPC) is significant and positive. The coefficient for EDUCATION has a positive sign, consistent with expectations, and is significant[30].

6.3.2.3. Card payments

As in the international comparison, the base model of demand for card payments is similar to that for electronic instruments overall. However, we need to control for the presence of additional variables relative to the provincial distribution of service access points, "security" and risk factors.

We have already examined the effect of the degree of penetration of the terminals for electronic payments in the firms, i.e. reachability (section 6.3.2.1). In the case of card payments, the analysis can be broadened to the distribution of the ratio of the number of ATMs to the number of POS terminals among the covariates, given the cards' dual function of both payment and cash withdrawal.

Among the economic-financial development indicators we consider the degree of bank presence (accounts per capita) as an alternative to per capita GDP, given the strong correlation between the two variables, which in some specifications may cause problems of collinearity.

In addition, as in the international specification, the demand model includes the variables both of the official and of the underground economy, and the indicators of the criminal economy. In particular, for the underground economy we have defined an *ad hoc* indicator for the retail trade sector (SHADOWPOS), equal to the number of positive audits carried out by the Finance Police on shopkeepers, divided by the number of POS terminals[31]. The standardization with respect to the number of POS terminals helps to capture the opportunity for tax evasion among the merchants, which is presumably greater where the diffusion of electronic terminals is lower[32].

The indicators of crime are number of reported robberies per capita (ROBBERY) and the ratio between the overall level of POS frauds and the overall level of card payments (FRAUD).

Finally, the indicator SAFETY is given by the percentage of chip cards and of cards blocked for safety reasons with respect to the total number of cards, which should capture the effect of preventive technologies[33].

The equation of per capita demand for card payments is therefore:

$$PAGCARTA = \alpha_0 + \beta_3 ACCOUNTPC + \beta_1 ATMPOS + \beta_4 SAFETY + \beta_5 SHADOWPOS + \beta_6 FRAUD + \\ + ROBBERY + \varepsilon \qquad [3a]$$

[30] In model 2b the EDUCATION coefficient is not significant.

[31] SHADOWPOS reflects the irregularities involving merchants detected by the Finance Police, and is weighted by the index of concentration of GDP among provinces. The presence of significant regional differences in endowment of automatic devices (in particular between Centre-North and South), and its possible impact on the likelihood of tax evasion (which is lower where the number of POS terminals is higher), explains the need for standardization with respect to the number of terminals; the ratio of the number of episodes of tax fraud to the number of terminals should facilitate controlling for these disparities in opportunity and produce a better evaluation of the amplitude of the phenomenon. For an estimate of the underground economy in Italy through the information relative to the assessment activities carried out by the Finance Police, see Ardizzi et al., 2011).

[32] For more details on the same topic see Ardizzi et al (2011), above-quoted.

[33] Over the last few years so called "sms alert" mechanisms have been developed to ensure the timely notification of anomalies to customers via mobile phone messages, and the simultaneous temporary blockage of the card.

Table 13 of the Appendix shows the results of the estimates for equation [3a].

As expected, the impact on card payments of the ratio of ATMs to POS terminals is negative and significant (-0.28). The indicator of safety is strongly positive and significant as well. A 1 per cent increase in the indicator corresponds to a 0.39 per cent increase in per capita card transactions. The result for the degree of development and bank presence (ACCOUNTPC) is similar.

As to the variables of the underground economy, the sign of tax audits of shopkeepers is negative and significant. As for "illegal activities", first of all the sign of the regression coefficient for robberies is positive. This is consistent with the possible discouraging effect of high robbery risk on the level of cash holdings. The second indicator of crime, the POS fraud rate, is negative and significant, as expected (see Table 13).

Table 13 also shows the results of estimations excluding the variables related to the criminal offences (model 3b), in accordance with the base model set out in section 6.3.2.1. The values remain substantially stable, significant and consistent.

6.3.2.4 Cash payments

Cash card ratio. As in the international so in the inter-regional analysis, the demand for cash is expressed as the ratio between ATM cash withdrawals and total ATM card and POS transactions. This ratio is interacted with the main explanatory factors of cash use, substantially identical to the factors underlying electronic payments and specified in section 2.2.1.

The base equation, consistent with that specified in the international context (section 5.3.1), is:

$$CASHRATIO = \alpha_0 + \beta_1 YPC + \beta_2 POSENTERP + \beta_3 SHADOWPOS + \varepsilon \qquad [4a]$$

The indicator of the size of the underground economy in Italy is constructed differently from that used for the European equation but is similar to that adopted in the equation of card demand: the number of positive tax audits among shopkeepers standardized with respect to the number of POS terminals in the area (SHADOWPOS).

The estimation results are presented in Table 14 (Appendix) and prove significant; as expected, their signs are opposite to those of the coefficients of the demand for electronic payments. The relative use of cash in terms of ATM card withdrawals (CASHRATIO) is negatively correlated with the indicator of financial literacy or economic development (GDP per capita, YPC) and with the diffusion of ATMs in the area (ATMPOP); the coefficient that captures the effect produced by the underground economy is instead positive and significant (SHADOWPOS).

The cash equation can be usefully modified to take some Italian national specificities into account: the large number of small businesses and the diffusion of paper-based payment procedures (postal payment slips for the payment of utility bills, etc.), which still induces many people to hold cash for transaction purposes.

We also factor in the "crime rate" variable (CRIME), whose effect on the volume of cash in circulation can be ambiguous and may depend on the relative importance of the "risk" factor (robberies) compared to the "non-traceability" factor (e.g. trade in drugs).

The equation for demand for cash is therefore disturbed by comparison with the base model and is defined as follows:

$$CASHRATIO = \alpha_0 + \beta_1 YPC + \beta_2 GDP\_ENTERP + \beta_3 ATMPOP + \beta_4 POSENTERP + \beta_5 SHAREBILL + \beta_6 SHADOWPOS + \beta_7 CRIME + \varepsilon \quad [4b]$$

In [4b] the GDP is divided by the number of firms in order to proxy average company size in the territory. Again we take per capita GDP as the development indicator but we also include a control variable so as to control for the effect of the territorial distribution of ATMs on withdrawals (ATMPOP).

The indicator of crime is the total number of crimes reported to the law enforcement authorities (source: ISTAT) at provincial level divided by the number of inhabitants (see also Humphrey 1996). The strongest factor increasing the use of cash is a low level of per capita income (Table 14 in the Appendix). The use of cash is positively correlated with the size of the ATM network, the use of postal payment slips (SHARE_BOLL), small average firm size (GDP_ENTERP) and low POS endowment (POSENTERP).

The size of the underground economy (SHADOWPOS), while correlated with the use of cash cards, is not in itself sufficient to explain the factors behind the regional differences (the estimated coefficient is not particularly large with respect to magnitude of the coefficients of the other variables). The results for the crime index are not significant; and they diminish the coefficient pertaining to the underground economy.

Total Cash Ratio. As noted in section 5.3, when they want to procure cash people resort mainly to the traditional cash desks. The inclusion of such facilities in the analysis could shift the focus to the "pathological" factors (underground economy, crime, money laundering) in the preference for untraceable payments, whereas our intention here is to investigate the "physiological" (structural or evolutionary) causes for the low use of electronic payment instruments in Italy.

Nevertheless, it may be useful to test the robustness of the analytical framework further by examining an adapted version of the cash demand equation [4a-4b] that comprises, in addition to ATM withdrawals, over-the-counter (OTC) provision at bank branches. This means modifying the equation based on the "cash card ratio" and specifying as dependent variable the ratio of the total flow of cash withdrawals from traditional and automated cash desks to the total value of electronic payments[34].

The cash equation is defined as follows:

$$CASH\ TOT\ RATIO = \alpha_0 + \beta_1 YPC + \beta_2 MICRO + \beta_3 INTDEP + \beta_4 ATMPOS + \beta_5 SHAREBILL + \beta_6 SHADOWPOS + \beta_7 CRIME2 + \varepsilon \quad [4c]$$

In addition to the variables mentioned so far, we now include among the covariates an alternative indicator of the degree of local penetration of micro-firms (MICRO), namely the share of units with fewer than 10 workers, the ratio of postal payment slips to the total number of payments (SHAREBILL), and the indicator of the size of the underground economy based on the audits of merchants with POS terminals. In addition, we include the interest rate on bank deposits (INTDEP) among the explanatory variables, given the nature of the new dependent variable (CASH TOT RATIO). As the interest rate on bank deposits rises, the relative advantage of withdrawing non-interest-bearing cash from the accounts decreases. Finally, for the crime variable CRIME2, in this case we resort

[34] Taking as denominator the value of all non-cash payments is consistent with the use of all cash withdrawals (by OTC and ATM) as the numerator. Consider that on average OTC cash withdrawals are is five times as large as ATM withdrawals.

only to types of activity (normalized by population) that imply some kind of mutual agreement among the parties (e.g. narcotics traffic, fencing of stolen property, exploitation of prostitution). This should allow us to sterilize the presumed ambiguous effect of such criminal acts as robbery on the use of cash for ordinary payments.

The results of model 4c are shown in Table 14 in the Appendix. As in versions 4a and 4b, both the negative impact of the lower level of economic development (YPC) and the positive effects of the diffusion of ATMs relative to POS terminals, the presence of micro-firms, the propensity to use "cash-based" non-electronic instruments (SHAREBILL), and the underground economy (SHADOWPOS), are confirmed. The coefficient of the interest rate (INTDEP) is not significant, while that of crime (CRIME2) is large and significant, as expected[35].

7. Conclusion and policy implications

The international comparison allowed us to identify two groups of factors in the use of electronic payment instruments: one representing the country's structural characteristics, the other its potential for development.

The model of demand for cash and electronic instruments that we estimated shows that the main factors that can reduce the demand for cash are the distribution of income and of access points for card payments at retail level (POS by firms). By contrast, the essential factors explaining the use of electronic payment systems are innovation and safety (Table 1). The variables associated with the underground economy, while they do have a positive impact on the use of cash, are not significant in explaining the observed discontinuity between countries or, within Italy, between provinces.

Our study suggests that greater investment in innovation could induce changes in payment behaviour and in the relative use of payment instruments. There is accordingly a need for policy measures to overcome the obstacles to innovation and to facilitate the diffusion of innovative payment instruments. At the national level, for instance, the relatively rapid growth in prepaid cards indicates potential demand for electronic instruments used primarily for small payments.

On the supply side, one major obstacle to innovative solutions is the lack of incentive-compatible alternative payment schemes. The payment networks tend to be two-sided, with two distinct groups of participants, namely those who use payment instruments and those who accept them. The incentive to innovate therefore depends strictly on network externalities (switching costs, coordination failure, transaction costs). So if the cost of setting up new infrastructures is relatively high, there is in fact a strong disincentive for incumbent operators to invest in innovation, especially in the presence of shared monopoly platforms. Milne (2006), based on a comparison of the Scandinavian countries, the UK and the US, shows that interventions to diminish the role of common infrastructure and stimulate competition between payment service providers can increase the market incentives to innovate[36].

One way to overcome the obstacles to innovation in Italy in particular could be direct public intervention to foster cooperation among the large banks to create an ad hoc infrastructure for micro-payments. Alternatively, a viable solution could be to encourage ad hoc micro-payment schemes in the

[35] As regards the interest rate, the hypothesis set forth in other studies of the Italian case appears to hold – namely, that the opportunity cost of cash withdrawal has little impact on the demand for currency, given the very low interest rates paid and their accordingly small impact on decisions concerning the amount (or flows) of cash withdrawals relative to the demand for "cash inventories" (or cash balances).

[36] For an analysis of the determinants of innovation in retail payments, see Milne (2006).

framework of existing payment infrastructures. Enhancing the reachability of the current infrastructure at the small business level is important and may be achieved by incentive mechanisms or regulatory action to ensure, for example, that the allocation of physical or virtual POS terminals becomes an essential and strategic requirement for business.

Table 1

Summary of results

Variable	Description	Marginal Impact on			
		Cross-country comparison in Europe		Cross-regional comparison in Italy	
		Electronic payments	cash	Electronic payments	cash
	Development factors				
YPC	GDP per capita	+ ***	− ***	+ ***	− **
EBANKP	Online banking connection			+ **	
SAFETY	Safe technology			+ ***	
RD	R&D	+***			
	Structural factors				
ACCOUNTPC	Banked persons			+ ***	
POSENTERP	POS	+ **	− ***	+ ***	
ATMPOP	ATM				+ **
SHAREBILL	Pre-printed slips				+ ***
AGEING	Age	− ***		− *	
EDUCATION	Education			+*	
MICRO	Small firms				+ **
SHADOW	Shadow	− *		− *	+**

Note: + / − representing the sign of the marginal impact (positive/negative); * denoting the magnitude of the impact considering standardized variables. The *bootstrap* estimates in the cross-country analysis confirm the significance of all the estimated coefficient with the exception of the shadow variable.

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APPENDIX

INTERNATIONAL COMPARISONS

Table 1

Relative importance of payment instruments
(as a percentage of the total number of transactions)

Country	Card payments	Direct Debits	Credit transfers	Cheques	Other payment instruments
Austria	17.32	37.98	42.91	0.09	0.47
Belgium	43.56	11.37	41.64	0.35	0.01
Bulgaria	18.80	0.31	80.89	0.00	0.00
Cyprus	37.14	8.49	26.99	27.38	0.00
Denmark	67.59	12.13	19.63	0.65	0.00
Estonia	57.29	6.88	35.82	0.00	0.00
Finland	50.65	4.85	44.48	0.03	0.00
France	42.16	19.88	16.99	20.11	0.64
Germany	14.83	49.40	35.17	0.34	0.00
Greece	46.63	7.74	30.23	13.98	0.41
Hungary	21.81	8.05	68.61	0.00	1.54
Ireland	46.74	16.03	22.52	14.71	0.00
Italy	37.18	14.55	30.44	8.47	7.09
Latvia	45.00	2.01	52.62	0.01	0.00
Lithuania	43.56	5.64	50.71	0.09	0.00
Malta	38.34	4.08	18.80	38.79	0.00
Netherlands	41.24	25.37	29.86	0.00	0.00
Poland	34.48	1.10	64.41	0.01	0.00
Portugal	65.98	13.73	11.19	8.93	0.04
Romania	30.14	1.26	65.45	3.15	0.00
Slovakia	27.60	17.03	55.36	0.02	0.00
Slovenia	34.42	14.37	51.12	0.08	0.00
Spain	38.81	43.75	14.55	2.04	0.84
Sweden	59.61	8.47	31.90	0.02	0.00
United Kingdom	51.51	19.82	20.61	8.07	0.00
EU	38.53	25.80	27.64	6.64	0.56
Euro area	33.19	30.19	27.20	7.16	0.77

Source: Blue Book Bce.

Table 2

Data description (definition of variables and data sources): *country data*

Variabile	Descrizione	Fonte
gdpxcapita09	National GDP per capita	Eurostat
cc_per_inhab09	Overnight deposit account per capita	BCE - Eurostat
cashratio	Ratio of withdrawals from ATMs and total number of ATM and POS transactions	BCE
sepapop	Number of transaction per inhabitant with credit transfers, direct debits and payment card	BCE - Eurostat
transpop	Number of transaction per inhabitant with all payment instruments	BCE
transcard09	Total number of card transactions	BCE
atmpop09	Number of ATM per inhabitant	BCE - Eurostat
pospop09	Number of POS per inhabitant	BCE - Eurostat
transxpos	Number of card payments (debit, credit and prepaid cards) divided by the number of POS	BCE
cardpercapita	Number of card payments (debit, credit and prepaid cards) per inhabitant	BCE - Eurostat
numdd09	Total number of direct debits	BCE
numct09	Total number of credit transfers	BCE
internetsell08	Percentage of non financial business firms with more than 10 employees, which sell goods and services over the Internet	OCSE
internetpurch08	Percentage of non financial business firms with more than 10 employees, which purchase goods and services over the Internet	OCSE
enterpx1000inhab	Number of industrial and service enterprises per 1000 inhabitant	Eurostat
rd	Ratio of public and private expenditures to GDP	Eurostat
emvcards09	Percentage of chip card on total cards in circulation	BCE
shareofshadoweconomy	Percentage of shadow economy on national GDP	Schneider (2010)
shadow09mln	Estimated value of national shadow economy	Schneider (2010) - Eurostat
gini_ineq09	The Gini coefficient measuring the inequality among values of the levels of income frequency distribution	Eurostat
crimepop	Share of total number crimes per inhabitants	Eurostat
posenterp	Number of point of sales divided by the number of non financial business firms	BCE - Eurostat
educationpes	Percentage of persons aged from 24 to 65 with a secondary school certificate, weighted by the GDP concentration index.	Eurostat
education09	Percentage of persons aged from 24 to 65 with a secondary school certificate	Eurostat
ageing	Percentage of population aged 65 and over	Eurostat

Table 3

Descriptive statistics: *country data*

Variabili	Obs	Mean	Std. Dev.	Min	Max
gdpxcapita09	25	91,80	27,69	44,00	131,00
cc_per_inhab09	22	1,81	0,89	0,59	3,98
cashratio	25	0,56	0,21	0.06	0,88
sepapop	25	142,68	100,28	8,90	332,70
transpop	25	154,55	100,68	8,90	332,80
transcard09	25	1251,36	2045,62	11,00	8185,00
atmpop09	25	0,76	0,34	0,36	1,61
pospop09	25	18,26	9,91	4,60	45,20
transxpos	25	152,18	113,30	15,30	383,90
cardpercapita	25	67,76	57,04	2,00	183,00
numdd09	25	853,59	1850,09	0,21	8424,45
numct09	25	901,58	1322,02	5,51	5815,53
internetsell08	14	15,61	8,79	3,24	32,20
internetpurch08	14	28,16	16,19	7,05	54,34
enterpx1000inhab	21	48,58	15,67	22,30	83,90
rd	24	1,63	1,03	0,46	3,96
emvcards09	15	71,21	30,46	17,90	100,00
shareofshadoweconomy	25	20,45	7,19	8,50	33,00
shadow09mln	25	73162,00	101373,70	1482,00	351729,00
gini_ineq09	25	29,67	4,00	22,70	37,40
crimepop	23	49,06	30,72	9,48	141,13
posimpr	21	0,36	0,15	0,11	0,65
educationpes	25	0,90	0,45	0,34	1,77
education09	25	73,05	16,82	27,6	91,3
ageing	25	16,20	2,25	11,00	20,40

Comparison of means (1) (2) **Table 4**

Indicators	Cluster 1	Cluster 2	Mean value cluster 1	Mean value cluster 2	Difference of means (3)	*Bootstrap* estimates	Confidence interval *bootstrap* estimates	
gdpxcapita09	15	10	73,87	118,70	44,83***	44,83***	34,27	55,80
			(20,49)	(7,15)	[6,78]	[5,62]		
cc_per_inhab09	13	9	1,93	1,64	-0,29	-0,29	-0,90	0,36
			(1,07)	(0,57)	[0,39]	[0,34]		
sepapop	15	10	74,44	245,03	170,59***	170,59***	117,13	210,72
			(51,17)	(57,79)	[21,99]	[22,51]		
transpop	15	10	86,03	257,33	171,30***	171,30***	128,15	210,59
			(55,84)	(51,18)	[22,07]	[20,96]		
transcard09	15	10	424,87	2491,10	2066,23***	2066,23***	601,22	4274,22
			(646,16)	(2768,24)	[736,30]	[865,02]		
atmpop09	15	10	0,73	0,80	0,07	0,07	-0,19	0,34
			(0,35)	(0,32)	[0,14]	[0,14]		
pospop	15	10	17,95	18,73	0,78	0,78	-6,77	7,53
			(11,70)	(6,97)	[4,13]	[3,63]		
cashratio	15	10	0,67	0,40	-0,27***	-0,27	-0,40	-0,14
			(0,16)	(0,18)	[0,07]	[0,07]		
transxpos	15	10	75,85	266,67	190,82***	190,82***	138,35	248,68
			(40,35)	(86,16)	[25,48]	[27,93]		
cardpercapita	15	10	36,73	114,30	77,57***	77,57***	35,57	110,82
			(32,94)	(54,57)	[17,44]	[19,18]		
numdd09	15	10	233,14	1784,27	1551,13**	1551,13*	381,25	3937,70
			(626,19)	(2629,37)	[700,47]	[817,71]		
numct09	15	10	340,18	1743,68	1403,50***	1403,50**	627,92	2967,49
			(432,33)	(1748,34)	[467,24]	[550,49]		
internetsell08	6	8	8,50	20,94	12,45***	12,45***	4,89	18,33
			(5,59)	(6,74)	[3,39]	[3,29]		
internetpurch08	6	8	13,10	39,46	26,36***	26,36***	13,96	33,34
			(5,24)	(11,27)	[4,99]	[4,54]		
enterpx1000inhab	12	9	52,38	43,51	-8,87	-8,87	-21,44	3,88
			(18,38)	(9,94)	[6,79]	[6,33]		
rd	14	10	0,94	2,58	1,64***	1,64***	1,15	2,21
			(0,50)	(0,78)	[0,26]	[0,27]		
emvcards09	8	7	51,37	93,89	42,51***	42,51***	21,96	62,59
			(28,54)	(9,52)	[11,34]	[10,55]		
shareofshadowec	15	10	25,36	13,08	-12,28***	-12,28***	-14,90	-9,30
			(4,35)	(2,79)	[1,56]	[1,44]		
gini_ineq09	15	10	30,98	27,71	-3,27**	-3,27**	-5,52	-0,44
			(4,41)	(2,30)	[1,52]	[1,31]		
crimepop	15	8	31,35	82,28	50,93***	50,93***	36,84	79,44
			(13,00)	(26,36)	[8,12]	[9,81]		
posenterp	12	9	0,30	0,43	0,13**	0,13**	0,02	0,25
			(0,12)	(0,15)	[0,059]	[0,059]		
educationpes	15	10	1,07	0,65	-0,43**	-0,43**	-0,69	-0,17
			(0,52)	(0,6)	[0,17]	[0,13]		
education09	15	10	70,62	76,69	6,07	6,07	-3,25	19,22
			(21,21)	(5,48)	[6,90]	[5,43]		
ageing	15	10	16,06	16,41	-0,35	-0,35	-1,43	2,17
			(2,23)	(2,37)	[0,93]	[0,94]		

Fonte: Blue Book, Eurostat, Ocse.

(1) Cluster 1 includes countries with values lower that the average level of GDP and non cash payments (per inhabitant) in Europe; Cluster 2 consider countries above the GDP and non cash payment average level in Europe. – (2) Standard deviation is reported in parenthesis; standard error is reported in bracket. – (3) Difference of means between the indicator of cluster 2 and the indicator of cluster 2.

*, **, ***: denote significance level at 10%, 5%, 1%.

Table 5

FACTOR ANALYSIS (principal components)

Factor analysis/correlation

Rotation: (unrotated)

Factor	Eigenvalue	Difference	Proportion	Cumulative
Factor1	4,47198	1,44119	0,4969	0,4969
Factor2	3,03079	2,20522	0,3368	0,8336
Factor3	0,82557	0,48902	0,0917	0,9254
Factor4	0,33655	0,21287	0,0374	0,9628
Factor5	0,12369	0,02793	0,0137	0,9765
Factor6	0,09576	0,01972	0,0106	0,9871
Factor7	0,07603	0,04471	0,0084	0,9956
Factor8	0,03132	0,02301	0,0035	0,9991
Factor9	0,00831	.	0,0009	1

obs		21
Retained	factors	2
Number of	params	17

Table 6

Fattori rilevanti

Rotation: orthogonal varimax

Factor	Variance	Difference	Proportion	Cumulative
Factor1	4,14953	0,7963	0,4611	0,4611
Factor2	3,35324	.	0,3726	0,8336

Table 7

Rotated factor loadings (pattern matrix)

Variable	Factor1	Factor2	Uniqueness	Kmo (Kaiser-Meyer-Olkin measure of sampling adequacy)
zageing 09	0,5813	0,1917	0,6253	0,6276
zind_serv_07	0,9841	-0,0041	0,0315	0,6025
zgdp gdpxcapita 09	0,3366	0,8239	0,2079	0,6481
zatm_num09	0,9617	0,0562	0,072	0,7966
zpos_num09	0,9048	0,1056	0,1702	0,5947
zcard_percapita	-0,1336	0,8997	0,1727	0,7682
ztranspop	0,0111	0,9759	0,0475	0,5826
zrd	0,1195	0,9258	0,1286	0,8089
zshadow09mln	0,9768	0,0666	0,0414	0,703
Overall				0,671

Table 8

ESTIMATED MODELS OF DEMAND FOR PAYMENT INSTRUMENTS (1) (2)

(*standardized coefficients*)

	Model 1 Cash	Model 2 Electronic payments	Model 2a Non cash payments	Model 3 Card payments	Model 4 Internet payments
gdpxcapita	-0,594***	0,362**	0,411**	0,102	0,506***
	(3,703)	(2,141)	(2,865)	(0,531)	(3,88)
posenterp	-0,431***	0,212**	0,270***	0,468***	
	(-3,44)	(2,23)	(3,11)	(3,32)	
shadow09mln	0,146	-0,209*	-0,205*	-0,282*	
	(1,08)	(-2,07)	(-2,12)	(-2,00)	
r&d		0,532***	0,470***	0,502**	0,408*
		(3,60)	(3,47)	(2,45)	(2,07)
Ita				0,027	
				(0,43)	
education09					-0,052
					(-0,47)
ageing					- 0,431***
					(-5,34)
N.	21	21	21	21	13
R-quadro (adjasted)	0,779		0,913	0,805	0,794

*, **, ***: denote significance level at 10%, 5%, 1%.

(1) t-value in parenthesis.

(2) In the case in which the dependent variable is expressed in relative terms, the value of which is included in an interval [0-1] (percentages, such as the "cash card ratio" equal to the ratio of cash withdrawals to total cash and non-cash operations) the estimates were carried out by using a Tobit model for truncated variables. The results confirm the ones obtained with the OLS approach.

Table 9

BOOTSTRAPPED ESTIMATES: MODEL OF DEMAND FOR CASH AND ELECTRONIC PAYMENTS

(*normalised coefficients*)

	Model1			Model2		
	Coeff. (1)	Bootstrap [95% Conf.Interval] (2)		Coeff. (1)	Bootstrap [95% Conf.Interval] (2)	
gdpxcapita	-0,004	-0.00677	-0.00186	1,281	-0,13345	2.41151
	(0.001)			(0,662)		
posenterp	-0,623	-1.05159	-0.24409	144,271	5,57498	300,2961
	(0.205)			(76,498)		
shadow09mln	0,000	-0,00000	0,00000	-0,000	-0.00046	0.000012
	(0.00)			(0.000)		
education09						
rd				50,760	11,29954	79,631
				(18,194)		
r2	0,732			0,913		
r2_a	0,685			0,892		
N	21			21		

(1) The significance level is based on normally distributed intervals. Bootrapped standard error in parenthesis.
(2)) Intervals of confidence are bias-corrected and accelerated (Bca). The level of significance of the coefficients is confirmed in the case the Bca interval does not include the zero term.

Table 10

BOOTSTRAP ESTIMATES: MODELS OF DEMAND FOR PAYMENT INSTRUMENTS
(*standardized coefficients*)

	Model2a			Model3			Model4		
	Coeff. (1)	Bootstrap [95% Conf.Interval] (2)		Coeff. (1)	Bootstrap [95% Conf.Interval] (2)		Coeff. (1)	Bootstrap [95% Conf.Interval] (2)	
gdpxcapita	1,456	0,33577	2,42634	0,212	-0,73114	1,01016	0,351	-1,98028	0,744503
	(0,558)			(0,445)			(0,369)		
posenterp	183,980	29,260	305,9781	187,028	50,8055	312,9636			
	(67,241)			(64,293)					
shadow09mln	-0,000	-0,00045	0,00002	0,000	-0,00031	0,00010			
	(0,000)			(0,000)					
education09							-0,053	-6,00432	0,67792
							(0,540)		
rd	44,817	9,24073	72,14747	28,050	-5,14648	48,08906	8,044	-2,55797	53,39177
	(15,622)			(12,592)			(8,864)		
lta				7,313	-8,19953	50,32868			
				(46,834)					
ageing09							-3,111	-9,07254	-0,31617
							(2,862)		
r2	0,913			0,805			0,794		
r2_a	0,892			0,740			0,692		
N	21			21			13		

(1) The significance level is based on normally distributed intervals. Bootrapped *standard error* in parenthesis.
(2) Intervals of confidence are bias-corrected and accelerated (Bca). The level of significance of the coefficients is confirmed in the case the Bca interval does not include the zero term.

ITALY: REGIONAL COMPARISONS

Table 11

VARIABLE DESCRIPTION (at province level)

(estimated models reported in tables 13 and 14)

Variable	Description	Source
Dependent variables		
SEPA transactions per inhabitant (SEPAPOP)	Number per inhabitant of payment with credit transfer, direct debit and card	Banca d'Italia
Percentage of Internet payments (INTERNETSHARE)	Percentage of internet payments on banking and postal payments	Banca d'Italia
Card payments per inhabitant (TRANSCARD)	Number of credit cards, debit cards and prepaid cards transactions per inhabitant	Banca d'Italia
EBANKP	Number of online network connections for e-banking per inhabitant	Banca d'Italia
Cash Card Ratio	Ratio of withdrawals from ATMs and total number of ATM and POS transactions	Banca d'Italia
Cash Tot Ratio	The ratio of the overall flow of cash withdrawals from the (traditional and automated) cash desks to the total value of electronic payments	Banca d'Italia
Explanatory variables		
ATMPOP	Number of atm per inhabitant	Banca d'Italia
ATMPOS	Number of atms divided by the number of point of sales	Banca d'Italia
ACCOUNTPC	Number of overnight deposit accounts per inhabitant	Banca d'Italia
CRIME	Number of crimes declared to the justice offices per inhabitant	Istat
CRIME2	Number of crimes from drug dealing, prostitution and receiving stolen within the province per inhabitant	Istat
AGEING	Percentage of population aged 65 and over	Istat
INTDEP	Interest rate on current accounts	Banca d'Italia
MICRO	Percentage of non financial business firms with less than 10 employees	Istat
GDPENTERP	GDP divided the number of non financial business firms	Banca d'Italia, Istat
POSENTERP	Number of point of sales divided the number of non financial business firms	Banca d'Italia, Istat
POSPOP	Number of point of sales per inhabitant	Banca d'Italia
SHADOW1	Number of specific tax audits in a province divided by its sample mean value (weighted by a GDP concentration index)	Guardia di Finanza
SHADOW2	Share of employment in agriculture and constructions (proxy for irregular work)	Istat
SHADOWPOS	Ratio of the number of detected tax frauds on cash registers and commercial receipts within the province to the number of existing POS)	Guardia di Finanza
SHAREBILL	Share of pre-determined bill on the total number of non cash payment in the province	Banca d'Italia
SAFETY	Square root of the summation of the percentage of chip cards and the percentage of blocked cards because of security reasons (proxy of the index of the prevention technology).	Banca d'Italia
EDUCATION	Share of graduated persons resident in the province	Istat
YPC	Provincial GDP per inhabitant	Ist. Tagliacarne

Table 12

DESCRIPTIVE STATISTICS
(variables of estimated models reported in the tables 13 e 14)

Dependent variables	*Obs*	*Mean*	*Std. Dev.*	*Min*	*Max*
SEPA transactions per inhabitant (SEPAPOP)	103	41.9625	22.16807	10.30196	122.3383
Percentage of Internet payments (INTERNETSHARE)	103	.0301479	.0156239	.0105854	.1136993
Card payments per inhabitant (TRANSCARD)	107	33.39614	21.05032	1.0139	108.3976
EBANKP	107	.3546119	.1201288	.1272011	.7124479
Cash Card Ratio	107	.4514341	.1190565	.2064787	.8299388
Cash Tot Ratio	99	.0896071	.0442928	.0077287	.2158397

Explanatory variables	*Obs*	*Mean*	*Std. Dev.*	*Min*	*Max*
ATMPOP	107	.0008919	.0003292	.0000861	.0022047
ATMPOS	107	.0457143	.0120266	.0084034	.0725651
ACCOUNTPC	107	.6295452	.1733305	.3105971	1.169849
CRIME	88	.6139773	.6900901	.115	5.048
CRIME2	88	.040914	.0300987	.0015765	.1418214
EBANKP	107	.3546119	.1201288	.1272011	.7124479
AGEING	103	152.1641	46.84873	64.58	263.27
INTDEP	107	.3102077	.0874062	.1280326	.6433469
MICRO	103	.948645	.0124002	.9216719	.971199
GDPENTERP	107	298019.4	39066.38	226283.8	408428.3
POSENTERP	103	.2477708	.0594285	.1564102	.4306536
POSPOP	107	.0198586	.0070983	.0053679	.0413248
SHADOW1	103	99331.39	54055.17	22524.79	286611.3
SHADOW2	88	.1364527	.0444241	.0452649	.291748
SHADOWPOS	103	.1123957	.0679449	.0162403	.3218178
SHAREBILL	103	.1655236	.0648434	.0539852	.3386953
SAFETY	107	.0261461	.0162013	.0000898	.0917766
EDUCATION	107	.0075965	.0071015	.0000161	.043422
YPC	107	24023.98	5675.603	14345.56	36530.24

Table 13

ESTIMATES OF THE EQUATION MODEL DEMAND FOR ELECTRONIC PAYMENT INSTRUMENTS IN ITALY (1)

(*provincial data; standardized coefficients*)

	SEPAPOP		***INTERNET***		***TRANSCARD***	
Regressor (a)	**model 1a** **Sepa transactions per inhabitant**	**model 1b** **Sepa transactions per inhabitant**	**model 2a** **Percentage of Internet payments (%)**	**model 2b** **N. online accounts pr inhabitant**	**model 3a** **N. Card payments per inhabitant**	**model 3b** **N. Card payments per inhabitant**
YPC	0,425***		0,244***	0,421**		
	(5,688)		(1,501)	(2,621)		
ACCOUNTPC		0,411**	0,697**	0,498***	0,340**	0,351**
		(3,771)	(4,334)	(2,931)	(2,132)	(2,146)
BANKP	0,310***	0,208**				
	(3,512)	(2,361)				
POSENTERP	0,215***	0,165***				
	(3,275)	(2,601)				
ATMPOS					-0,291***	-0,281***
					(-3,532)	(-3,523)
SAFETY					0,394***	0,350**
					(2,661)	(2,171)
EDUCATION			0,125**	-0,049		
			(2,214)	(-0,801)		
AGEING			-0,425**	-0,205*		
			(-2,624)	(-1,931)		
SHADOW1	-0,096*					
	(-1,833)					
SHADOW2		-0,245***				
		(-3,871)				
SHADOWPOS					-0,205*	-0,187**
					(-2,738)	(-2,478)
CRIME					0,127*	
					(1,978)	
FRAUDPOS					-0,153*	
					(-1,661)	
Obs,	88	88	102	102	88	88
R quadro (corrected)	0,599	0,656	0,540	0,644	0,570	0,548
F statistics	43,080	35,000	32,080	49,850	20,060	13,590

T-test in parenthesis. Significance level at: * = 10%, ** = 5%, *** = 1%.

(1) In the case in which the dependent variable is expressed in relative terms, the value of which is included in an interval [0-1] (percentages, such as the "cash card ratio" equal to the ratio of cash withdrawals to total cash and non-cash operations) the estimates were carried out by using a Tobit model for truncated variables. The results confirm the ones obtained with the OLS approach.

Note (a): see the variable description in Table 11.

Table 14

ESTIMATES OF THE CASH DEMAND EQUATIONS (1)
(*provincial data; standardized coefficients*)

Regressor [a]	**model 4a** **Cash card Ratio**	**model 4b** **Cash card Ratio**	**model 4c** **Cash Tot Ratio**
YPC	-0,327***	-0,283*	-0,292**
	(-3,080)	(-1,716)	(-2,401)
POSENTERP	-0,396***	-0,388***	
	(-5,770)	(-5,478)	
ATMPOS			0,133*
			(1,775)
SHADOWPOS	0,180*	0,152*	0,191***
	(-1,854)	(1,650)	(2,823)
ATMPOP		0,171*	
		(1,717)	
GDPENTERP		0,165*	
		(1,997)	
SHAREBILL		0,365***	0,144
		(2,876)	(1,292)
MICRO			0,256**
			(2,173)
CRIME2			0,158**
			(2,482)
INT_DEP			-0,0601
N. obs.	102	103	88
R quadro (corretto)	0,501	0,563	0,715
F statistics	50,.960	27,600	33,921

T-test in parenthesis. Significance level at: * = 10%, ** = 5%, *** = 1%.

(1) In the case in which the dependent variable is expressed in relative terms, the value of which is included in an interval [0-1] (percentages, such as the "cash card ratio" equal to the ratio of cash withdrawals to total cash and non-cash operations) the estimates were carried out by using a Tobit model for truncated variables. The results confirm the ones obtained with the OLS approach.

Note (a): see the variable description in Table 11.