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# Carrot and Stick: Impact of Regulations, Subsidies, and Obligations on the Development of Cashless Payments in Poland

**Abstract**: Between 2012 and 2024, Poland—once a laggard in cashless payments among EU countries—underwent a profound transformation. The per capita number of cashless transactions at physical points of sale increased more than eightfold, rising from approximately 30 to over 250 per year, surpassing the EU average. While the number of payment cards per capita grew by about 40%, payment terminals per one million inhabitants increased almost fivefold, from 7,500 to 36,700. This paper adopts a two-stage analytical approach to examine whether policies introduced over the past decade influenced the growth in payment terminals and cards, and ultimately, the volume of cashless transactions. These policies include regulations of the interchange fee level, a program to subsidize payment terminals for merchants, and the introduction of the legal obligation for merchants to accept cashless instruments. Our findings indicate that the first two policies—interchange fee regulation and terminal subsidies—positively affected the expansion of the acceptance network. In turn, this expansion had a statistically significant impact on the growth of cashless payment usage.

**Keywords**: payment cards, payment terminals, interchange fee, obligations, subsidies, cashless payments

**JEL Classification:** E42, L51, H25

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## 1. Introduction

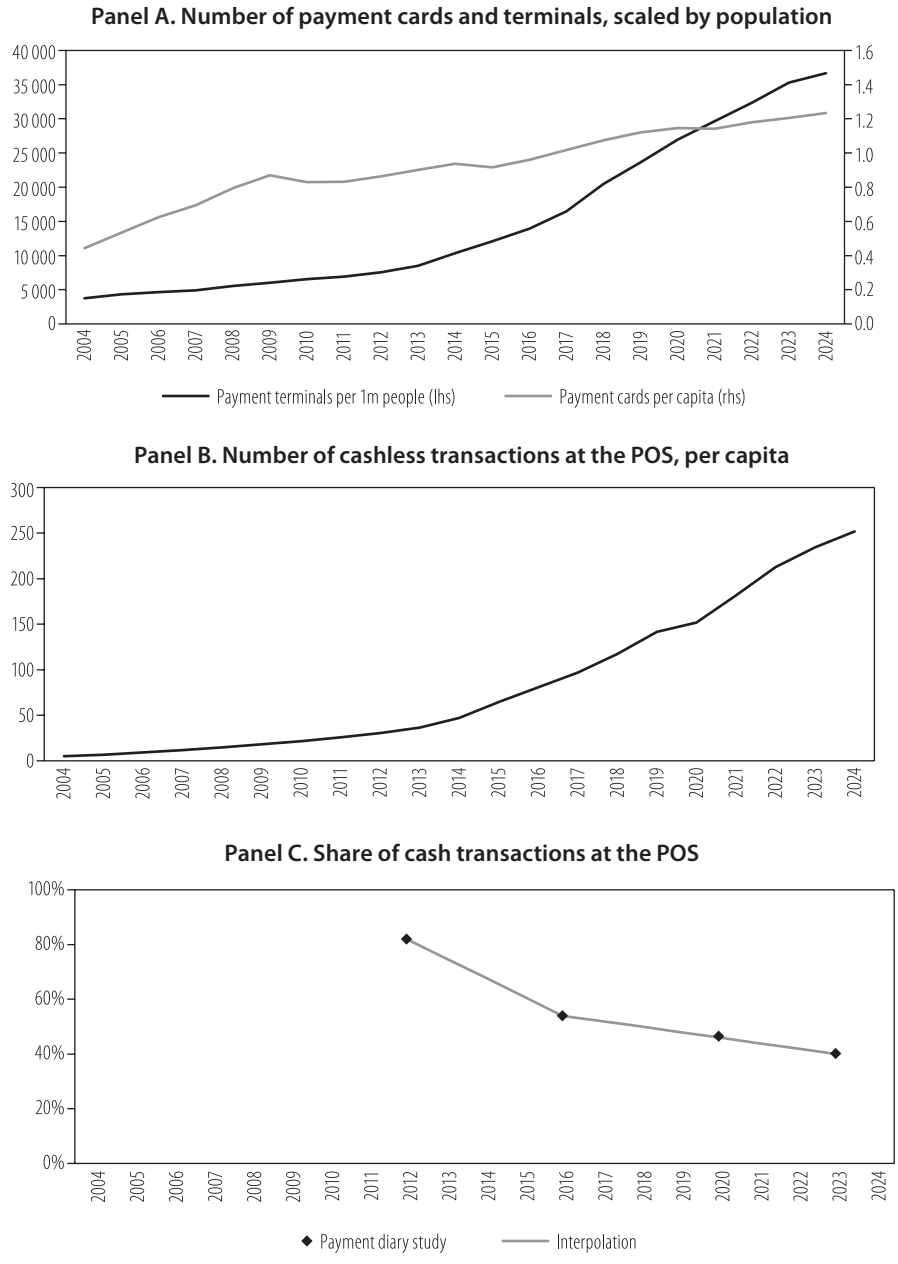
Card payments have become a fundamental retail transaction method in several advanced economies (Khiaonarong & Humphrey, 2023). For success in this field to continue, it is necessary to achieve additional and balanced advancements in supplying consumers with cashless payment options (known as issuing) and expand the network of places that accept these payment methods (known as acquiring). This is because the payments market operates as a two-sided market that is subject to network externalities—cf., e.g., Gowrisankaran & Stavins (2004), Rochet & Tirole (2003, 2006), and Wang (2016)—that is, the payments market is a market where consumers and retailers derive value from the size and activity of the other group. This value—or utility—is vital for further growth.

In Poland, the payment card industry has had an imbalanced development. Specifically, for a long time, the issuance of cards outpaced the deployment of payment terminals. This can be observed in Panel A of Figure 1. As a result, even though at the end of 2011 there were about 83 payment cards in circulation for every 100 people, payments at physical points-of-sale (POS) were still dominated by cash. Cash transactions accounted for almost 82% of all transactions at these locations (Koźliński, 2013). Research conducted at the time revealed that the limited size of the card acceptance network was a significant barrier for consumers to pay by card. According to a consultancy report, only approximately 15% of retailers accepted payment cards during that period (Polasik, 2013). Marzec, Polasik, & Fiszeder (2013) highlight that this hindered many consumers from aligning their payment choices with their preferences.

In recent years, the gap between the number of people with payment cards and the availability of places where these cards can be used has narrowed significantly; see again Panel A of Figure 1. In 2019, an estimated 43% of all retailers accepted payment cards (Polasik et al., 2020). This may have been a key contributing factor because, by 2023, the share of cash transactions at the POS had dropped to 40% (NBP, 2024).

To sum up, Panels A-C of Figure 1 show, respectively, that in Poland, the number of both payment cards and terminals is on the rise (albeit at a different pace), that the same is true for the number of cashless transactions, and that, conversely, the share of cash transactions at the POS is steadily declining. This is an ideal setting to examine the causal relationships between these developments, if any. In what follows, we present a formal analysis of whether, and to what extent, changes in the adoption of payment cards and the size of the acceptance network impact the number of cashless transactions.

**Figure 1: Card payment infrastructure in Poland and cash(less) transactions at the POS**




Notes: Panels A and B – own calculations based on public data repositories of the National Bank of Poland; Panel C – based on the Cash Usage Database (Kotkowski, Dybka, Piotrowska, & Van Hove, 2025).

Additionally, we look closer into the possible explanations for the observation that the number of payment cards grew more rapidly in 2004-2013, whereas in 2014-2024, the acceptance network developed faster. We hypothesize that three events, all policy-related but with different aims, may help explain the second development:

1. three rounds of interchange fees regulation (in 2013, 2014, and 2015),
2. the launch of the "Cashless Payment Support Program" (in 2017), and
3. the introduction of an obligation for merchants to accept cashless instruments (in 2021).

Given the importance of cashless payments—which have been associated with benefits such as increased GDP growth (Tee & Ong, 2016; Wong, Lau, & Yip, 2020; Zhang, Zhang, Liu, De Renzis, & Schmiedel, 2019), a decrease in the size of the shadow economy (Dybka, Kowalczuk, Olesiński, Torój, & Rozkrut, 2019; Dybka, Olesiński, Rozkrut, & Torój, 2023; Reimers, Schneider, & Seitz, 2020; Schneider, 2018), and higher tax revenues (Hondroyiannis & Papaoikonomou, 2017, 2020; Immordino & Russo, 2018; Spinelli, Gastaldi, Van Hove, & Van Droogenbroeck, 2024)—we believe that the results of our analysis might be helpful not only for academia but also for policymakers, as information regarding the possible impact of a given policy might be helpful.

The paper is structured as follows. Section 2 provides a detailed overview of key interventions implemented over the past decade that may have influenced the Polish payments market. Section 3 describes the dataset and outlines our research model and methodology. Section 4 presents the results of our analysis and offers a discussion of the findings. Section 5 summarizes the study's conclusions and highlights potential directions for future research. Finally, Section 6 discusses the broader policy implications of our findings.

## 2. In-depth review of interventions

This Section discusses the three key interventions in the Polish payments market that were listed above and that, as will become apparent, have had the most significant impact on the development of cashless payments in Poland.

### 2.1. Interchange fee regulations

A typical phenomenon in payment markets in general is the existence of network externalities, which implies that each new entrant increases the system's value for all participants (Church, Gandal, & Krause, 2008; Katz & Shapiro, 1985). This network effect is related to the theory of two-sided markets (Evans & Schmalensee, 2007; Wang, 2016; Wright, 2004a, 2004b), where two different user groups are served. According to this theory, there are indirect network externalities in that the higher the number of users on one side of the market, the greater the benefits users enjoy (Rochet & Tirole, 2003).

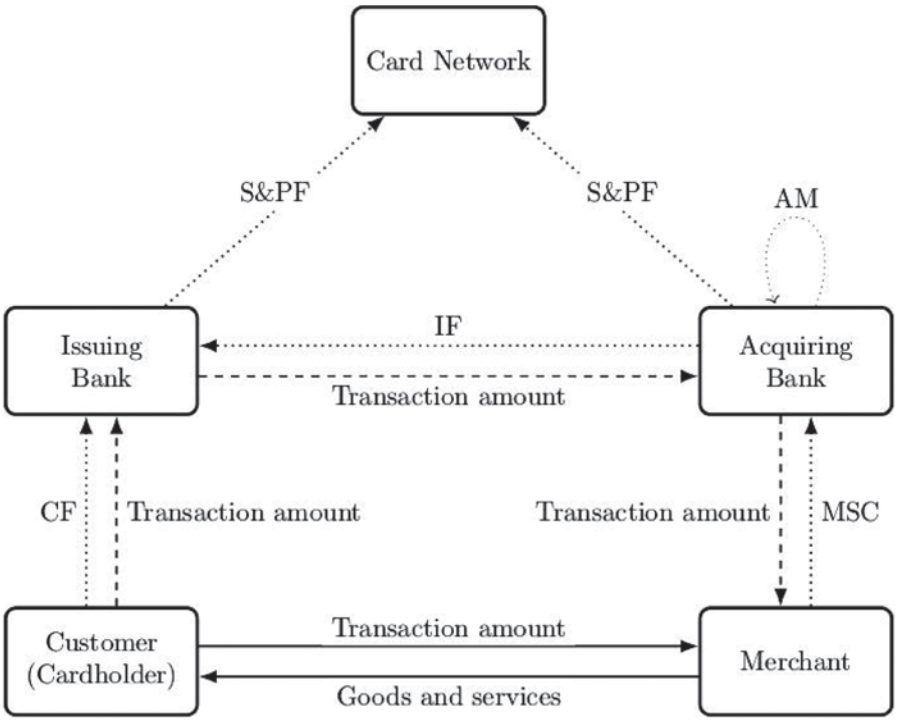
This also holds for the payment cards market, including the most widespread payment card schemes—such as Mastercard and Visa—that operate under the so-called four-party model; see Figure 2 for a simplified presentation. As can be seen, apart from the scheme itself (the "card network" in the Figure), the model consists of four types of entities:

1. cardholders – consumers making payments;
2. merchants – retailers accepting payments made with cards;
3. acquirers (acquiring banks) – companies taking care of the acceptance of cards for merchants;
4. issuers (issuing banks) – often banks, issuing cards to consumers.

In a four-party payment card scheme, each stakeholder sets prices (fees) for its customers; see again Figure 2. Issuers put fees on cardholders and acquirers on merchants[1], and the card scheme itself sets system fees on both issuers and acquirers. At the same time, the card scheme sets a unique fee that can have a significant impact on the commercial success and stability of the scheme: the interchange fee (Górka, 2018; Mariotto & Verdier, 2017; Rochet, 2003; Schmalensee, 2002; Verdier, 2011).

[1] In most cases, acquirers also charge merchants for the lease and maintenance of payment terminals.

**Figure 2: Simplified model of cash and card transactions**




Note: Solid lines show the exchange of funds and goods or services during cash transactions, whereas dashed lines present the flow of funds in payment card transactions made in the four-party model. The dotted lines show the flow of fees. CF stands for "Cardholder fees," IF for "Interchange fee," S&PF for "Scheme & Processing Fees," AM for "Acquirer margin," and MSC for "Merchant Service Charge."

Source: own elaboration based on Welte & Molnar (2021) and Rysman & Wright (2015)

Technically, this is a fee that the acquirer pays the issuer to compensate the latter for the costs involved in issuing cards, a cost that issuers have trouble recouping directly from cardholders. There is a complete pass-through of the interchange fee to merchants, who may pass it on to consumers, depending on the market competition (Shabgard & Asensio, 2023). In practice, acquirers charge merchants a so-called "merchant service charge" (MSC), which includes the interchange fee, the "system fee" paid by the acquirer, and the "acquirer margin". Studies done in Poland have shown that interchange fees can account for up to 85% of the MSC (Maciejewski, 2012).

The specificity of the four-party model lies in the fact that the issuers incur the bulk of the costs, e.g., for acquiring customers, issuing and servicing cards, promoting their use, and adapting cards and banking systems to new technologies. At the same time, most of the revenue in the system is generated by the acquirers (such as through the processing and registration of transactions, as well as the leasing and maintenance of terminals). Hence, it is necessary to balance this disequilibrium by transferring funds from acquirers to issuers. The interchange fee is thus a factor that stimulates the activity of issuers, who are motivated to encourage cardholders to make card transactions as often as possible. Issuers can do so by, e.g., waiving fees or granting bonuses for using cards (Ching & Hayashi, 2010; Schwartz & Vincent, 2006; Shy, 2023). Without the interchange fee, banks would not earn sufficient revenue from the sole issuance of cards, which could hurt the whole system's efficiency. In addition, it is argued that revenues from interchange fees enable banks to invest in innovative, more secure, and more efficient payment solutions (Bourreau & Verdier, 2019; Reisinger & Zenger, 2019; Verdier, 2010).

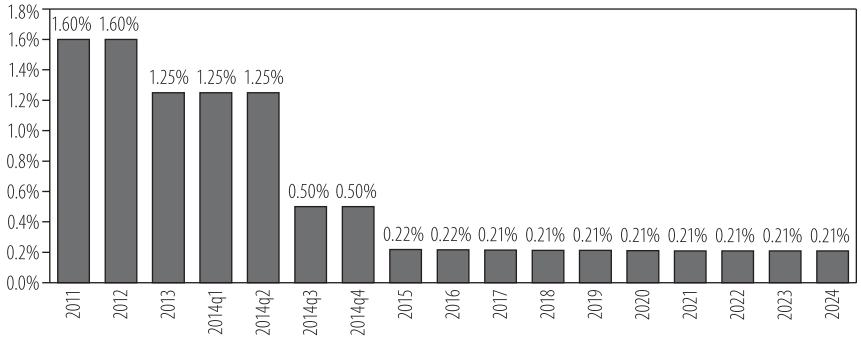
However, it should be noted that, to the detriment of merchants, competition between card schemes works towards increasing interchange fees, which—as mentioned—increases the propensity of acquirers to issue more payment cards but raises the barriers to acceptance by merchants, who face higher MSCs (Wright, 2012).

The high interchange fee levels that prevailed in the noughties attracted academic interest. They led to the development of the so-called Merchant Indifference Test (also dubbed the "Tourist Test") by Rochet and Tirole (2011). The Tourist Test calculates the interchange fee level at which merchants would be indifferent (hence the name), in terms of costs, between accepting cash or cards from a non-repeat consumer (a "tourist," thus the alternative name) (Aurazo & Vasquez, 2020; Górka, 2014). Armed with this tool, and after years of debate, the European Commission introduced the *Regulation on Interchange Fees for Card-based Payments* (the so-called Multilateral Interchange Fees, or MIF, Regulation)[2], which established maximum interchange fees in all European Union member states, at a low level of 0.2% of the value of debit card transactions and 0.3% for credit card transactions. The change entered into force on December 9, 2015.

[2] Regulation (EU) 2015/751 of the European Parliament and of the Council of 29 April 2015 on interchange fees for card-based payment transactions (Text with EEA relevance) OJ L 123, 19.5.2015, p. 1–15, http://data.europa.eu/eli/reg/2015/751/oj

However, before the introduction of the MIF Regulation, three other changes to the interchange fee level had already occurred in Poland. Until the end of 2012, Poland's effective interchange fee levels (considering debit and credit cards) amounted to ca. 1.6% of the transaction value. They were the highest in the European Union. This resulted in the high profitability of card issuance for banks, but was met with objections from the merchant community, bearing the burden. As part of work carried out under the auspices of the National Bank of Poland (the Polish central bank) and then parliamentary work, interchange fees were first reduced to approximately 1.3% in 2013 as a result of voluntary decisions of Visa and Mastercard, and then—as a result of an amendment to the Payment Services Act adopted on August 30, 2013, but effective as of July 1, 2014—to a maximum level of approximately 0.5% of the value of card transactions. Subsequently, on November 28, 2014, a further amendment to the Act mentioned above was adopted under which the interchange fee was reduced to 0.2% of the transaction value for debit cards and 0.3% for credit cards as of January 29, 2015 (so almost a full year earlier than ordained by the MIF Regulation). Figure 3 presents an overview of the evolution of Poland's effective interchange fee levels.

**Figure 3: Estimated effective interchange fee levels in Poland**




Notes: Debit and credit cards combined. For the years 2011–2014: own calculations based on reports by the National Bank of Poland (Krawczyk, Klepacz, Ożdżeńska, & Tochmański, 2015; Maciejewski, 2012); from 2015 onward: own calculations based on the total values of domestic debit and credit cashless payments and the rates set by the law. For simplicity's sake, prepaid cards are debit cards, whereas charge cards are credit cards.

## 2.2. Cashless Payment Support Program

In June 2016, the incumbent Polish government started the project "From Paperless to Digital Poland" (also known as "Paperless and Cashless Poland"), which

later became part of the even broader "Strategy for Responsible Development for the period up to 2020 (including the perspective up to 2030)". Within Paperless and Cashless Poland, nine streams (or working groups) were established, each to generate a solution for the modernization and digitalization of the Polish economy in their respective areas. One of the streams was called "Increasing Cashless Transactions," and this working group came up with the idea for a "Cashless Payment Support Program" (hereafter: CPSP). Subsequently, the CPSP was established as an initiative of the Polish Bank Association and the Ministry of Development and Finance, in cooperation with card schemes Visa and Mastercard (Szalacha-Jarmużek, Polasik, & Jakubowska, 2022).

The main objective of the CPSP was "to undertake activities in the development of cashless payments in Poland, in particular by expanding the network of acceptance of payment instruments and promoting and developing cashless payments among Polish entrepreneurs and consumers, as well as activities to build technological innovations in payments". In 2017, its implementation was entrusted to the newly established "Cashless Poland Foundation". To accomplish the designated objective, a dedicated Fund was established, comprising financial resources contributed by issuers, acquirers, and card schemes. The precise sum of monies to be given to the Fund from every national debit card transaction, which served as the foundation for computing the charge, was:

1. 0.01 PLN (about 0.0025 USD[3]) per transaction for the issuer (lowered to 0.006 PLN (0.0015 USD) from the 3rd quarter of 2021 onward),
2. 0.015 PLN (about 0.0037 USD) per transaction for the card scheme (lowered to 0.009 PLN (about 0.0022 USD) from the 3rd quarter of 2021),
3. 0.01% of the transaction value for the acquirer (lowered to 0.006% from the 3rd quarter of 2021).

Total estimated contributions to the Fund are presented in Figure 4. Interestingly, due to the documented annual increase in the number of cashless transactions, total contributions to the Fund exhibited an upward trend—until they were reduced by 40% in the third quarter of 2021. Since then, no further changes to the fees have been introduced, and as the number of cashless payments in Poland continues to grow, the nominal value of the contributions has been rising again.

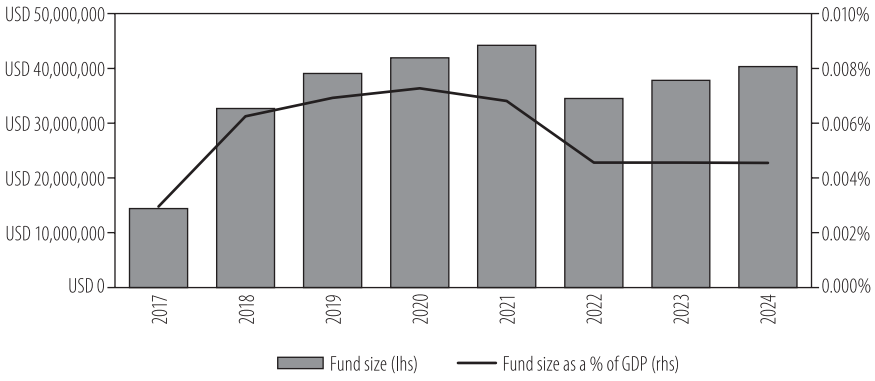
The CPSP was officially launched in January 2018 and initially targeted small and medium enterprises, including micro-enterprises, that had not accepted cashless transactions in the previous twelve months. To join the program, the merchant

[3] Based on the official exchange rate provided by the National Bank of Poland on 2024-12-31.

had to opt in to be subsidized when concluding a contract with an acquirer (who also has joined the CPSP). The subsidy covered the costs related to the installation and lease of up to three terminals and the commissions related to cashless payments (up to a total of about 25,000 USD in turnover per terminal) for twelve months. In other words, thanks to the CPSP, the marginal MSC of participating merchants (temporarily) drops to 0, while acquirers retain their revenue streams. To be clear, merchants do not receive subsidies; the Cashless Poland Foundation transfers them directly to the acquirer.

The Cashless Poland Foundation was initially scheduled to operate until the end of 2022; however, stakeholders extended its duration to 2025 and later to 2028. Along the road, there have also been some changes to the setup. For example, public authorities and institutions (such as city councils or local government units) could join over time. Also, at the beginning of March 2022, the financing period was shortened to five months (instead of twelve), and the number of terminals eligible for subsidies was limited to just one. This was in response to the surge in interest of entrepreneurs in the CPSP caused by the entry into force of regulations under the 'Polish Deal' law, which obliged cash register users to accept cashless payments (see the next section). However, after a few months, interest returned to the norm of previous years, and the rules that were in force until the end of February 2022 were restored, albeit only for one device.

**Figure 4: Estimated contributions from stakeholders to the Cashless Payment Support Program Fund**




Note: Own calculations based on the total number and value of domestic debit payments at physical POS in combination with the contribution rates found in the official documentation of the Cashless Poland Foundation. The total size of contributions to the fund is provided in USD for ease of international interpretation. We used the exchange rate as of the end of December 2024 rather than more precise year averages so that exchange rate fluctuations do not distort the picture.

### 2.3. Obligation to accept a cashless payment instrument

In January 2022, the Polish government put into motion the "Polish Deal," a development program primarily aimed at speeding up the recovery from the crisis caused by the COVID-19 pandemic[4]. One of the measures in the package was a change in the Entrepreneurs' Law that entered into force on January 1, 2022 (but was announced on October 23, 2021)[5]. With the revised law, the Polish government mandated that every entrepreneur who sells goods or services using cash registers must allow customers to pay cashless.

Let us stress that the law does not impose the acceptance of card payments. Merchants may use other solutions to accept cashless payments, e.g., credit transfers or payments "to their phone" via the local payment scheme BLIK. Note also that non-compliance with the obligation has not yet been sanctioned, so entrepreneurs do not see the consequences of non-compliance.

This is a rare policy initiative; in many areas of the world, it is cash whose acceptance by retailers is protected (see, e.g., Zamora-Pérez, 2022). The only other known cases are Belgium, where such an obligation has been in force since 1 July 2022, and Italy, where, since 2014, merchants have been required to accept card payments, necessitating the use of a card reader. Notably, even in Poland, this policy sparked disagreement between the government, which supported the legislation, and the National Bank of Poland, which emphasized the need for stronger measures to protect cash in its "National Strategy for Cash Circulation Security" (NBP, 2021).

## 3. Materials and methods

This section first outlines the data that we use. Next, we introduce our two-stage investigation method to identify the determinants of the volume of cashless transactions, the extent of the payment card acceptance network, and the number of payment cards.

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[4] See website of Chancellery of the Prime Minister for more details: https://www.gov.pl/web/primeminister/the-polish-deal--a-real-profit-for-18-million-poles

[5] Act of 29 October 2021 amending the Personal Income Tax Act, the Corporate Income Tax Act, and certain other acts (Dz. U. 2021 item 2105)

### 3.1. Data

The data for our models has been collected from various sources. Our main dependent variables, namely the number of cashless transactions (*cashless_trx_volume*), the number of payment terminals (*payment_terminals*), and the number of payment cards (*payment_cards*), have been collected from public repositories of the National Bank of Poland. Note that, in some regressions, these variables will be used as explanatory variables. Our other explanatory variables, namely the average interchange fee level in the economy (*IF_rate*), the active operations of the CPSP (*Cashless_Poland*), and a dummy for the law obliging merchants to accept cashless instruments (*mandatory_acceptance*), have been collected or calculated by us. Additionally, we use two control variables: Polish households' consumption level (*household_consumption*) and a dummy variable, *COVID-19*, indicating whether, during a given quarter, the state of epidemic emergency was in force (in Poland, it was in force between March 20, 2020, and May 16, 2022). All data are quarterly and span between the 4$^{th}$ quarter of 2003 and the 4$^{th}$ quarter of 2024.

The *COVID-19* variable has been added because recent studies have already shown that the pandemic had an impact on many aspects of everyday life, including the adoption of cashless payments and changes in shopping and payment behaviors (Bounie, Camara, & Galbraith, 2023; Jonker, van der Cruijsen, Bijlsma, & Bolt, 2022; Kotkowski & Polasik, 2021; Wisniewski, Polasik, Kotkowski, & Moro, 2024). However, we are unaware of any research investigating the impact of COVID-19 on the card acceptance network. We consider this to be an intriguing dimension.

Table 1 presents the variables, their description, and the data source, whereas Table 2 presents descriptive statistics.

**Table 1: Definitions of variables**

| Variable | Description | Source |
|---|---|---|
| cashless_trx_volume | Total number of domestic cashless transactions made with payment cards per quarter. | National Bank of Poland |
| payment_terminals | Total number of payment cards at the end of the quarter. | National Bank of Poland |
| payment_cards | Total number of payment terminals accepting card transactions at the end of the quarter. | National Bank of Poland |
| IF_rate | Effective interchange fee rate per quarter. | Own calculations |
| Cashless_Poland | Dummy variable indicating whether the CPSP was operating (see section 2.2) in a given quarter. | Own calculations |
| mandatory_acceptance | A dummy variable indicating whether the obligation for cashless instrument acceptance (see Section 2.3) was present in a given quarter. | Own calculations |
| household_consumption | The nominal value of households' expenditure (in millions of PLN) per quarter. | Statistics Poland |
| COVID-19 | Dummy variable indicating whether the state of epidemic emergency was in effect in a given quarter. | Own calculations |

**Table 2: Descriptive statistics**

| Variable | N | Mean | SD | Min | Median | Max |
|---|---|---|---|---|---|---|
| cashless_trx_volume | 85 | 767,215,381 | 731,752,660 | 41,561,206 | 413,495,010 | 2,382,129,237 |
| payment_terminals | 85 | 544,559 | 404,996 | 128,002 | 357,378 | 1,374,706 |
| payment_cards | 85 | 34,300,809 | 8,623,426 | 15,130,136 | 34,744,930 | 46,258,025 |
| household_consumption | 85 | 278,049 | 102,604 | 139,185 | 254,500 | 528,556 |
| IF_rate | 85 | 0.0090 | 0.0067 | 0.0021 | 0.0125 | 0.0160 |
| Cashless_Poland | 85 | 0.3294 | 0.4728 | 0.0000 | 0.0000 | 1.0000 |
| mandatory_acceptance | 85 | 0.1412 | 0.3503 | 0.0000 | 0.0000 | 1.0000 |
| COVID-19 | 85 | 0.1176 | 0.3241 | 0.0000 | 0.0000 | 1.0000 |

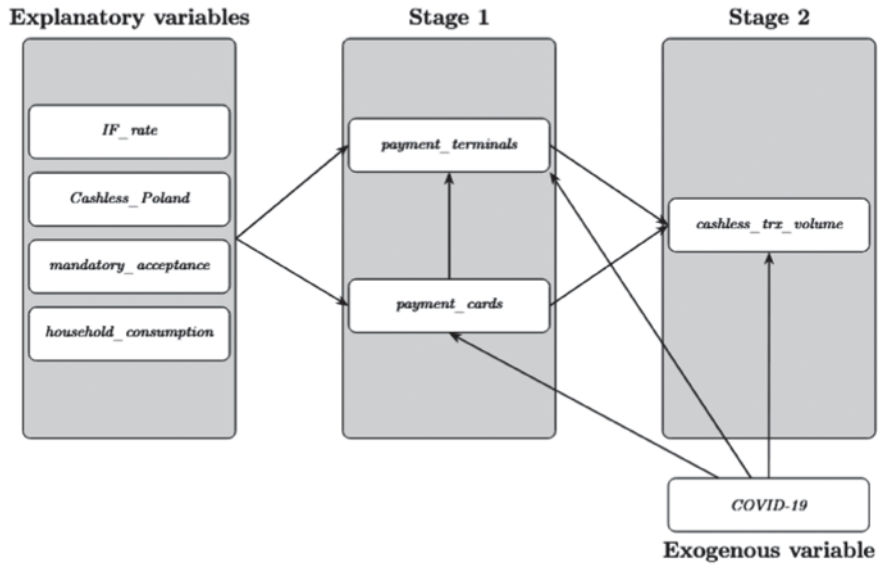
## 3.2. Research model and methods

Figure 5 illustrates the two-stage approach that we use. First, we determine what factors affect the number of payment terminals and payment cards. Subsequently, we use the latter as our main explanatory variables in Stage 2, explaining the total number of cashless transactions in the Polish economy.

We construct three Autoregressive Distributed Lag (ARDL) models in our analysis. The first model of Stage 1 has *payment_terminals* as the dependent variable and *payment_cards* as a dynamic regressor. The model includes the following exogenous variables: *IF_rate, Cashless_Poland*, *mandatory_acceptance*, and *COVID-19*. In the second model of Stage 1, *payment_cards* is the dependent vari-

able, and *payment_terminals* and *household_consumption* are dynamic regressors. The model includes *IF_rate* as an exogenous variable.

**Figure 5: Initial research model**




Finally, the sole model in Stage 2 has *cashless_trx_volume* as the dependent variable and *payment_terminals*, *payment_cards*, and *household_consumption* as dynamic regressors, with *COVID-19* as an exogenous variable.

ARDL is a widespread technique, and its use is warranted when there is a single cointegrating vector, identified here by unrestricted co-integration rank tests: trace and maximum eigenvalue (Johansen, 1988; Pesaran, Shin, & Smith, 2001). An additional reason for using the model was the ambiguous results of the unit root test we conducted.

The Conditional Error Correction Form of our ARDL model reads:

$$\Delta Y_t = c + \alpha_0 \cdot Y_{t-1} + \sum_{j=1}^{k} \alpha_j \cdot X_{j,t-1} + \sum_{l=1}^{p-1} \alpha_{1,l} \cdot \Delta Y_{t-l} + \sum_{j=1}^{k} \sum_{l=0}^{q_j-1} \beta_{j,l} \cdot \Delta X_{j,t-l} + \gamma \cdot D_t + \varepsilon_t \quad (1)$$

where:

$Y_t$ = the dependent variable;

$X_t$ = a vector of regressors;

$D_t$ = a vector of deterministic variables.

From (1) we can obtain the long-run relation defined by cointegrating vector $(1, \frac{c}{\alpha_0}, \frac{\alpha_1}{\alpha_0}, \ldots, \frac{\alpha_k}{\alpha_0})$:

$$Y_t = -\frac{c}{\alpha_0} - \sum_{j=1}^{k} \frac{\alpha_j}{\alpha_0} \cdot X_{j,t}, \tag{2}$$

with $\alpha_0$ = speed of adjustment to equilibrium following short-run shocks.

Based on the results of the Johansen test (Johansen, 1991), we concluded that a cointegrating relationship exists and that ARDL models are viable for use in the 1st model of Stage 1 and the Stage 2 model. However, the Granger Causality test results indicated a lack of causality between *payment_cards* and *cashless_trx_volume*, *payment_terminals*, or *household_consumption*. Hence, using the ARDL approach for the 2nd model of Stage 1 was impossible. As a result, we estimated a simple OLS model with *payment_cards* as the dependent variable and the exogenous variables *IF_rate*, *Cashless_Poland*, *mandatory_acceptance*, and *COVID-19*. However, because of insignificance, only one explanatory variable is left in the model, that is, *IF_rate*.

## 4. Results

Results are presented in the following order: First, we will describe a model that estimates factors affecting the acceptance network of payment cards, followed by a model that describes factors affecting the number of payment cards. These two models represent the two sides of the payment card market. Lastly, we present estimates of how these two dimensions affect the total number of cashless payments at physical POS in Poland.

### 4.1. Payment terminals

Table 3 presents the results of our model for the number of payment terminals. The long-run coefficient is statistically significant and aligns with theoretical expectations. In the short run, the coefficients for *IF_rate* and *Cashless_Poland* are significant and display the expected signs. The variables *mandatory_acceptance* and *COVID-19* also have the expected signs, but their effects are not statistically signifi-

cant. The coefficient on the error correction term is negative and highly significant. (t-statistic = -6.7131), and less than one in absolute value. Its relatively low magnitude (-0.05) suggests that approximately 5% of any deviation from the long-run equilibrium is corrected each quarter.

**Table 3: Results of ARDL estimation for model 1 of Stage 1. Dependent variable: payment_terminals**

| Relation | Variable | Coefficient | Std. Error | t-Statistic | Prob. | Sig. |
|---|---|---|---|---|---|---|
| Long-run | constant | 572,287 | 275,665 | 2.0760 | 0.0416 | ** |
| | payment_cards | 0.02 | 0.01 | 2.7011 | 0.0087 | *** |
| Short-run | Δ(payment terminals)(-1) | -0.03 | 0.11 | -0.2751 | 0.7840 | |
| | Δ(payment terminals)(-2) | -0.17 | 0.11 | -1.5305 | 0.1304 | |
| | Δ(payment terminals)(-3) | -0.22 | 0.11 | -1.9342 | 0.0571 | * |
| | Δ(payment_cards) | 0.00 | 0.00 | 2.2278 | 0.0291 | ** |
| | Cashless_Poland | 26,441 | 4,807 | 5.5002 | 0.0000 | *** |
| | IF_rate | -2,050,025 | 329,449 | -6.2226 | 0.0000 | *** |
| | mandatory_acceptance | 4,531 | 3,648 | 1.2420 | 0.2184 | |
| | COVID-19 | 5,399 | 3,517 | 1.5350 | 0.1293 | |
| | error correction term | -0.05 | 0.01 | -6.7131 | 0.0000 | *** |

Note: Sig. indicates statistical significance levels based on p-values: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

## 4.2. Payment cards

Table 4 presents the results of the OLS regression between the number of payment cards and the *IF_rate*. The relationship between these variables has the expected sign, with a higher interchange fee rate associated with a higher growth rate in the number of payment cards.

**Table 4: Results of OLS estimation for model 2 of Stage 1. Dependent variable: payment_cards**

| Variable | Coefficient | Std. Error | t-Statistic | Prob. | Sig. |
|---|---|---|---|---|---|
| constant | 369,925 | 122,489 | 3.0201 | 0.0034 | *** |
| IF_rate | 17,013,172 | 7,675,766 | 2.2165 | 0.0295 | ** |
| quarter 1 | -164,861 | 145,250 | -1.1350 | 0.2598 | |
| quarter 2 | -154,027 | 145,250 | -1.0604 | 0.2922 | |
| quarter 3 | -282,765 | 145,224 | -1.9471 | 0.0551 | * |

Note: Sig. indicates statistical significance levels based on p-values: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

## 4.3. Number of cashless transactions

Table 5 presents the estimation results for the Stage 2 model, capturing the long-run relationship between *cashless_trx_volume* and the variables *payment_terminals*, *payment_cards*, and *household_consumption*, as well as the short-run dynamics associated with the COVID-19 pandemic. In the long run, only the coefficient for *payment_terminals* is statistically significant and exhibits the expected sign. In the short run, the coefficients for the *COVID-19* variable across different lags are significant but vary in sign, reflecting the evolving phases of the pandemic. The error correction term is negative, highly significant (t-statistic = -5.4543), and less than one in absolute value. Its moderate value (-0.48) indicates that approximately 48% of any deviation from the long-run equilibrium is corrected within a single quarter.

**Table 5. Results of ARDL estimation for the Stage 2 model. Dependent variable: cashless_trx_volume**

| Relation | Variable | Coefficient | Std. Error | t-Statistic | Prob. | Sig. |
|---|---|---|---|---|---|---|
| Long-run | constant | -179,000,000 | 86,858,891 | -2.0588 | 0.0438 | ** |
| | payment_terminals | 1,895 | 178 | 10.6556 | 0.0000 | *** |
| | payment_cards | 0.3035 | 4.1748 | 0.0727 | 0.9423 | |
| | household_consumption | -246 | 792 | -0.3113 | 0.7566 | |
| Short_run | Δ(cashless_trx_volume)(-1) | -0.08 | 0.06 | -1.2673 | 0.2099 | |
| | Δ(cashless_trx_volume)(-2) | -0.16 | 0.07 | -2.3584 | 0.0216 | ** |
| | Δ(cashless_trx_volume)(-3) | -0.06 | 0.09 | -0.7252 | 0.4711 | |
| | Δ(cashless_trx_volume)(-4) | 0.65 | 0.09 | 7.1958 | 0.0000 | *** |
| | Δ(payment_cards) | -12.36 | 7.28 | -1.6983 | 0.0945 | * |
| | Δ(household_consumption) | 3,096 | 581 | 5.3242 | 0.0000 | *** |
| | Δ(household_consumption)(-1) | 206 | 528 | 0.3910 | 0.6972 | |
| | Δ(household_consumption)(-2) | 826 | 453 | 1.8239 | 0.0731 | * |
| | Δ(household_consumption)(-3) | 640 | 467 | 1.3703 | 0.1756 | *** |
| | Δ(household_consumption)(-4) | -3,390 | 578 | -5.8640 | 0.0000 | *** |
| | COVID-19 | -75,421,016 | 28,886,568 | 0.0000 | 0.0000 | *** |
| | COVID-19(-1) | -70,364,453 | 37,302,171 | 0.0000 | 0.0000 | *** |
| | COVID-19(-2) | 99,733,679 | 45,640,740 | 0.0000 | 0.0000 | *** |
| | COVID-19(-3) | -42,728,180 | 34,874,980 | 0.0000 | 0.0000 | *** |
| | error correction term | -0.48 | 0.09 | -5.4543 | 0.0000 | *** |

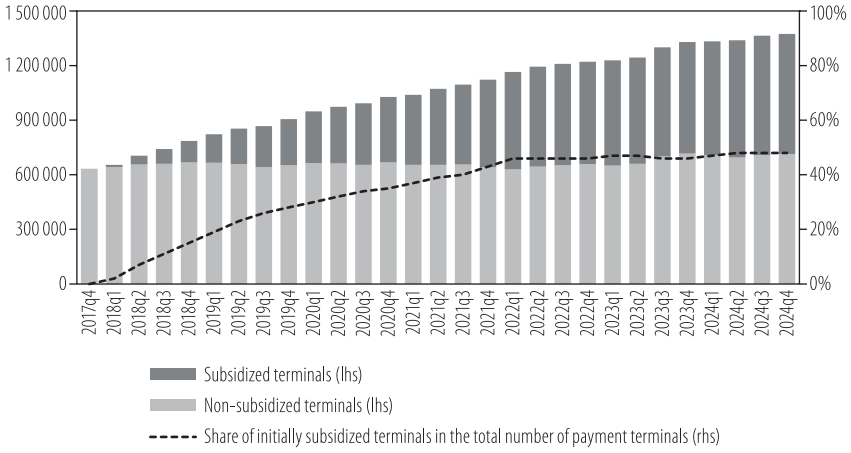
Note: Sig. indicates statistical significance levels based on p-values: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

# 5. Discussion

## 5.1. Impact of policies on acceptance network

The findings of our study indicate that two important policies discussed in this paper, namely the implementation of regulations to decrease interchange fees (*IF_rate*) and the establishment of the CPSP (*Cashless_Poland*), had a substantial and statistically significant influence on the growth of the payment card acceptance network. While the benefit of reducing interchange fees may only be observed via studies such as this one, the effect of the CPSP is far more palpable. Data published by the Cashless Poland Foundation enables a visual presentation of CPSP's impact on the acceptance network. Figure 6 displays the number of payment terminals that, upon their introduction, benefited from subsidies out of the total installed base. At the end of 2024, around 48% of terminals operating in Poland originated from subsidies of CPSP.

**Figure 6: Number and share of payment terminals subsidized by CPSP**




Note: Own elaborations based on data from the Cashless Poland Foundation (Meler, 2025).

Interestingly, both policy measures impacted the costs of those who accept or were to accept cashless payment methods. Reducing interchange fees facilitated a decrease in the MSC (the variable cost of accepting payments), creating more room for competition among acquirers. In contrast, the CPSP temporarily eliminated variable and fixed costs for new merchants.

According to the POLASIK Research consultancy, Polish merchants have hesitated to embrace payment terminals due to the costs of implementation and operation and the fees for handling cashless transactions (see Table 6). Consequently, both regulations addressed a crucial issue for merchants. Indeed, a review of the other reasons put forward by retailers indicates that providing systematic support in the cost area was the only viable option for stakeholders. This is because the remaining reasons cited were challenging to modify, owing to entrenched positions, preferences, and technological barriers.

**Table 6: Reasons for not accepting payment cards: years 2013–2016–2019**

| Category | Reason | 2013 | 2016 | 2019 |
|---|---|---|---|---|
| Costs | The high cost of implementing this method | 0.27 | 0.21 | 0.14 |
| | High monthly operating costs | 0.35 | 0.34 | 0.26 |
| | High merchant fee per transaction value, so-called MSC | 0.30 | 0.22 | 0.18 |
| Demand | Low customer interest in a particular location | 0.39 | 0.51 | 0.45 |
| Security | Security concerns | 0.06 | 0.16 | 0.09 |
| Technical and organizational | Slow payment process | NA | 0.07 | 0.07 |
| | Technical obstacles | 0.12 | 0.11 | 0.16 |
| Other | Little benefit to the business | 0.28 | 0.42 | 0.42 |
| | Preference for cash for settlements | NA | 0.31 | 0.31 |
| | Our company has not been approached recently with such an offer | 0.11 | 0.18 | 0.11 |
| | Lack of conviction or lack of knowledge about paying by card | NA | NA | 0.14 |
| | Other | 0.13 | 0.14 | 0.18 |

Note: Data derived from POLASIK Research consultancy research (Polasik, 2013, 2017; Polasik et al., 2020). KANTAR TNS conducted interviews with merchants. N = 547 (in 2013), 738 (in 2016), and 586 (in 2019).

The third and final policy under analysis, i.e., the obligatory acceptance of a cashless method (*mandatory_acceptance)*, proved insignificant in Model 1 of Stage 1. From our perspective, there are many potential explanations:

1. the duration since the legislation was implemented may have been inadequate, as it is too soon to see the impact,
2. the absence of penalties (see Section 2.3) may have led to the law being disregarded,
3. the concurrent activities of the CPSP may have disrupted our model.

Combining arguments (ii) and (iii) might provide a reasonable explanation. The most compelling evidence for point (iii) is data presented by the Cashless Poland Foundation (Meler, 2025), which indicates that the average number of newly subsidized terminals between December 2021 and February 2022 (considering that the obligation was implemented on January 1, 2022) was 2.5 times greater than the average from the announcement of the law (on October 23, 2021), until the end of November 2021.

As expected, based on the two-sided market literature previously discussed, we observe a positive correlation between the number of payment cards and the size of the acceptance network. This is because the demand for payment card acceptance from customers, together with the notion that it is a necessary market standard, is a significant driver for shops in the Polish market to implement this service (see Table 7). This information is supported by the findings from the POLASIK Research consultancy that have been previously mentioned (Meler, 2025).

**Table 7: Reasons for accepting payment cards: years 2013–2016–2019**

| Category | Reason | 2013 | 2016 | 2019 |
|---|---|---|---|---|
| Financial | Greater control over funds | 0.11 | 0.05 | 0.05 |
| | Desire to increase spending by existing customers | 0.19 | 0.15 | 0.13 |
| | Low card processing costs/reduction in the cost of card processing | NA | 0.06 | 0.07 |
| Demand | Interest from customers | 0.62 | 0.48 | 0.45 |
| | The desire to attract new customers to the store | 0.34 | 0.26 | 0.29 |
| Security | High security | 0.17 | 0.08 | 0.15 |
| Other | Speed of payment and reduction of queues | 0.22 | 0.16 | 0.22 |
| | Image of a modern enterprise | 0.38 | 0.23 | 0.25 |
| | Standard of service required in the market | 0.50 | 0.44 | 0.39 |
| | Opportunity to participate in marketing/loyalty programs | 0.05 | 0.01 | 0.01 |
| | Attractive offer of payment service delivery | 0.16 | 0.06 | 0.06 |
| | The Cashless Poland program terminal is free for a year | NA | NA | 0.08 |
| | Other | 0.05 | 0.03 | 0.02 |

Note: Data derived from POLASIK Research consultancy research (Polasik, 2013, 2017; Polasik et al., 2020). KANTAR TNS conducted interviews with merchants. N = 547 (in 2013), 738 (in 2016), and 586 (in 2019).

We also find that the COVID-19 pandemic had an impact. One possible reason is that the fear of handling cash, evident during the epidemic's initial phases (Auer, Cornelli, & Frost, 2020; Wisniewski, Polasik, Kotkowski, & Moro, 2024), made some consumers hesitant to shop at establishments that do not accept cards.

Consequently, following the imperative of the "must take" argument (Bounie, François, & Van Hove, 2016; Bourguignon, Gomes, & Tirole, 2019), merchants decided to adjust and make such a possibility available.

## 5.2. Impact of policies on payment card issuance

Regarding the number of payment cards in the market, our results show that higher interchange fee rates are associated with higher growth. As explained, interchange fees constitute revenues for issuers. Hence, reducing the interchange fee levels stalled progress in this area. This observation is vital for policymakers in countries considering the regulation of said fees, but where the adoption of payment cards (or, for that matter, any other cashless instrument) is still in the initial stages.

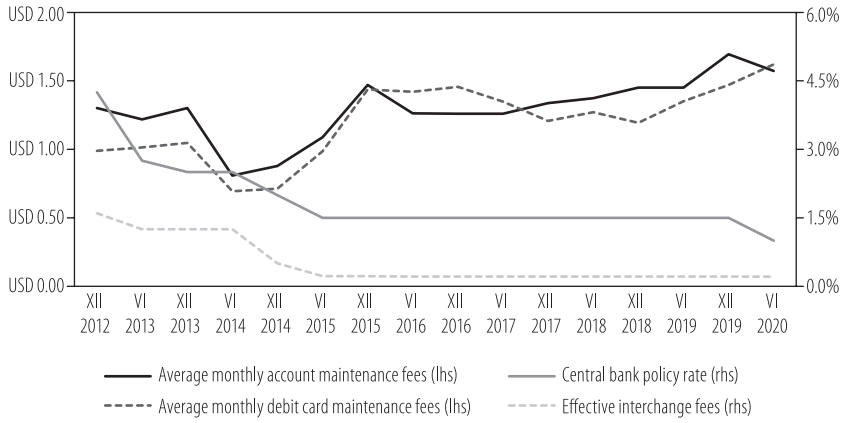
At the turn of 2011 and 2012, before the regulations, around 66% of Poles had a payment card (Koźliński, 2013), with 83 cards issued per 100 people. In 2023, adoption reached 86.7% (NBP, 2024), with 121 cards issued per 100 people. In our opinion, payment card adoption and penetration would have been higher if interchange fees had been higher (see also Górka, 2018; Polasik & Maciejewski, 2017; Polasik & Piotrowski, 2016a, 2016b).

Firstly, faced with lower potential revenues, banks decided to decrease their budget to promote payment cards. This led to a situation where, according to the report "Payment Habits in Poland in 2023" published by the National Bank of Poland (NBP, 2024), one of the most stated reasons given by Polish consumers for not owning any payment card is "I don't see the use of it."

Secondly, the decrease in interchange revenues led banks to increase the maintenance fees for bank accounts and debit cards. Figure 7 compares the average monthly account and debit card maintenance fees with the effective interchange fee levels. According to data collected by the National Bank of Poland (2020), at the end of 2012, i.e., before the MIF reductions, the monthly maintenance fees for using a debit card averaged around 0.99 USD (arithmetic mean calculated based on offers of more than 20 banks in Poland[6]), and the maintenance fees for a bank account averaged around 1.30 USD. By the middle of 2014, the average value of these fees dropped to approximately 0.69 USD (-30%) and 0.81 USD (-38%), respectively.

[6] The offers presented in the National Bank of Poland statistics represent standard offers, the only source of long-term data on bank fees. They should not be considered effective fees because, after meeting certain conditions (e.g., active use of payment cards), the bank often waived these fees at the end of the month.

**Figure 7: Average monthly debit card and bank account maintenance fees, effective interchange fees, and central bank policy rate levels**




Note: Data on average monthly debit card and bank account maintenance fees are compiled from reports of the National Bank of Poland. We utilized all publicly available data from the end of 2012 to the middle of 2020. Data on effective interchange fees are our estimations based on reports by the National Bank of Poland (Krawczyk, Klepacz, Ożdżeńska, & Tochmański, 2015; Maciejewski, 2012) for 2012-2014 and, from 2015 onward, based on the total values of domestic debit and credit payments at physical POS and the rate set by the law.

Still, since 2015, banks have changed their policy to force customers to use payment cards actively. In 2015 and 2016, the average maintenance fee for a debit card increased from 0.67 USD to 1.36 USD (+104%), and the average maintenance fee for a bank account increased from 0.82 USD to 1.18 USD (+44%). This resulted, among other things, in a temporary decrease in the number of debit and prepaid cards: from the end of 2014 to the end of the middle of 2015, the number of payment cards in Poland decreased from 29.7 million to 26.3 million, i.e., by 1.7 million. This was probably because some customers removed seldom-used cards to avoid additional costs. In subsequent years, the fees behaved differently: at the end of 2020, maintenance fees for debit cards rose by another 11% compared to end-2016, whereas maintenance fees for bank accounts rose by 25%.

A qualification is that the observed rises in debit card and bank account maintenance costs are not only attributable to decreased interchange fees. Various factors influence banks' income, including domestic interest rates (Bikker & Vervliet, 2018) and non-interest-related factors (DeYoung & Rice, 2004; Haubrich & Young, 2019). For instance, from the end of 2012 to the first part of 2020, Poland's central bank policy rate declined from around 4.25% to 1% (which, by coincidence, roughly mirrored the changes in interchange fee rates). In addition, there

was an increase in the charges banks must pay to the Bank Guarantee Fund[7]. Furthermore, in February 2016, a so-called bank levy was imposed on Polish banks (for a more detailed discussion about the effects of this levy, see, e.g., Borsuk & Kowalewski (2023) or Kapuściński (2022, 2025)).

### 5.3. Impact of policies on the number of cashless transactions

Our final model reveals that, of our two primary explanatory variables, only the size of the acceptance network (*payment_terminals*) is substantially related to the total number of cashless payments at physical POS; *payment_cards* was statistically insignificant.

Hence, it can be inferred that two of the three policy efforts examined in this study, namely the decrease in the interchange fee rates and the operation of the CPSP, indirectly also influenced the overall volume of non-cash transactions, as the expansion of the acceptance network enabled cardholders to make payments at additional locations. It allows consumers to match their payment choices with their individual preferences.

Therefore, to ascertain the impact of the CPSP on customers, we rely on other analyses. A 5-year research panel commissioned by the Cashless Poland Foundation reveals that from 2018 to 2022, the "Acceptance Confidence Index" (which measures the perception of whether it is possible to pay cashless in different types of retailers) increased in every category (see Table 8). This suggests that the Cashless Poland Foundation's efforts have positively impacted this perception.

[7] See website of Bank Guarantee Fund for more details: https://bfg.pl/dla-instytucji-finansowych/skladki/oplaty-i-skladki-na-fundusze-bfg-dane-historyczne/

**Table 8: Perception of cashless payment coverage by consumers**

| Merchant category | 2018 | 2019 | 2020 | 2021 | 2022 | Δ 2018-2022 |
|---|---|---|---|---|---|---|
| Supermarkets or hypermarkets | 0.92 | 0.96 | 0.95 | 0.95 | 0.93 | 0.01 |
| Small grocery stores | 0.60 | 0.74 | 0.76 | 0.80 | 0.78 | 0.18 |
| Shoe/clothing stores | 0.77 | 0.83 | 0.87 | 0.87 | 0.86 | 0.09 |
| Drugstores and pharmacies | 0.88 | 0.94 | 0.94 | 0.95 | 0.92 | 0.04 |
| Specialized stores | 0.58 | 0.63 | 0.68 | 0.71 | 0.76 | 0.19 |
| Vending machines | 0.17 | 0.32 | 0.28 | 0.33 | 0.38 | 0.21 |
| Petrol stations | 0.95 | 0.98 | 0.98 | 0.98 | 0.98 | 0.03 |
| Parking/highway tolls | 0.40 | 0.46 | 0.54 | 0.61 | 0.63 | 0.23 |
| Public transport/taxi fares | 0.30 | 0.36 | 0.42 | 0.43 | 0.51 | 0.21 |
| Restaurants | 0.63 | 0.69 | 0.73 | 0.74 | 0.82 | 0.19 |
| Bookstores, stationery, and newsstands | 0.55 | 0.62 | 0.68 | 0.73 | 0.74 | 0.19 |
| Medical services | 0.37 | 0.40 | 0.54 | 0.59 | 0.55 | 0.18 |
| Entertainment/culture/sports | 0.61 | 0.69 | 0.64 | 0.72 | 0.79 | 0.18 |
| Hotels/travel agencies/airlines | 0.57 | 0.55 | 0.56 | 0.63 | 0.64 | 0.07 |
| Home appliances/electronics/furniture/ building materials | 0.82 | 0.88 | 0.83 | 0.87 | 0.87 | 0.05 |
| Workshops and car dealerships | 0.33 | 0.33 | 0.39 | 0.39 | 0.51 | 0.18 |
| Services (hairdresser, repairs) | 0.36 | 0.47 | 0.51 | 0.55 | 0.54 | 0.18 |
| Services at home | 0.31 | 0.35 | 0.40 | 0.36 | 0.34 | 0.03 |
| Administration | 0.40 | 0.48 | 0.56 | 0.55 | 0.54 | 0.14 |

Note: Data derived from POLASIK Research consultancy research (Polasik et al., 2023). Minds & Roses and Kantar Polska conducted customer surveys. N = 1500 (in 2018), 1000 (in 2019), 1223 (in 2020), 1000 (in 2021), and 1003 (in 2022).

Although the model suggests that the number of payment cards might not have significantly impacted the total number of cashless transactions, this should not be interpreted to mean that payment cards are unimportant. On the contrary, they are a necessary prerequisite for enabling such transactions. Furthermore, bearing in mind that the interchange fee reduction increased the maintenance fees of both debit cards and bank accounts, there might be some links indicating that the new approach of banks forcing consumers to use their payment cards actively had a positive impact on the increase in the number and value of cashless transactions made with payment cards. Lastly, as COVID-19 affected the acceptance network, it also affected the number of contactless payments.

## 6. Conclusions and implications for policy

The findings presented in this paper illustrate how targeted regulatory changes and subsidization schemes can meaningfully reshape two-sided markets like payment systems. A shift in a single policy lever—such as pricing or infrastructure support—can generate significant ripple effects across supply and demand.

This study contributes to the growing literature on payment market design (Ardizzi, Scalise, & Sene, 2021; Ardizzi & Savini Zangrandi, 2018; Carbó-Valverde, Chakravorti, & Fernández, 2016; EY & Copenhagen Economics, 2020; Górka, 2018; Jonker & Plooij, 2013; Layne-Farrar, 2013). Our analysis shows that the introduction of legislation to lower interchange fees and the launch of the Cashless Payment Support Program (CPSP) significantly expanded Poland's payment card acceptance network. Lower interchange fees reduced merchants' transaction costs, while the CPSP temporarily eliminated fixed and variable costs for new adopters. Despite initial cost-related resistance, these measures encouraged retailers to adopt cashless payment options. By contrast, the mandatory acceptance requirement had no clear effect, likely due to its overlap with the CPSP and lack of enforcement.

We also find that reducing interchange fees, while beneficial for acceptance, may have slowed the expansion of card issuance. This appears linked to rising account and card maintenance fees, which may discourage financially excluded individuals from joining the banking system.

Importantly, our results confirm that growth in the acceptance infrastructure—not just the number of cards—has been the primary driver of increased cashless transaction volume. As the number of accepting merchants grew, consumers were increasingly able to act on their preferences for digital payments.

Moreover, we show that initiatives such as the CPSP have the potential to enhance the expansion of the acceptance network significantly. As far as we know, the CPSP is, together with a similar program in Hungary (Kajdi & Kiss, 2022), the first program of its sort globally and, in our view, merits wider acknowledgment and further study. It might serve as a blueprint for other nations grappling with uneven demand and supply dynamics in the payment card market. Furthermore, our analysis confirms a link between the size of the acceptance network and the total number of transactions. Given that the CPSP has positively impacted expanding this network, such initiatives accelerate the positive feedback loop between network growth and transaction volume.

We see the empirical validation of network externalities as our core contribution. Reducing interchange fees and the CPSP triggered reinforcing effects between merchant adoption and consumer usage. This dynamic highlights how even modest interventions, if well-targeted, can reshape a market ecosystem.

The study provides a crucial justification for other nations' policymakers, especially those outside the EU, where card acceptance costs remain high, by illustrating the effects of reducing card acceptance charges for merchants on the overall operation of the payment card system. It is worth noting that the full effects of interchange fee regulation will take years to materialize, particularly for banks. Future research should revisit this question and inform ongoing regulatory assessments in the EU and elsewhere.

Finally, while our analysis centers on card-based payments, the findings may inform strategies for designing and implementing Central Bank Digital Currencies (CBDCs). Mechanisms that proved effective in boosting cashless adoption—such as price incentives, infrastructure subsidies, and acceptance mandates—may also support CBDC uptake. In particular, the role of the acceptance infrastructure underscores the need for CBDCs to be technically sound, easy to use, and widely accepted.

This view aligns with recent studies stressing that early policy support is essential to overcoming merchant resistance, digital skill gaps, and trust barriers (Ozili & Alonso, 2024). Ensuring legal tender status and integrating CBDCs into everyday retail contexts is also key to preventing marginalization relative to private alternatives (Kaczmarek, 2022). Moreover, well-designed CBDCs may enhance financial stability by reducing panic risk and fostering trust through transparent oversight and governance (Ben Souissi & Nabi, 2023; Vučinić & Luburić, 2022).

Together, these perspectives reinforce the broader relevance of our findings for crafting public policies that shape both the infrastructure and behavioral foundations of digital payment adoption.

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