

The acceptance of payment methods on the Polish e-commerce market

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Abstract

The paper deals with an analysis of factors influencing the acceptance of the seven major payment methods (i.e. cash on delivery, bank transfer, online payment integrator, payment in person, pay-by-link, card payment and virtual payment provider) by the Polish online shops. Our research was based on empirical data obtained from survey interviews conducted with the managers of online shops. The univariate logit models describing the acceptance of seven payment methods were constructed. A total of 45 explanatory variables divided into five categories were taken into account.

The results obtained in the study demonstrated that a shop's strategy of using traditional and electronic distribution channels has a strong influence on its acceptance of particular payment methods. The preferences of online shop managers, the involvement in online auctions and cross-border sales also play a significant role. The study confirmed competition between banks and non-bank intermediaries on the payment market as well as the widespread popularity of outsourcing in the area of online payments.

JEL classification – L81, E42, G21, O33

Keywords – Payment acceptance, Online shops, Electronic Commerce, Non-bank payments,
Online auctions

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1. Introduction

The payment market is an example of a two-sided market where technological and business platforms compete (Rochet and Tirole, 2003; Milne, 2005; Chakravorti and Roson, 2006), so the platforms have to be accepted by both customers and merchants. A strong influence of network effects and economies of scale can be observed on this market (Gowrisankaran and Stavins, 2004; Bolt and Humphrey, 2007). The growing significance of e-commerce all over the world led to that it has become a subject of many studies (Eastin, 2002; Min and Galle, 2003; Koyuncu and Bhattacharya, 2004; Liu *et al.*, 2008; Schröder and Zahariab, 2008). However, most of these studies focus on the demand side of the market and take into account various factors influencing the preferences and choices of individual customers. Factors affecting the decisions of merchants have not been studied thoroughly, probably due to that they are more difficult to analyse. It should be remarked that the availability of payment instruments accepted on the Internet for customers is an extremely important, but simultaneously frequently underestimated, factor influencing the development of e-commerce. In a situation where the basic instruments are available to a limited degree, an example of which is the availability of credit cards in Poland², on-line shops managers' decisions concerning the methods of payment become more and more important.

Just as payment instruments influence the expansion of online shopping, e-commerce is a vital stimulus to the development of payment services (Evans and Schmalensee, 2008). Analyses of innovations conducted in the field of payment services over the last 20 years have clearly shown that on-line payment systems have provided more solutions than those used in local Points-of-Sale (OECD, 2006; Heng, 2007; Chande, 2008). On the one hand this results from highly varied payment needs of Internet users, but on the other hand, it stems from relatively low costs of online payment systems, owing to which niche solutions can function (Heng, 2007). Low costs needed to introduce online payments into the market result from the fact that these services do not require the development of a dedicated nation-wide network of acceptance in local Points-of-Sale (Levitin, 2007) as they use the already existing and universal infrastructure of the Internet. The abundance of online payment methods compel Internet shops to select only those that will be accepted. Results of these decisions strongly affect the development of the whole e-commerce market.

This study seeks to identify the drivers underlying the decision of online shop managers to accept particular payment methods. The empirical analysis presented here is

² In 2007 only 8.2% of Poles aged 15-75 held credit cards, 35% possessed debit cards, and only 48% had a bank account, (source: Polasik and Maciejewski, forthcoming 2009).

based on a sample of online shop managers and employs an extensive set of explanatory variables. The logit models were constructed to explain the reasons for accepting or rejecting the most important seven payment methods by an online shop. So far, the research concerning e-commerce supply side has been rarely published and many factors taken into account in our study, such as parallel physical distribution channels, the role of auction markets, or managers' preferences³, are a real novelty. This study focuses on Poland, which is the biggest market among the new EU member states (Eurostat, 2008) and records extraordinarily large dynamics of e-commerce development.

The paper is structured as follows. Section 2 provides a brief comparison of e-commerce⁴ in Poland and other EU member states, whereas Section 3 contains a description of the major methods of payment used in e-commerce in Poland and abroad. The conceptual research model and research hypotheses are presented in Section 4. Section 5 focuses on the methodology used in the study as well as on potential explanatory variables. The results of empirical research conducted on the basis of the logit model for selected seven payment methods are presented in section 6. The last section contains the summary and conclusions.

2. E-commerce in Poland and other European Union countries

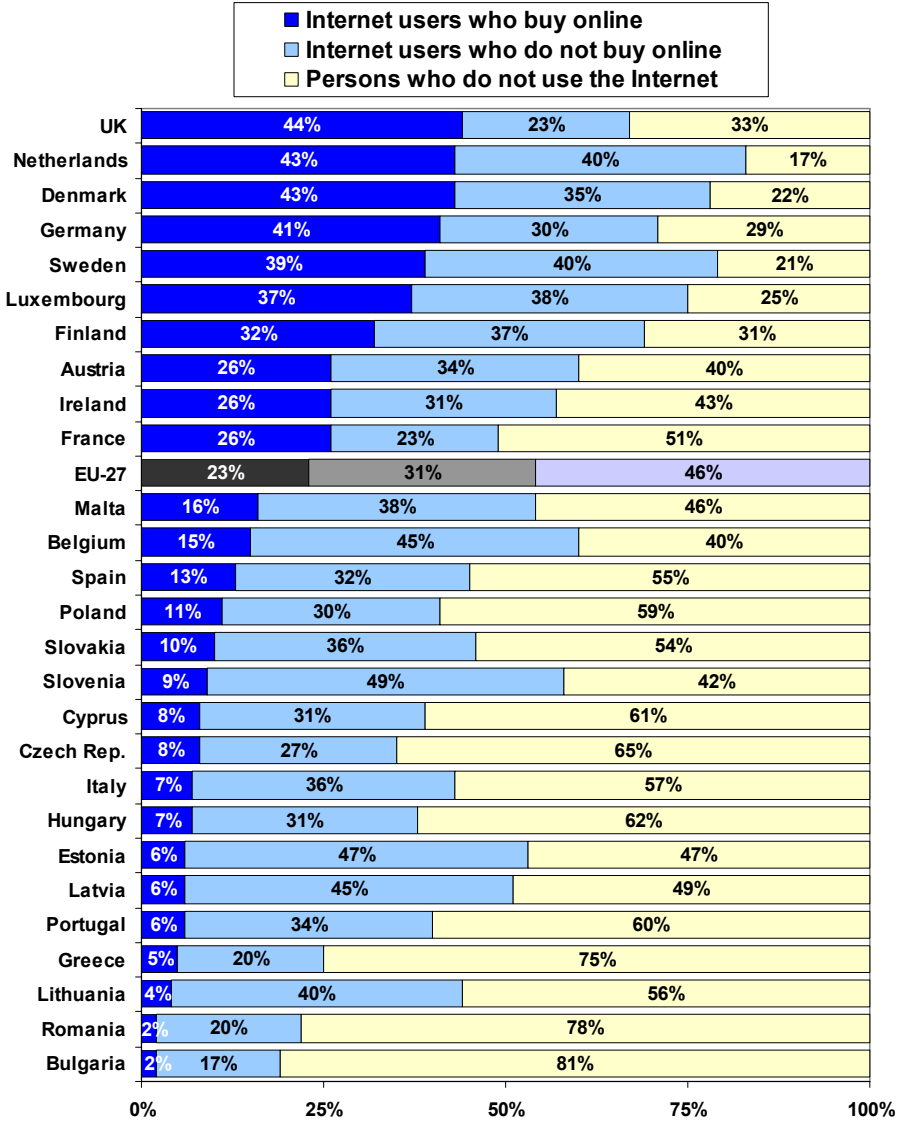
Owing to its unusually dynamic development, the Internet has been used for various commercial purposes, with e-commerce as one of the most important applications. This market has already become a vital segment of retail in many countries all over the world. However, the degree of e-commerce development depends on many factors, including the availability of the Internet, the activity of users as regards shopping, customers' trust in online transactions, and the amount of a household's disposable income per capita (Oxley and Yeung, 2001). Consequently, there exist considerable differences in the use of e-commerce and payment methods in particular countries. Figure 1 illustrates the percentage of Internet users and online shoppers in the European Union in 2007. The percentage of online shoppers in the whole population (aged 16-74) was the biggest in the United Kingdom (44%), and only slightly lower in the Netherlands and Denmark (43%) as well as in Germany (41%). The average percentage of online shoppers in the whole European Union (27 states) equalled 23%. In Poland, 11% of the society shopped online, which ranked the country first among the new

³ Managers' preferences as to payment methods were analysed in the research conducted by Arango and Taylor (2008); however, this study focused only on payments at Points-of-Sale in physical distribution channels but not in e-commerce.

⁴ In this paper the term e-commerce is used in a narrow sense and refers to the online market and transactions concluded via Internet.

EU member states from Central Europe. It must be noticed that this result was only slightly lower than that recorded for Spain (13%) and higher than the one for Italy (7%) and Portugal (6%).

Figure 1. Percentage of Internet users and online shoppers in the European Union in 2007

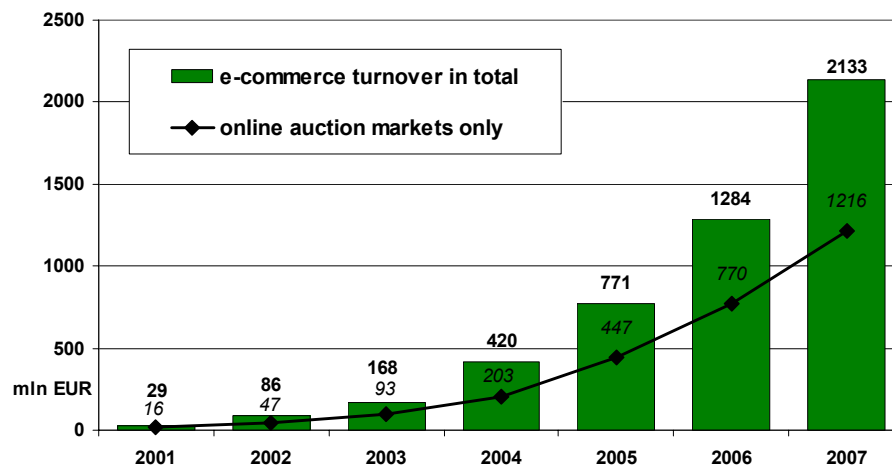


Source: Authors' own compilation based on Eurostat (2008); Data for 2007 concerning persons aged 16-74; The percentage takes into account persons who performed a given activity within three months before the study.

At the end of the 20th and the beginning of the 21st centuries, e-commerce played a minor role in Poland. It was only in 2004 that one could observe the start of dynamic development of e-commerce in Poland (see Figure 2). According to the data from the Interactive Advertising Bureau (Kaznowski, 2005), the first time e-commerce accounted for 1% of total retail trade in Poland was in 2005 (whereas it was 2.5% in Western Europe and 4% in the USA). In 2007 the Polish e-commerce turnover increased by 61% and equalled

EUR 2.13 billion (Grzechowiak and Jarosz, 2008). A typical feature of the Polish Internet market is a considerable share of online auction markets, accounting for 50 to 60% of the total turnover. In 2007, the value of the Allegro.pl auction market turnover, the leader of the Polish Internet auction markets, increased to EUR 1.03 billion (an annual increase of 56%). The other four leading auction systems had their turnover estimated at a total of about EUR 0.19 billion, whereas approximately 4,000 online shops recorded a total turnover of more than EUR 0.9 billion. It must be remarked that a part of the Internet shops turnover is generated through online auctions where the shops offer their products. The development of e-commerce in Poland is stimulated by a dynamically increasing number of Internet users, which rose from 8.8 million to 14.1 million between 2005 and 2007 (Internet World Stats, 2008).

Figure 2. E-commerce turnover in Poland between 2001 and 2007



Source: Grzechowiak and Jarosz (2008); The annual average PLN / EUR exchange rate was employed.

3. Payment methods in e-commerce

The dynamic development of e-commerce stimulates the demand for payment services which are useful in online shopping. The providers of payment services used in e-commerce can be divided into two groups: (a) banks and acquirers and (b) non-bank intermediaries offering payments based on various innovative solutions. The emergence of a new group of intermediaries resulted from the demand for servicing transactions conducted on specific new electronic markets, particularly Internet ones. Initially, banks were not interested in such payment methods, especially the so-called micropayments, as they were unprofitable due to the limited value of transactions, (OECD, 2006; McGrath, 2006; Kisiel, 2006). Moreover,

traditional bank and card payment⁵ methods were often inconvenient to make online transactions and did not guarantee security to the transaction parties, especially to the buyer. In many cases it is also difficult to use them due to legal or system limitations, e.g. when making cross-border payments. Consequently, there emerged a market niche that was used mostly by IT firms (Chande, 2008).

The growing importance of e-commerce for economy in recent years encouraged many banks to offer payment services dedicated to online and low-amount transactions, which has resulted in an increased competition in this segment of the retail payments market. Since banks enjoy public trust and deal with millions of customers in traditional distribution channels, they find it relatively easy to win the trust of Internet users (OECD, 2006; Heng, 2007). Consequently, many customers who appreciate security will opt for payment services offered by banks, especially that in most cases the cost of the service for the customer is low. Payment methods offered by non-bank institutions are usually more flexible (e.g. person-to-person payments, payments via e-mail) and quicker as compared to services provided by banks (González, 2004; Jackson, 2006). They facilitate easy and effective conclusion of cross-border transactions, which is greatly appreciated by many customers in the era of globalization (the advantage of non-bank institutions in this respect has been partially eliminated as a result of SEPA development; Bolt and Humphrey, 2007; Jonker and Kosse, 2008). It must be noticed that non-bank entities include also online payment integrators, which specialize in combining and servicing the maximum number of payment methods within one system. Their role often goes unnoticed as they are almost transparent for buyers⁶. However, due to that they offer the outsourcing of online payments, they bring in a new quality and functionality for online shops, owing to which these institutions exert considerable influence on the e-commerce market.

⁵ In this study, term *payment card* means any payment card which can be used to make online payments. Until recently it has been mainly the credit card; however, today online payments can also be made with debit cards and pre-paid cards (the percentage of such cards in Poland was low when the research was conducted). Moreover, the market knows the so-called virtual cards which can be used for online and remote payments. Despite that the functionality of these cards differs substantially for customers, online shops cannot diversify their acceptance. It results from that acquirers usually do not inform online shops about the kinds of cards they accept, even though there may charge slightly different commission on each (e.g. differences concerning the Interchange Fee). Therefore, in the survey, shop managers were asked only about the *payment card* in general.

⁶ Customers consider online payment integrators to be transparent because they usually provide an Internet interface that services many payment methods. Thus, it is not perceived as a payment method by customers for whom the payment method is the instrument they will eventually use to conclude the transaction, e.g. a credit card. The intermediation of online payment integrators is of secondary importance for customers (excluding the question of trust and security). However, online shops treat online payment integrators as a separate payment method because they are often not informed about the way the customers used to pay the intermediary. Online shops receive payments, diminished by the commission for the intermediary, in the same way, irrespective of the methods the customers used to pay.

The most important payment methods used in e-commerce are presented in Table I. Generally, it must be concluded that customers can choose from a wide range of payment methods, including various forms of cash based payments, cards and mobile payments⁷, as well as totally virtual instruments. Due to customers' concerns about the security of online transactions, the usefulness of pre-paid instruments (limiting the amount of possible losses resulting from fraudulent transactions) is much greater than that of payments in local Points-of-Sale. It must be noticed that the customers who do not have access to bank and card instruments may perform online transactions using various forms of cash transfer, including online vouchers and cash payments at the traditional cash desk for the shopping done online (payment in other POS).

Table I. Comparison of types of payments used in e-commerce

	Cash based	Bank's intermediation	Non-bank's intermediation
pay before	<ul style="list-style-type: none"> online vouchers 	<ul style="list-style-type: none"> virtual/pre-paid card 	<ul style="list-style-type: none"> mobile payment (e-wallet) virtual (e-mail) payment provider virtual (e-mail) payment + Escrow online vouchers (online purchase)
pay now	<ul style="list-style-type: none"> cash on delivery payment in person payment in other POS payment onto banking account (eg. at post office) 	<ul style="list-style-type: none"> bank transfer (any ordering channel) pay-by-link debit card 	<ul style="list-style-type: none"> mobile payment (current account) virtual (e-mail) payment provider
pay later		<ul style="list-style-type: none"> credit/charge card 	<ul style="list-style-type: none"> mobile payment via SMS mobile payment (based on credit card) virtual (e-mail) payment provider (based on credit card)

online payment integrator

Source: Authors' own study.

Most of the above payment methods are common in online transactions, however, some of them need to be precisely defined in order to be further used in the research model. Thus,

- **online payment integrator** is a company providing many types of payment for Internet shops. On the basis of a framework agreement, this intermediary automatically services many payment channels, owing to which the shop is not engaged in this process. This activity should be treated as a form of outsourcing;

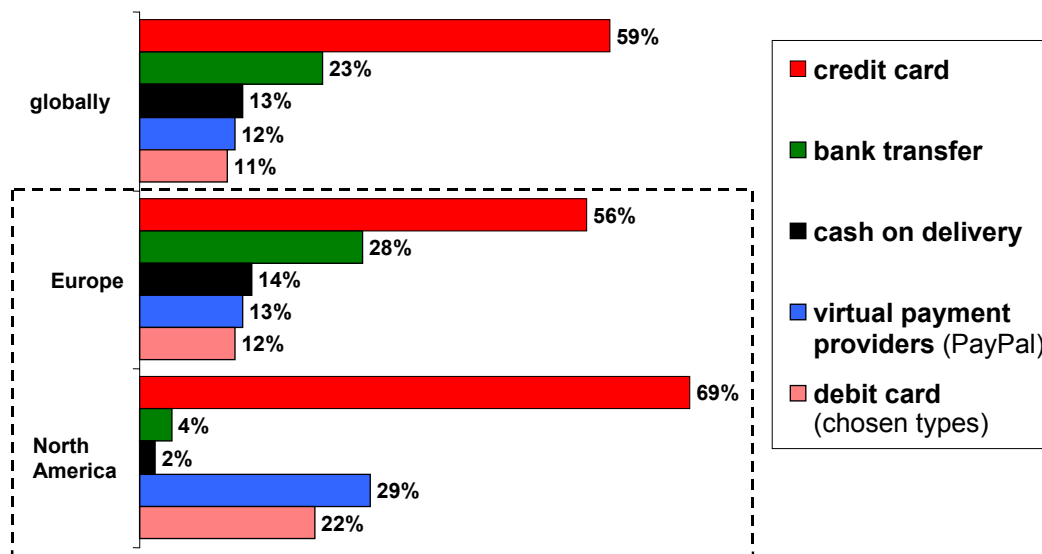
⁷ See: Van Bossuyt and Van Hove, 2007.

- **pay-by-link** is a solution consisting of an online interface, which automatically generates a bank transfer form that is authorised by the customer at their bank's online banking service. Thus, it is just an online cover for traditional bank transfers. However, a significant added value of pay-by-link comes from that the transaction is more convenient for the customer and the online shop is immediately informed about the payment;
- **virtual (e-mail) payment provider** is a company (usually non-bank) which facilitates sending the payment at the recipient's e-mail address through virtual accounts. The money needed to make the payment usually comes from debiting the buyer's payment (credit or debit) card. Owing to this method, individuals can accept payments in person-to-person transactions. The most popular instrument of this type is PayPal (Chande, 2008);
- **payment in person** means that the customer receives the goods ordered via the Internet and pays for them at a local Point-of-Sale or at the warehouse belonging to the online shop (also pure-play online shop can use that method);
- **payment in other POS** means that the customer pays for the shopping done online through a system applied to enable cash payments for bills (for electricity, gas, or telecommunications services) in shops or other Points-Of-Sale which belong to merchants different than the online shop. These systems usually use a dedicated terminal network.

3.1 Dominant payment methods in global e-commerce

Credit cards are the most popular payment method in global e-commerce (OECD, 2006). In 2005 the card was used by 59% of online shoppers (Figure 3), whereas the bank transfer was the second most popular payment instrument in the world (23%). Cash on delivery, virtual payment providers (e.g. PayPal) and debit cards were used less frequently (13%-11%). North America, the biggest e-commerce market in the world, was dominated with credit card payments (69%), while the second popular method were virtual payment providers (29%). Another popular payment method was the debit card (22%), whereas the bank transfer (4%) and cash on delivery (2%) played a minor role in North America (ACNielsen, 2005).

Figure 3. The most popular payment methods in global e-commerce in 2005



Customers could use several payment methods (multiple choice).

Source: ACNielsen (2005).

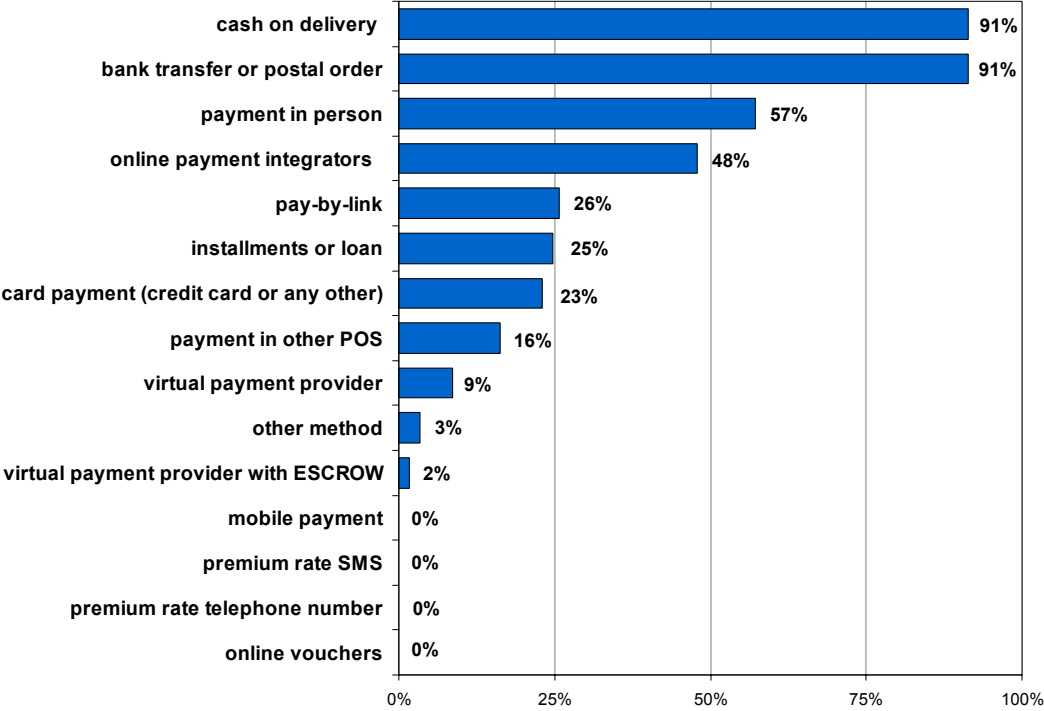
European Internet users displayed other preferences in relation to methods of payment for their online shopping. Similar to North America, credit cards were the most popular payment method (56%); however, European customers often used bank transfers (28%). Cash on delivery (14%), virtual service providers (13%) and debit cards (12%) were less popular. In the countries which were taken into account in the study of ACNielsen (2005), the bank transfer was used by most customers in Germany (as many as 83%) and Austria (65%), whereas Poland and Belgium came third with 42%. In Europe bank transfers are an important payment method in e-commerce (European Commission, 2008). However, in order to use them conveniently and effectively to pay for their online shopping, customers must have access to the Internet banking system, which may limit the availability of bank transfers (Polasik and Wisniewski, 2009).

3.2 The structure of payment methods in Poland

The survey research commissioned by the National Bank of Poland in 2008 showed that the structure of payment methods used in e-commerce in Poland significantly differs from that observed on the leading world markets (Polasik and Maciejewski, 2009). In terms of the popularity of acceptance, the Polish online market is dominated by two payment methods (see Figure 4): (1) cash on delivery and (2) the bank transfer (or its equivalent in the form of a postal order transferred to the shop's bank account) which are accepted by 91% of Internet

shops. The third most commonly accepted method was payment in person (57%). The advantage of this solution is the possibility of overcoming customers' mistrust, especially in the case of high-value transactions (e.g. the purchase of a laptop or refrigerator). However, this method is effective from the economic point of view only when used close to the customer's place of residence, which deprives it of one of the greatest advantages of e-commerce, i.e. its national-wide range. The popularity of cooperation between shops and online payment integrators shall be noticed. Almost a half of Internet shops (48%) decided to employ these intermediaries to outsource all or some types of payment. Owing to such a solution, customers are offered a wide range of payment methods without involving shops in their servicing (in particular, shops do not have to sign agreements with banks or acquirers to accept card payments or pay-by-link transfers). Moreover, 26% of shops accepted pay-by-link without the mediation of online payment integrators.

Figure 4. Structure of payment methods accepted by online shops in Poland

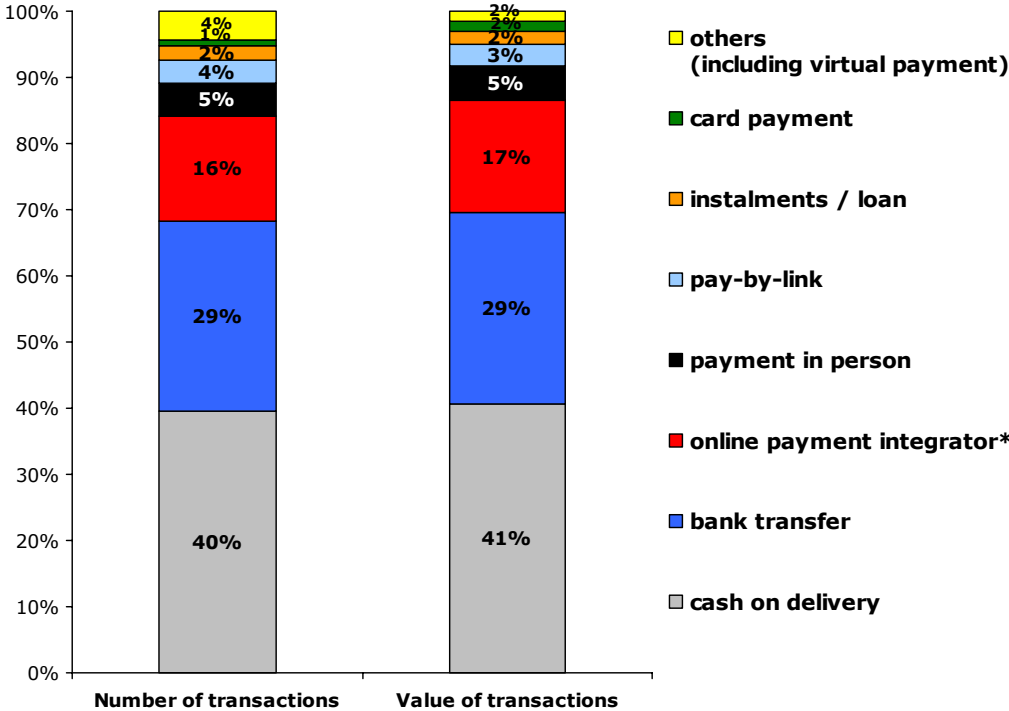


Source: Research conducted by Polasik and Maciejewski (2009), online shops sample N=117.

The results of this survey show that the popularity of accepting various payment methods (Figure 4) was connected with the volume of trade turnover generated by a particular method (Figure 5). Three most important payment methods in e-commerce included: (1) cash on delivery (39.5% of transactions and 40.6% of turnover value), (2) bank transfer to the shop's bank account (28.7% of transactions and 29% of turnover value), and (3) online payment integrators (15.9% of transactions and 16.9% of turnover value, including all

available payment methods). It is worth noticing that within the online payment integrators bank transfer and card payment have significant shares in the number and value of transactions. However, even adding direct and outsourced card payments, they still play a rather small role on the Polish market.

Figure 5. Percentage of payment transactions for online shopping according to payment method



* The following payment methods were used within the online payment integrators:

	% of total number of transactions	% of total value of transactions
pay-by-link	2.6	2.2
card payment	3.3	2.8
bank transfer	8.7	7.9
others	1.3	4.0
Total for online payment integrator	15.9	16.9

Source: Research conducted by Polasik and Maciejewski (2009), online shops sample N=117.

The above results indicate that the structure of payment methods used in the Polish e-commerce significantly differs from the international one (see Figure 3). Due to the importance of bank transfers, which demonstrates a major role of banks, the Polish market resembles the structure of the European markets rather than that of the North American market.

Worth noticing is the dominance of methods based on domestic settlement systems which are difficult to apply in cross-border trade, i.e. cash on delivery and bank transfer. However, both these methods may find direct application in online auctions in person-to-

person transactions, which is impossible in the case of payment cards that require the mediation of virtual payment providers.

4. Conceptual research model and hypotheses

On the basis of the usage structure of payment methods in the Polish e-commerce (presented in Figure 5) and the data from developed markets (see Figure 3), i.e. North American and West European ones, seven most important methods of payment have been distinguished. These methods include⁸: (1) *cash on delivery*, (2) *bank transfer*, (3) *online payment integrator*, (4) *payment in person*, (5) *pay-by-link*, (6) *card payment* and (7) *virtual payment provider*. In the research, the acceptance of each of these methods has been established as dependent variable and analysed in the econometric models described in consecutive parts of this work.

The selected methods differ in many respects. The most innovative methods include *virtual payment provider*, *online payment integrator*, and *pay-by-link*. *Bank transfer* and *pay-by-link* are based on a domestic system of credit transfer settlements, whereas *card payment* depends on payment cards settlements. Only *card payment* and *virtual payment provider* facilitate the acceptance of foreign payments, whereas the other methods shall be used on the domestic market. Since it does not entail any commission for recipient, *bank transfer* is clearly the cheapest method in terms of the cost of acceptance (OECD, 2006). *Card payment* is the least secure method for the shop because it is exposed to chargeback⁹ (Frank, 2004; OECD, 2006), whereas accepting *cash on delivery*, the shop runs the risk of losing the postage if the customer does not collect the parcel. The most secure methods use payments made in advance, i.e. *bank transfer* and *pay-by-link*. There are significant differences in the scope of the acceptance of particular payment methods on the Polish e-commerce market as shown in Figure 4.

⁸ Payment methods have been ordered according to descending values of their shares in total turnover of Polish Internet shop.

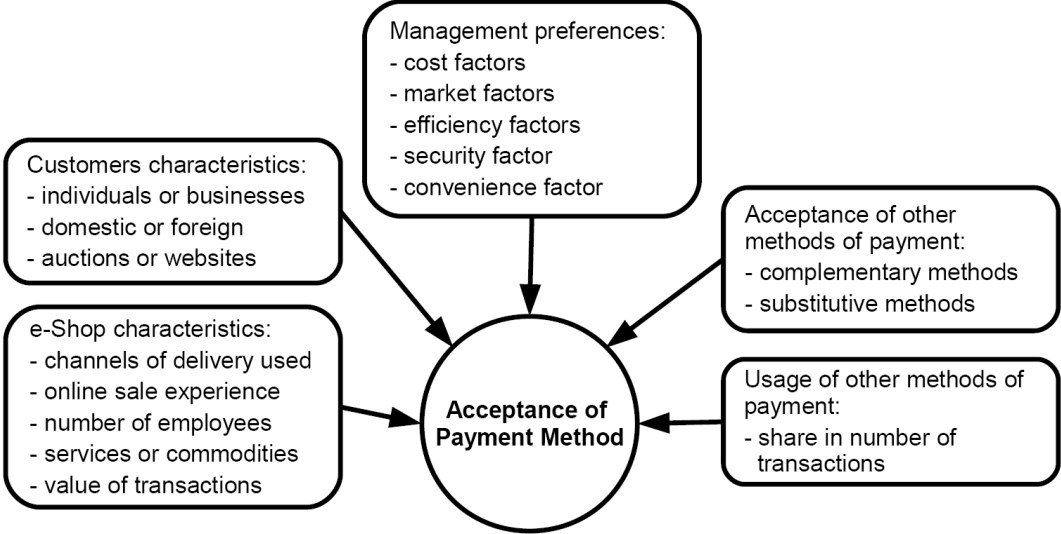
⁹ Such a low evaluation of the security of card payment does not concern 3D Secure Standard, supported by Verified By Visa and MasterCard SecureCode, which offers a high level of security. However, due to that such cards were not used on a large scale in Poland during the research (actually, they were offered only by one bank), the research results concern only cards without 3D Secure. Surcharging is not used in online transactions, irrespective of the kind of card.

The methods vary also in respect to their availability for Polish citizens. In September 2007 (Polasik and Maciejewski, 2009¹⁰) only 48% of Poles aged 15-75 [65% of Internet users respectively] held a bank account (and thus could make *bank transfers*), whereas 13% [33%] had a bank account that could be managed via the Internet and offered access to *pay-by-link*. 35% of Poles [53%] held debit cards, most of which excluded online payments. Only 8% of Polish citizens [13%] had credit cards, which significantly limited the use of *card payment*. The least popular method were accounts offered by *virtual payment providers*, held by as little as 0.6% of the society [1,6%]. *Online payment integrator* allowed customers to use any of the above payment methods, and was thus readily available, whereas almost all citizens could use *cash on delivery* and *payment in person*. The survey study of Polish society revealed that the customers considered *pay-by-link* and *cash on delivery* to be the most convenient payment methods on the Internet and thought *virtual payment provider* to be the least advantageous one.

In order to analyse the factors influencing the acceptance of chosen payment methods by the Polish online shops, we have formulated a conceptual research model presented in Figure 6. Within the proposed model, the authors divided into five major categories the hypothetical factors which might influence an online shop management's decision about the acceptance of a particular payment method. These categories include: (i) *e-Shop characteristics*, (ii) *customers characteristics*, (iii) *management preferences*, (iv) *acceptance of other methods of payment*, and (v) *usage of other methods of payment*. Each category was further divided into particular factors and each factor was studied with one or several explanatory variables.

¹⁰ The second survey study conducted by Polasik and Maciejewski for the National Bank of Poland under the project "Innovative payment services in Poland and Worldwide" based on a representative sample of Poles (Polasik and Maciejewski, forthcoming 2009).

Figure 6. Research model



Source: Authors’ own study.

Conducted at the initial stage of the study, the analysis of specialist literature and interviews with experts in e-commerce convinced the authors that the decision about accepting or not accepting a particular payment method may be based on a *given shop characteristics* which consists of several particulars. Selling via both the Internet and various physical distribution channels shall encourage the acceptance of *payment in person* and payment cards as long as they are accepted at local POS. A considerable number of employees shall encourage the acceptance of laborious methods, such as *payment in person*, *cash on delivery* and *bank transfer* (which requires be checked by staff). Firms with few employees shall prefer automated methods, especially *online payment integrator*, which relieve the shop staff of their duties. It may be assumed that shops with greater experience in e-commerce shall be more likely to optimise decisions and accept particular payment methods. Market observations imply that offering particular types of products, as well as an average value of transaction, requires accepting certain methods of payment, e.g. *pay-by-link* to sell services, and *bank transfer* and *cash on delivery* to sell expensive goods.

The choice of payment methods may also depend on the target group of customers to whom the shop addresses its offer. Some methods, such as *bank transfer* and *card payment*, are preferred by businesses, whereas others, i.e. *cash on delivery*, *payment in person* and *virtual payment*, are used almost exclusively by individuals. The geographical location of the target market also plays a significant role. Methods such as *cash on delivery*, *payment in person*, *pay-by-link* as well as *bank transfer* (before SEPA implementation) are used mostly on the domestic market, whereas *online payment integrator* can service foreign transactions

only through selected channels. Thus, a decision to sell abroad entails the necessity of accepting *card payment* and/ or *virtual payment*. It is also important whether an online shop chooses to use auction markets to sell its products. Customers who conclude transactions on this unusual market, which has dominated the Polish e-commerce, are accustomed to using two methods (Polasik and Maciejewski, 2009). Depending on customers' preferences, these methods are *bank transfer* for payment in advance and *cash on delivery* when they want to feel more secure. Contrary to that, Western auction markets are dominated by a payment instrument that has been created especially for person-to-person transactions conducted via e-mail communication, i.e. *virtual payment*.

Not only are the decisions of online shop managers conditioned by external factors, but they also greatly depend on the preferences of policy makers. The five groups of factors which are typical of *management preferences* have been distinguished. *Cost factors* mean the importance attached by managers to the amounts of the perceived commission on sales and the fixed costs of accepting payments. It may be assumed that the managers for whom these factors are of vital importance will prefer *bank transfer*. *Market factors* concern the market position of a particular method of payment, i.e. its popularity among prospective customers and competitor online shops. Theoretically, *online payment integrator* shall be the best method in this respect, whereas innovative niche methods shall be the least popular. *Efficiency factors* concern the attitude of policy makers to such features of payment methods as the automation of payment servicing, the time of payment settlement, the possibility of settling the payment in many currencies, and the inclusion of online payment integrator into the offer. Those who prefer these factors shall be discouraged from accepting laborious payment methods that engage the shop staff, i.e. *cash on delivery* and *payment in person*. The *security factor* reflects the importance of transaction security and risk for managers¹¹. Those who attach great significance to this factor will be unlikely to accept *card payment*, and, simultaneously, encouraged to opt for *bank transfer*, *pay-by-link* and *payment in person*. The last one is the *convenience factor* which relates to the meaning which managers attach to the convenience of their customers while making payments. Policy makers who seek to provide maximum convenience for their customers shall be more likely to accept *pay-by-link*. The impact of this factor on the acceptance of the other payment methods can be diversified. It

¹¹ The *security factor* concerns: (a) the technical aspects of transaction security, (b) the risk connected with potential frauds, and (c) trading risk resulting from the annulment of a transaction or complaint and from legal disputes.

shall be emphasised that the influence of all *management preferences* factors is based on a subjective perception of methods by managers.

The last two groups of factors include the *acceptance of other methods of payment* and the *usage of other methods of payment*. It may be assumed that the availability of many methods shall entail the occurrence of both substitution and complementary effects. It can be also expected that *cash on delivery* will substitute *payment in person*, whereas *online payment integrator* will substitute most methods of payment. It can be also assumed that the fact of accepting payment methods will entail several complementary effects as shops usually seek to increase possibilities of choice for customers. It is also interesting to analyse the influence not only of acceptance of particular methods but also of changes in shares of usage of these methods on acceptance of other methods. The usage of particular methods may be connected with substitution effect since shops focusing on dominating method are not motivated to accept other, less popular ones.

Based on the analysis presented above, the following research hypotheses were formulated:

- H1: Additional usage of traditional delivery channels, alongside with the Internet, has an impact on the selection of payment methods.
- H2: The sale to foreign markets discourages shops from accepting methods based on domestic settlement systems or personal contact.
- H3: Involvement in online auctions stimulates the acceptance of payment methods commonly used in online person-to-person transactions.
- H4: Security concern has a strong impact on the decision to accept the most of payment methods in e-commerce.
- H5: The number of employees has a positive effect on the tendency to accept labour-consuming methods of payment (such as cash on delivery) and a negative effect on the tendency to accept automated methods of payment (such as payment integrators and virtual payment).
- H6: Between card payment and most payment methods exist complementary effects.
- H7: The popularity of a particular payment method among prospective customers is a vital factor determining its acceptance online.

5. The survey methodology and the variable definitions

The purpose of the survey aimed at online shops was to collect source data based on the information from managers who decide about the forms of payment for goods and services purchased online. The study and the survey questionnaire were devised by Michal Polasik and Krzysztof Maciejewski, whereas the MillwardBrown SMG/KRC institute sampled the respondents and collected their replies, as commissioned by the National Bank of Poland. The study was conducted on the Polish market between December 2007 and March 2008 on a sample of 117 online shops. It is worth emphasising that at the end of 2007 there were only 3, 257 online shops in Poland (Grzechowiak and Jarosz, 2008); therefore, it can be estimated that the survey was conducted among 3.6% of this population. It must be underlined that the term 'online shop' means both entities conducting only Internet sales and those selling on the Internet in parallel with traditional channels (such as shops, salons, branches, registered offices, small Points of Sale, or sales representatives).

The survey used a method called the Computer Aided Web Interview (CAWI). The initial stage of the very survey consisted of Computer Aided Telephone Interviews (CATI) which distinguished the respondents who met the survey assumptions and who agreed to participate in the experiment. The respondents were authorised to decide about and accept the payment methods used by their shop. Next, they individually completed the survey forms on the Internet. Respondents could take breaks in the process of filling in the forms (the system would save their answers), which allowed them to use external sources of information needed to complete the form thoroughly (e.g. to provide financial data or to consult other employees). The research method applied by MillwardBrown guaranteed the sample to be representative of the whole population of Polish online shops¹². The comparison with two different independent studies (Kraska, 2008; Grzechowiak and Jarosz, 2008) have shown that differences for summary statistics between those investigations and our results are not significant. For example, it refers to statistics concerning the activity of shops in online auctions, their usage of traditional distribution channels, and the sector structure of products and services offered¹³.

According to the survey, the authors engaged 45 explanatory variables which are compared in Table II. Descriptive statistics for the above analysed variables are presented in Table A in Appendix.

¹² Stratified sampling was not used, because description statistics for the whole population of online shops in Poland are not known.

¹³ In our sample 51% of Polish Internet shops use traditional channels of distribution in parallel with selling via the Internet (coincident with 52% obtained from other Polish research; Grzechowiak and Jarosz, 2008).

Table II. Explanatory variables used in the study

Variable names	Definition
E-shop characteristic	
Number_shops	Number of traditional shops, salons, and branches.
Number_websites, Number_shopping_passages, Number_other_locations_online	Number of Internet locations concerning: online websites and portals, shopping passages of other internet portals, other internet locations.
Polish_Post, Courier_company, Collection_in_person	Manner of collecting goods by the customer through: the Polish Post, a courier delivery company or collection in person; 1 if a given method is possible; 0 otherwise.
Years_in_internet	Years of conducting online sales.
Years_in_business	Years of conducting traditional sales.
Foreign_language_website	Website in a foreign language version; 1 if owned by the shop, 0 otherwise.
Number_employees	Number of staff employed in e-commerce.
Internet_turnover	Value of turnover on the Internet in PLN.
Traditional_sales_turnover	Value of turnover in traditional distribution channels in PLN.
Services	1 if line of business is connected with services, 0 otherwise (which means offering only material or digital products).
Average_value_transaction	Average value of transactions in PLN.
Customers characteristic	
%_transactions_business	Share of transactions concluded with businesses and institutions (in %).
%_transactions_foreigners	Share of online transactions concluded with foreign customers (in %)
%_transactions_auctions	Share of online auctions in Internet transactions (in %)
Management preferences¹⁴ - Weights (in %) ascribed to particular factors influencing the decision to accept a new method of payment (summing up to 100)	
Factor_fixed_costs	Fixed costs of accepting a given method of payment
Factor_commission	Commission on the value of accepted transactions
Factor_popularity_consumer	Popularity of a given method with Polish Internet users
Factor_foreign_settlement	Possibility of settling transaction in many currencies
Factor_security	Transaction security (this factor concerns: technical security, risk of frauds and trading risk of transaction process)
Factor_customer_convenience	Payment convenience for customer
Factor_speed_settlement	Speed of settlement
Factor_automation	Payment automation
Factor_within_integrator	Offering a given method within online payment integrator
Acceptance of other methods of payment	
Cash_on_delivery Bank_transfer	Accepted methods of payment: cash on delivery, bank transfer, online payment

¹⁴ Online shops managers were asked to ascribe percentage weights to particular factors influencing their decision to accept or reject a new method of payment. The interactive survey form guaranteed summing weights up to 100%. The factors were not directly connected with a particular method of payment but only expressed the general preferences of policy makers as to a given issue.

Payment_integrator Payment_in_person Pay-by-link Card_payment Virtual_payment Credit_or_installment Payment_in_other_POS	integrator, payment in person, pay-by-link, card payment, virtual payment provider, purchases on credit or installment, cash payment at other POS via bills payments system; 1 if the method is accepted, 0 otherwise
Usage of other methods of payment	
%_tran_cash_on_delivery %_tran_bank_transfer %_tran_payment_integrator %_tran_payment_in_person %_tran_pay-by-link %_tran_card_payment %_tran_virtual_payment %_tran_credit_or_installment %_tran_payment_in_other_POS	Share of the number of transactions generated with a given payment method for (in %): cash on delivery, bank transfer, online payment integrator, payment in person, pay-by-link, card payment, virtual payment provider, purchases on credit or installment, cash payment at other POS via bills payments system.

Source: Self-compilation.

6. Empirical Results

The authors identify empirically the factors underlying the decision to adopt a particular payment method. The acceptance of a selected payment method is a binary choice which can take only two values. A convenient way of formalizing this situation is to consider the variable Y as a Bernoulli random variable and analyse its distribution conditional on the explanatory variables gathered in a vector \mathbf{x} , so that (Greene, 2003):

$$\text{Prob}(Y = 1) = F(\boldsymbol{\beta}' \mathbf{x}),$$

$$\text{Prob}(Y = 0) = 1 - F(\boldsymbol{\beta}' \mathbf{x}).$$

The set of parameters $\boldsymbol{\beta}$ reflects the impact of changes in \mathbf{x} on the probability. The logit and probit models are the most often used models to explain a binary dependent variable (see for example Maddala, 1983, 1996; Wisniewski, 1986; Hosmer and Lemeshow, 1989; Gruszczyński, 2002). In the probit model function F is a normal cumulative distribution function, while in the logit model the logistic cumulative distribution function is employed:

$$\text{Prob}(Y = 1) = \frac{\exp(\boldsymbol{\beta}' \mathbf{x})}{1 + \exp(\boldsymbol{\beta}' \mathbf{x})}.$$

The logistic distribution is similar to the normal one except in the tails which are considerably heavier. For intermediate values of $\boldsymbol{\beta}' \mathbf{x}$ the two distributions tend to give similar probabilities (see for instance Long, 1997; Hsiao et al., 1998). In some cases there are practical reasons for favouring one or the other for mathematical convenience, but it is

difficult to justify the choice of one distribution or another on theoretical grounds. Here the logistic model is used; however, very similar conclusions were obtained for most payment methods, also from the probit analysis. There were some differences for cash on delivery, bank transfer (very few Y's equal to zero) and virtual payment (very few Y's equal to one). It seems that for those methods the logit model is better because the departures from the normal distribution are more evident.

The parameters of the logit models were estimated by the quasi-maximum likelihood for all the analysed payment methods. Because those methods are quite different with respect to the business model, popularity and availability, usage on the market, security, technical solution and cost effectiveness, we did not like to adopt a “conventional” approach, which can be found in the literature and insists on a complete theoretical model of the phenomena of interest prior to data analysis. The a priori selection of variables for all models would cause a loss of information. Instead, a cross-sectional version of the general-to-specific¹⁵ search methodology was applied. General-to-specific modelling were used almost exclusively in time-series contexts; however, Hoover and Perez (2004) extended their investigations to cross-section datasets and found equally impressive performance in the model selection. Among the explanatory variables there are some which describe similar, but not the same, properties, for instance, the dummy variable which defines website in a foreign language and the share of online transactions concluded with foreign customers or the acceptance and usage of other payment methods. The procedure for model selection guarantees that only one of such variables, i.e. the most important for the specific payment method, can be used in the final parametrizations of models, which is why multicollinearity is not present. We did not like to use one of the variable a priori for all models, because it would cause a loss of information.

Estimates of parameters, robust standard errors, t-statistics, and corresponding p-values are reported in Tables III-IX. Additional information can be obtained through the analysis of the marginal effects calculated as the partial derivatives of the non-linear probability function, evaluated at each variable's sample mean. In order to better evaluate the quality of models, the tables present some additional statistics, such as: the mean of dependent variable, the percentage of cases correctly predicted by the model, $f(\beta'x)$ at the mean of explanatory variables, the log likelihood, the LR test for joint significance of explanatory variables and the McFadden pseudo- R^2 . The likelihood ratio test decidedly rejects the null

¹⁵ Starting from a general model, standard testing procedures eliminate statistically insignificant variables, with diagnostic tests checking the validity of reductions (see Hendry, 1995, Campos, Ericsson and Hendry, 2005).

hypothesis of no relationship between the dependent variable and the regressors for all payment methods. Moreover, the results from individual t-tests imply that most explanatory variables are strongly significant.

The models can be divided into two groups. The first one contains models for the following payment methods: *cash on delivery*, *bank transfer* and *virtual payment*. The second group includes models for the *online payment integrator*, *payment in person*, *pay-by-link* and *card payment*. Measures of goodness of fit indicate a significantly better quality of models for *cash on delivery*, *bank transfer* and *virtual payment*. The McFadden R^2 are higher (from 0.48 to 0.77) for models from the first group and those models correctly predicted more than 95 % of the observations. Those measures suggest that the logistic model is well fitted to the data for *cash on delivery* and *bank transfer* and middling for *virtual payment*. On the other hand, marginal effects for explanatory variables in those models are quite low, which is connected with close to zero values of $f(\beta'x)$ at mean of independent variables. Measures of closeness of fit for the second group indicate worse effectiveness of models but still a satisfactory one. Based on the classification with the prediction cut-off value of 0.5, the models correctly classified from 74.4% to 85.5% of decisions to adopt a selected payment method. The marginal effects for explanatory variables for models from this group are much higher.

First of all, the results for each payment method were discussed separately; following that the conclusions concerning many methods were presented. General acceptance of *cash on delivery* resulted from a well-developed distribution network (*number_shops*, see Table III), which is used to conduct traditional sales parallel to online ones. It is probable that the use of physical channels, which are dominated by cash transactions in Poland, makes shop managers accept cash in virtual transactions as well. The acceptance of this payment method is also encouraged by the services of the Polish Post which, despite being a state-owned company, uses attractive prices for servicing *cash on delivery* as compared to courier delivery companies¹⁶. Offering services by online shop has negative effect on acceptance of this method, because it requires quick payment and *cash on delivery* is one of the slowest payment method.

It turned out that a considerable share of business-to-business and foreign transactions were the factors that could discourage shops from accepting *cash on delivery*. It results from that the business customers which buy online are unwilling to use such a form of payment for practical and booking reasons, since this method would entail transferring cash to the courier

¹⁶ Self-calculations on the basis of: the Polish Post, <http://www.poczta-polska.pl> and DHL Express <http://www.dhl.com.pl> (read: January 2009).

by an appointed employee. At the same time, *cash on delivery* is a method that can be applied on the domestic market solely and practically cannot be used to service foreign transactions due to that posts offices and courier delivery companies are not interested in servicing transborder payments. Moreover, the managers who value customer convenience and payment automation are less likely to accept this method. On the other hand, ones who attach more importance to fixed costs are more inclined to accept *cash on delivery*, because this method does not imply such costs and commission is paid per transaction (the most often postage is covered by costumers).

Table III. The logit model for acceptance of cash on delivery

Variable	Coefficient	Std. error	t ratio	p-value	Marginal effect
Constant	5.4054	1.6307	3.32	0.0009	-
Number_shops	1.9766	0.9490	2.08	0.0373	2.6090e-7
Polish_Post	3.3044	1.5394	2.15	0.0318	1.4839e-6
Services	-3.4292	1.6407	-2.09	0.0366	-2.8545e-6
%_transactions_business	-0.0787	0.0197	-4.00	0.0001	-1.0386e-8
%_transactions_foreigners	-0.1000	0.0339	-2.95	0.0032	-1.3196e-8
Factor_fixed_costs	0.1023	0.0298	3.43	0.0006	1.3506e-8
Factor_customer_convenience	-0.0732	0.0253	-2.90	0.0037	-9.6658e-9
Factor_automation	-0.1585	0.0859	-1.85	0.0650	-2.0919e-8
Statistics					
Percentage of acceptance (Mean of Y)	0.915		Log likelihood		-10.7366
f(β^*x) at mean of independent vars.	0.000		LR statistic (8 df)		46.8385
Percentage of cases correctly predicted	0.966		McFadden R ²		0.6857

Source: Authors' calculations.

Bank transfer is an extremely popular method of payment in Polish e-commerce. That is why the managers who attach high importance to popularity of payment method are more inclined to accept it (see Table IV). This method plays a very significant role in transactions conducted on online auctions, where it is commonly used (*%_transactions_auctions*). The features contributing to the positive perception of bank transfer include: the lowest commissions (*factor_commission*), a short time of settlement (*factor_speed_settlement*), and the possibility of paying in various currencies (*factor_foreign_settlement*), which is confirmed by the preferences of online shop managers. Actually, domestic *bank transfer* is the only fully commission-free method of payment acceptance for recipients.

Higher share of business-to-business transactions in shops' transactions increases significantly the acceptance of bank transfer, because it is the most popular payment method among business customers. The managers who attach more importance to payment automation are less inclined to accept this method, because accepting *bank transfer* requires staff activity. Similarly usage of courier delivery company has negative influence on acceptance, probably because Polish Post is more preferred in this case.

Bank transfer acceptance is negatively correlated with the share of *virtual payment* in total online transactions, which is natural as these methods are direct competitors in online auctions. A considerable share of foreign transactions has a negative influence on the acceptance of *bank transfer*, which confirms hypothesis H2. It results from that this method is not very popular on many foreign markets; moreover, high commissions were charged on foreign bank transfers before SEPA implementation (at the time of the study). For above reasons, this instrument was used mainly to make domestic payments.

Table IV. The logit model for acceptance of bank transfer

Variable	Coefficient	Std. error	t ratio	p-value	Marginal effect
Constant	2.4783	1.3455	1.84	0.0655	-
Courier_company	-5.9156	1.7197	-3.44	0.0006	-5.8538e-7
%_transactions_business	0.0870	0.0249	3.50	0.0005	1.5174e-8
%_transactions_foreigners	-0.3136	0.0691	-4.54	0.0000	-5.4696e-8
%_transactions_auctions	0.0895	0.0508	1.76	0.0785	1.5604e-8
Factor_commission	0.0968	0.0470	2.06	0.0392	1.6888e-8
Factor_popularity_consumer	0.1165	0.0346	3.37	0.0008	2.0317e-8
Factor_foreign_settlement	3.0357	0.8499	3.57	0.0004	5.2950e-7
Factor_speed_settlement	1.1199	0.3610	3.10	0.0019	1.9533e-7
Factor_automation	-0.6858	0.2468	-2.78	0.0055	-1.1963e-7
%_tran_virtual_payment	-4.4464	1.5714	-2.83	0.0047	-7.7556e-7
Statistics					
Percentage of acceptation (Mean of Y)		0.915	Log likelihood		-7.9850
f(β^*x) at mean of independent vars.		0.000	LR statistic (10 df)		52.3417
Percentage of cases correctly predicted		0.974	McFadden R ²		0.7662

Source: authors' calculations.

The cooperation between an Internet shop and *online payment integrator* is based on payment outsourcing. This method is closely connected with the acceptance of *card payment* (see Table V). It is demonstrated by high value of t-statistics and the biggest marginal effect. The probability of using *online payment integrator* was 40.3 percentage points greater, all else equal, when a given shop accepted *card payment*. The complementarity of these payment methods may result from the fact, that shops accepting *card payments* are more open for payment methods which are alternative to *cash on delivery* and the *bank transfer*. On the other hand, the tendency to cooperate with *online payment integrator* is much smaller in the case of those Internet shops which service most transactions on their own, using methods such as *cash on delivery* and *bank transfer* (two dominant methods on the Polish market), and, especially, *payment in other POS*. Ceteris paribus, the increase by 1 percentage point in the share of these methods in the number of transactions serviced induces a drop in the probability of cooperation with *online payment integrator* of 1.2, 1.0 and 4.3 percentage

points, respectively, for *cash on delivery*, *bank transfer* and *payment in person*. They shall be considered as substitute methods for payment outsourcing.

Managers who value the popularity of a given payment method with customers are inclined to use *online payment integrator*, which does help them meet this goal. Similarly there is positive relation between the acceptance of this method and preferences of managers connected with settlement of foreign transactions. However, shops conducting many foreign transactions less frequently cooperate with *online payment integrator* as they tend to use other payment channels, such as *card payment*. Moreover, most payment channels offered by *online payment integrator* are domestic ones and are of no use in such transactions (*%_transactions_foreigners*). Variable which has also significantly negative effect on acceptance of *online payment integrator* is value of turnover in traditional distribution channels owned by online shops. Therefore, it is typically virtual shops that are most enthusiastic about payment outsourcing. On the other hand, for more valuable online transactions (*average_value_transaction*) the online shops are more inclined to accept *online payment integrator*.

Table V. The logit model for acceptance of online payment integrator

Variable	Coefficient	Std. error	t ratio	p-value	Marginal effect
Constant	2.5303	1.2543	2.02	0.0437	-
Traditional_sales_turnover	-1.2975e-6	6.5341e-7	-1.99	0.0471	-3.2229e-7
Average_value_transaction	1.1628e-4	5.2185e-5	2.23	0.0259	2.8884e-5
%_transactions_foreigners	-0.0589	0.0301	-1.96	0.0502	-0.0146
Factor_popularity_consumer	0.0277	0.0149	1.86	0.0632	0.0069
Factor_foreign_settlement	0.0748	0.0445	1.68	0.0926	0.0186
Card_payment	1.8933	0.5676	3.34	0.0009	0.4030
%_tran_cash_on_delivery	-0.0481	0.0148	-3.25	0.0012	-0.0119
%_tran_bank_transfer	-0.0399	0.0140	-2.84	0.0045	-0.0099
%_tran_payment_in_other_POS	-0.1711	0.0507	-3.38	0.0007	-0.0425
Statistics					
Percentage of acceptance (Mean of Y)		0.479	Log likelihood		-55.2111
$f(\beta \cdot x)$ at mean of independent vars.		0.248	LR statistic (9 df)		51.5604
Percentage of cases correctly predicted		0.744	McFadden R ²		0.3183

Source: authors' calculations.

The last payment method included in the study is *payment in person*, which, despite its small share in the number and turnover of online transactions (see Figure 4), was accepted by as much as 57% of Internet shops (see Figure 5). Calculated marginal effect values and t-statistics (see Table VI) imply that the main positive factor influencing the acceptance of this method is the possibility of collecting goods by the client in a traditional shop or warehouse and paying for them in person. The probability of accepting *payment in person* can be as much as 53 percentage points higher, all else equal, in shops facilitating individual collection

of goods (*collection_in_person*). Another important factor is accepting payment in the form of a *credit or installments*. The probability of accepting *payment in person* is 37.7 percentage points higher, all else equal, in shops accepting this method of payment. It results from limited popularity of the electronic signature in Poland, as signing a loan agreement requires a meeting between the client and a representative of a bank or a shop, which may happen when the customer comes to the shop to collect and pay for their goods.

It turns out that the acceptance of *payment in person* is also encouraged by a high share of auctions in shop' transactions as customers who perform this kind of transactions are more likely to collect their goods in person. A positive relation between *payment in person* and *virtual payment* acceptance results probably from addressing the offer to customers participating in online auctions. Thus, these data may support hypothesis H3. Contrary to that, this method is used less frequently by shops participating in shopping passages on Internet portals as these entities focus more on virtual trading. Consequently, the tendency to accept *payment in person* decreases with a rise in online turnover of the shops, because development of online sale enforces shop to search more nation-wide payment methods. By the same token, there is a negative relation with the share of the number of transactions generated by *pay-by-link*, which is also preferred by typically virtual shops.

Table VI. The logit model for acceptance of payment in person

Variable	Coefficient	Std. error	t ratio	p-value	Marginal effect
Constant	-2.0242	0.7407	-2.73	0.0063	-
Number_shopping_passages	-0.3969	0.2301	-1.72	0.0846	-0.0942
Collection_in_person	2.3706	0.5513	4.30	0.0000	0.5303
Years_in_internet	0.3956	0.1429	2.77	0.0056	0.0939
Foreign_language_website	-1.0841	0.6258	-1.73	0.0832	-0.2641
Internet_turnover	-5.8353e-7	2.8043e-7	-2.08	0.0374	-1.3844e-7
%_transactions_auctions	0.0254	0.0120	2.12	0.0343	0.0060
Factor_fixed_costs	-0.0300	0.0163	-1.84	0.0661	-0.0071
Virtual_payment	1.8889	0.8201	2.30	0.0213	0.3251
Credit_or_installment	1.9405	0.7158	2.71	0.0067	0.3774
%_tran_card_payment	0.4663	0.1654	2.82	0.0048	0.1106
%_tran_pay-by-link	-0.0830	0.0243	-3.45	0.0006	-0.0197
Statistics					
Percentage of acceptance (Mean of Y)		0.573		Log likelihood	-46.6195
f(β^*x) at mean of independent vars.		0.237		LR statistic (11 df)	66.4786
Percentage of cases correctly predicted		0.829		McFadden R ²	0.4162

Source: authors' calculations.

Moreover, accepting *payment in person* is not suitable for foreign transactions, which explains the negative effect of running a website with a foreign language version. Shops with longer experience in online sales (*years_in_internet*) tend to accept *payment in person* more

often. This method is also positively correlated with the share of *card payments* in online transactions. It may result from the fact that, apart from cash, *payment in person* often includes *card payment* at a POS terminal, which means that the shop has an agreement with an acquirer. It is worth noticing that the managers who attach significance to low costs of payment servicing (*factor_fixed_costs*) realize that *payment in person* burdens the employees of physical distribution channels and generates additional costs; therefore, they are less likely to accept this method.

The *pay-by-link* payment constitutes an example of an innovative method which has been successful on the Polish market (see Figure 4). Its acceptance is complementary with *card payment*, whose servicing considerably increases the probability of accepting *pay-by-link* (see Table VII). Simultaneously, *pay-by-link* is a substitution for *bank transfer* as increase in the share of the latter diminishes the probability of accepting *pay-by-link*. It results from the fact that this method constitutes an online interface which is conducive to perform *bank transfer* via the Internet. It is worth emphasising that despite the acceptance of *pay-by-link* is connected with commissions at the level of *card payment* (*bank transfer* is free of charge for recipient), shop managers perceive it (*factor_commission*) as financially attractive instrument.

The biggest obstacle for the acceptance of *pay-by-link* is that this method facilitates only the acceptance of domestic payments from the customers of Polish Internet banks. Therefore, having a website in a foreign language version, all else equal, diminishes the probability of accepting *pay-by-link* by as much as 20.2 percentage points. Moreover, the requirement that customers possess Internet accounts in Polish banks (only 13% of Poles use it; Polasik and Maciejewski, 2009), makes this instrument a niche one, which discourages those shop managers who attach a great significance to the popularity of payment methods. There is also negative relation between the acceptance of *pay-by-link* and the value of turnover in traditional distribution channels, because this method is preferred by virtual shops.

A strong incentive to use *pay-by-link* is shops pursuit to maximize customer convenience. Managers very well understand the preferences of clients for whom it is the most convenient payment method (Polasik and Maciejewski, 2009). Consequently, this aspect of competition increases the probability of accepting *pay-by-link*. It has also occurred that the use of *pay-by-link* is strongly and positively influenced by conducting business activity in sectors requiring quick payment, especially delivery of services. In comparison to a typical *bank transfer*, the advantage of *pay-by-link* is a considerable acceleration of the payment process.

Table VII. The logit model for acceptance of pay-by-link

Variable	Coefficient	Std. error	t ratio	p-value	Marginal effect
Constant	-1.9391	0.6652	-2.92	0.0036	-
Foreign_language_website	-2.8582	1.1607	-2.46	0.0138	-0.2015
Traditional_sales_turnover	-4.1391e-7	1.6910e-7	-2.45	0.0144	-5.3243e-8
Service	1.6980	0.9968	1.70	0.0885	0.3220
Factor_commission	0.0271	0.0137	1.98	0.0478	0.0035
Factor_popularity_consumer	-0.0332	0.0190	-1.75	0.0797	-0.0043
Factor_customer_convenience	0.0875	0.0290	3.01	0.0026	0.0112
Card_payment	1.8312	0.5704	3.21	0.0013	0.3175
% tran bank transfer	-0.0320	0.0105	-3.06	0.0022	-0.0041
Statistics					
Percentage of acceptance (Mean of Y)		0.256	Log likelihood		-45.6898
$f(\beta'x)$ at mean of independent vars.		0.129	LR statistic (8 df)		41.8293
Percentage of cases correctly predicted		0.838	McFadden R ²		0.3140

Source: authors' calculations.

Despite that *card payment* is relatively commonly accepted by online shops, the share of this method in the Polish e-commerce market is insignificant (compare Figure 4 and Figure 5). *Card payment* seems to be strongly complementary to *online payment integrator* and *pay-by-link* (see Table VIII, Tables V and VII), both of which are open to cashless and innovative payments. Taking into consideration that most *card payments* are made with credit cards, it is natural that there is a positive connection between this method and credit acceptance (*credit_or_installment*). A major advantage of *card payment* on the Polish market is that it is one of the few methods facilitating the acceptance of foreign payments. That is why the higher share of foreign transactions in total online transactions increases acceptance of card payment by online shop.

Experience in conducting sales via traditional channels (measured in this analysis by length of time conducting traditional sales and value of turnover in traditional distribution channels) is conducive to card acceptance, as many traders have become convinced about the growing popularity of cards among Polish customers. The probability of accepting this method of payment is 35.5 percentage points higher, all else equal, for delivery of *services*, because for this business activity quick payment and settlement is very important. As regards managers preferences, paying too much attention to customer convenience has a negative impact on the acceptance of *card payment*. It means that policy makers realize customers do not consider this method to be very convenient (Polasik and Maciejewski, 2009). Moreover, high share of business-to-business transactions decreases acceptance of this method, because business costumers in Poland prefer mainly *bank transfer* (see Table IV).

Table VIII. The logit model for acceptance of card payment

Variable	Coefficient	Std. error	t ratio	p-value	Marginal effect
Constant	-3.7019	0.9727	-3.81	0.0001	-
Number_other_locations_online	0.6194	0.2806	2.21	0.0273	0.0681
Years_in_business	0.1472	0.0483	3.05	0.0023	0.0162
Traditional_sales_turnover	9.8046e-8	5.9007e-8	1.66	0.0966	1.0775e-08
Services	1.9728	1.1226	1.76	0.0788	0.3553
%_transactions_business	-0.0365	0.0142	-2.57	0.0101	-0.0040
%_transactions_foreigners	0.0553	0.0215	2.58	0.0100	0.0061
Factor_customer_convenience	-0.0311	0.0189	-1.65	0.0993	-0.0034
Payment_integrator	2.1483	0.7615	2.82	0.0048	0.2570
Pay-by-link	1.4549	0.6591	2.21	0.0273	0.2077
Credit_or_installment	1.5227	0.6203	2.46	0.0141	0.2215
Statistics					
Percentage of acceptance (Mean of Y)		0.231		Log likelihood	-41.0059
$f(\beta \cdot x)$ at mean of independent vars.		0.110		LR statistic (10 df)	44.3961
Percentage of cases correctly predicted		0.855		McFadden R ²	0.3512

Source: authors' calculations.

Virtual payment is an innovative solution usually based on e-mail communication and it has already been accepted by 8.5% of Polish Internet shops. Its usage is encouraged by a considerable share of auction sales in a shop's transactions because auctions constitute a natural environment for this payment method (see Table IX). This conclusion confirms hypothesis H3. Online auctions are usually connected with delivery by the *Polish Post*, which is demonstrated by a positive relation with the use of *virtual payment*.

Table IX. The logit model for acceptance of virtual payment

Variable	Coefficient	Std. error	t ratio	p-value	Marginal effect
Constant	-6.5792	2.4149	-2.72	0.0064	-
Polish_Post	4.2525	1.7607	2.42	0.0157	6.6148e-3
%_transactions_auctions	0.0454	0.0188	2.42	0.0157	1.0260e-4
Factor_popularity_consumer	-0.2090	0.0863	-2.42	0.0154	-4.7239e-4
Factor_within_integrator	0.1050	0.0360	2.92	0.0035	2.3737e-4
Pay-by-link	1.8663	1.0743	1.74	0.0824	7.6091e-3
%_tran_cash_on_delivery	-0.0593	0.0254	-2.34	0.0193	-1.3411e-4
%_tran_card_payment	0.4432	0.1323	3.35	0.0008	1.0017e-3
Statistics					
Percentage of acceptance (Mean of Y)		0.085		Log likelihood	-17.7619
$f(\beta \cdot x)$ at mean of independent vars.		0.002		LR statistic (7 df)	32.7878
Percentage of cases correctly predicted		0.951		McFadden R ²	0.4800

Source: authors' calculations.

Accepting *virtual payment* seems to be complementary with accepting *pay-by-link*, which is a sign of a shop's openness to innovative methods. Moreover, accepting *virtual payment* is positively related to the share of *card payments* in shops' transactions as debiting cards is the most common method to supply customer's virtual account by funds. On the other hand, a big share of *cash on delivery* transactions discourages to the acceptance of innovative

methods and probably competes with them in servicing Internet auctions on the Polish market. The managers preferring methods which are greatly popular with clients avoid accepting *virtual payment*. Nevertheless, it is favoured by the policy makers planning to implement payment outsourcing and wishing to have this method included on the *online payment integrator* offer.

In order to facilitate a broader look at seven logit models and all the explanatory variables employed in the study, a comparison of results for these models has been presented in Table B in Appendix. Signs of relation of significant explanatory variables on the acceptance of particular methods of payment have been reported. Taking into account acceptance, most methods of payment seem to be complementary with each other. On the other hand, the higher share of particular payment methods in the number of online transactions often discouraged managers from using other instruments and generates substitutive effect. It should be noted that the lack of the variable in the model does not have to mean that this variable does not influence the specific payment method. It results from the above-mentioned procedure for model selection. Such variable can be really insignificant or the influence can be not sufficiently strong to be included in the model or in some cases the influence can be taken over by other variable.

The empirical results obtained during the study allowed the authors to refer to the hypotheses. Thus, it became apparent that the usage of traditional delivery channels, parallel with the Internet (variables: *number_shops*, *collection_in_person*, *traditional_sales_turnover*), has a significantly positive impact on the acceptance of *cash on delivery*, *card payment*, and *payment in person*. Simultaneously, using such a distribution strategy reduced the chance of accepting *online payment integrator* and *pay-by-link*. Thus, it can be concluded that hypothesis H1 is supported by the data. The analysis of the influence of transborder trade on the acceptance of particular payment methods is interesting. The involvement of shops in foreign sales (*%_transactions_foreigners*) or running a website in a foreign language version exert a negative influence on the acceptance of five methods of payment, based on domestic settlementsystems or personal contact, including the most popular ones. In this case, the only favourable method was *card payment*. Such a considerably limiting influence of foreign sales on the range of accepted payment methods confirms hypothesis H2. The examples of *bank transfer* and *virtual payment* demonstrated that conducting sales via online auctions (*%_transactions_auctions*) stimulates the acceptance of payment methods which are person-to-person enabled. Thus, the data supports hypothesis H3.

Surprisingly, the security factor (*factor_security*) determining the decision to accept particular payment methods was not present as explanatory variable in any of the considered models. In order to additionally confirm the lack of relation between the acceptance of a payment method and the factor of security, the means of percentages attributed to security, separately for adopters and non-adopters of a specific payment method, were calculated. Further, the test for equality of means was performed. The values of z-statistic equalled -1.141, -0.398, 0.723, -2.487, 0.185, -0.255, -1.223 for *cash on delivery*, *online payment integrator*, *card payment*, *bank transfer*, *pay-by-link*, *virtual payment* and *payment in person*, respectively. It means that for all methods except the bank transfer, there was no reason to reject hypothesis of the lack of relation between the acceptance of payment method and the factor of security at the 0.05 significance level. The research did not corroborate hypothesis H4 relating to the strong influence of security on the acceptance of payment methods in e-commerce. In particular, there is no basis to assume that the influence of the security factor on *card payment* acceptance is negative, despite that the problems of card fraud and chargeback are well-documented reality (APACS, 2007).

Similarly, the number of employees (*number_employees*) was not an explanatory variable in any model. The test for equality of means for adopters and non-adopters of a specific payment method was also performed to additionally check the relation between this variable and the acceptance of payment methods. The values of z-statistic equalled -5.267, 1.373, 0.629, -0.315, -0.210, 3.171, -1.006 for *cash on delivery*, *online payment integrator*, *card payment*, *bank transfer*, *pay-by-link*, *virtual payment* and *payment in person*, respectively. It means that for all methods except cash on delivery and virtual payment, there was no reason to reject hypothesis of the lack of relation between the acceptance of payment method and the number of employees at the 0.05 significance level. Thus, the results do not allow the authors to unambiguously corroborate hypothesis H5 and the influence of the number of employees in an online shop on the acceptance of particular payment methods had not been confirmed.

It is interesting that *card payment* is complementary with most of other payment methods. The acceptance of *online payment integrator*, *pay-by-link* and *credit or installment* have positive impact on the acceptance of *card payment*. Additionally, the acceptance of *card payment*, as well as the high share of card payments in the number of transactions (*%_tran_card_payment*), stimulate the acceptance of *online payment integrator*, *pay-by-link*, *virtual payment* and *payment in person*. This is due to the fact that on the Polish market *card payment* does not compete with domestic-oriented payment methods. Thus it is possible to

conclude that the complementarity of payment methods is true in relation to *card payment* and that empirical evidence corroborates hypothesis H6. However, the question of the substitution and complimentary effects for other payment methods in e-commerce requires further research.

The obtained results explain the influence of the popularity of particular payment methods with prospective clients (*factor_popularity_consumer*). Managers wishing to reach the mass market are more likely to accept *bank transfer* (very popular in Poland) and to cooperate with *online payment integrator*, which offers various channels of payment service. They are also less inclined to accept niche methods, such as *pay-by-link* and *virtual payment*. Consequently hypothesis H7 cannot be rejected.

7. Summary and conclusions

The work deals with an analysis of factors influencing the acceptance of major payment methods by the managers of Polish online shops. The study was based on empirical data obtained through surveys interviews with the managers of online shops who decided about the usage of certain forms of payment for goods and services. Taking into account the share of particular payment methods in e-commerce in Poland and abroad, seven major instruments were selected and thoroughly analysed. These methods include: (1) *cash on delivery*, (2) *bank transfer*, (3) *online payment integrator*, (4) *payment in person*, (5) *pay-by-link*, (6) *card payment*, and (7) *virtual payment provider*. The methods differ considerably in many respects, such as: the level of innovation, the use of settlement systems, the participation of banks, the security of transactions, the costs incurred by shops, speed, and convenience for customers. In order to evaluate econometrically the determinants of the adoption status of a particular payment method, a binomial logistic regression was employed. The univariate logit models describing acceptance of seven payment methods were constructed. Divided into five categories within the proposed research model, a total of 45 explanatory variables were taken into account. They include both detailed e-shop characteristics and customers characteristics as well as management preferences. Acceptance of other payment methods and the intensity of their usage were also investigated. The analysis showed that the acceptance of particular payment methods depends on various sets of factors which differ significantly from one another.

The research verified statistically many assumptions and statements which relate to the influence of various factors on the acceptance of particular methods of payment in e-

commerce and are greatly popular in business and in academic works. The study results demonstrated that a shop's strategy of using distribution channels has a strong influence on its acceptance of particular payment methods. The shops that decided to use traditional local Points-of-Sale alongside Internet sales tended to choose a different payment methods than typically virtual shops. Shops involvement in online auctions requires them to adapt themselves to their specificity of auctions, including payment. In the case of Poland, it encourages them to use *bank transfer* and *payment in person* on the one hand and opens an opportunity to apply innovative methods offered by non-bank providers on the other.

It is interesting, that managers attach the highest importance to the payment related factors determining the market competitiveness of online shops, i.e. popularity of the method and customer's convenience. Polish Internet shops generally demonstrate willingness to accommodate to market requirements and customer needs. Furthermore the research did not corroborate hypothesis relating to the strong influence of security on the acceptance of payment methods in e-commerce. It is indication for payment solution providers, how to increase chances of adoption of their products by online shops.

The results of analysis has revealed that most of payment methods used by Polish online shops and preferred by consumers are characterized by slight usefulness for cross-boarder transactions. It creates the market niche for non-bank *virtual payment providers*. However, one has to expect changes in the near future connected with development of SEPA and higher competition in the mail and courier delivery market. That is why non-bank competitors have to undertake urgent activities if they want to make use of favorable current conditions to increase their market share. *Virtual payment providers* play a marginal role on the Polish market so far.

Both *pay-by-link* and *virtual payment* are niche products on the Polish market. It seems that *pay-by-link* method has higher chances for popularization, because it benefits from strong banks and acquirers support. The substantial share of *bank transfer* in e-commerce payment market in Poland assures favourable position to this method nowadays. This situation creates a high potential to convert part of *bank transfer* payments into *pay-by-link* payments. Therefore it seems that banks will remain important players on the online payment market in Poland. Implementation of the SEPA program will certainly favour banks in competition with non-banks *virtual payment providers*.

The main and permanent barrier for development of most cashless payment methods in Poland, including online payments, is low penetration of banking accounts in the society, and as a result low availability of payment cards. It is a vital reason for large usage of cash as

a component of payment in e-commerce. It gives additional possibilities for development of non-banks agents in online payments, especially for *online payment integrator*, which can exploit this opportunity.

An interesting feature of the Polish e-commerce is that many Internet shops often opt for full or partial payment outsourcing which is implemented through their cooperation with *online payment integrators*. Due to that they do not have physical distribution channels, typically virtual shops reveal a special interest in such solutions. *Online payment integrators* play a major role on the Polish market as they cooperate with almost a half of online shops and, through their offer, are able to attract to e-commerce many Poles who do not hold credit cards or even bank accounts.

The results described in the article have demonstrated that in order to explain the processes occurring in e-commerce, it is important to analyse the factors influencing the decisions made by online shop managers and not to limit oneself to studying the behaviour of customers. The acceptance of particular payment methods by online shops is a wide subject requiring further comprehensive research. It would be particularly interesting to study similar variables in America and Western Europe which have more developed e-commerce markets and different structures of accepted payment methods.

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Appendix

Table A. Descriptive statistics for the analysed variables

Variable names	Mean	Std. dev	Minimum	Maximum
Number_shops	5.3419	46.2889	0	500
Number_websites	1.2735	1.0556	0	10
Number_shopping_passages	0.5385	1.2494	0	10
Number_other_locations_online	0.1538	0.7265	0	7
Polish_Post	0.7436	0.4385	0	1
Courier_company	0.7949	0.4055	0	1
Collection_in_person	0.6410	0.4818	0	1
Years_in_internet	2.8889	2.2823	0	13.25
Years_in_business	3.9430	5.7683	0	23
Foreign_language_website	0.1538	0.3624	0	1
Number_employees	1.8803	2.3162	0	13
Internet_turnover	971 564	7 011 304	500	75 000 000
Traditional_sales_turnover	533 158	3 363 398	0	34 250 000
Services	0.0940	0.2931	0	1
Average_value_transaction	7 159	46 454	0	428 571
% transactions_business	22.1538	27.0142	0	100
% transactions_foreigners	4.0598	10.7754	0	60
% transactions_auctions	18.1111	26.1421	0	100
Factor_fixed_costs	16.0598	17.7032	0	91
Factor_commission	23.8120	23.0408	0	100
Factor_popularity_consumer	12.0855	15.6247	0	100
Factor_foreign_settlement	2.9829	4.9879	0	30
Factor_security	9.9402	9.0347	0	50
Factor_customer_convenience	11.1111	13.4259	0	100
Factor_speed_settlement	7.1966	7.2626	0	40
Factor_automation	5.9231	10.5456	0	100
Factor_within_integrator	4.5299	10.1892	0	100
Cash_on_delivery	0.9145	0.2808	0	1
Bank_transfer	0.9145	0.2808	0	1
Payment_integrator	0.4786	0.5017	0	1
Payment_in_person	0.5726	0.4968	0	1
Card_payment	0.2308	0.4231	0	1
Pay-by-link	0.2564	0.4385	0	1
Virtual_payment	0.0855	0.2808	0	1
Credit_or_installment	0.2479	0.4336	0	1
Payment_in_other_POS	0.1624	0.3704	0	1
% tran_cash_on_delivery	39.5299	27.9234	0	100
% tran_bank_transfer	28.7265	28.2768	0	100
% tran_payment_integrator	15.9316	26.7739	0	100
% tran_payment_in_person	5.0171	10.6480	0	95
% tran_pay-by-link	3.5983	10.7053	0	60
% tran_card_payment	0.9573	3.0749	0	20
% tran_virtual_payment	0.2821	1.2377	0	10
% tran_credit_or_installment	2.0085	4.8432	0	25
% tran_payment_in_other_POS	1.2906	4.9932	0	35

Source: Authors' own calculations.

Table B. Comparison of results for logit models for the acceptance of seven payment methods

Variable names	Payment methods						
	Cash on delivery	Payment integrat.	Card payment	Bank transfer	Pay-by-link	Virtual payment	In person
Number_shops	+						
Number_websites							
Number_shopping_passages							-
Number_other_locations_online			+				
Polish_Post	+					+	
Courier_company				-			
Collection_in_person							+
Years_in_internet							+
Years_in_business			+				
Foreign_language_website					-		-
Number_employees							
Internet_turnover							-
Traditional_sales_turnover		-	+		-		
Services	-		+		+		
Average_value_transaction		+					
%_transactions_business	-		-	+			
%_transactions_foreigners	-	-	+	-			
%_transactions_auctions				+		+	+
Factor_fixed_costs	+						-
Factor_commission				+	+		
Factor_popularity_consumer		+		+	-	-	
Factor_foreign_settlement		+		+			
Factor_security							
Factor_customer_convenience	-		-		+		
Factor_speed_settlement				+			
Factor_automation	-			-			
Factor_within_integrator						+	
Cash_on_delivery							
Bank_transfer							
Payment_integrator			+				
Payment_in_person							
Pay-by-link			+			+	
Card_payment		+			+		
Virtual_payment							+
Credit_or_installment			+				+
Payment_in_other_POS							
%_tran_cash_on_delivery		-				-	
%_tran_bank_transfer		-			-		
%_tran_payment_integrator							
%_tran_payment_in_person							
%_tran_pay-by-link							-
%_tran_card_payment						+	+
%_tran_virtual_payment				-			
%_tran_credit_or_installment							
%_tran_payment_in_other_POS		-					

The sign of relation represents positive or negative impact of significant explanatory variables on the acceptance of particular payment methods.

Source: Self-compilation.