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ASSESSMENT OF THE LEVEL OF DEVELOPMENT OF CASHLESS TRANSACTIONS IN THE EUROPEAN UNION COUNTRIES BETWEEN 2019–2023

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ABSTRACT

The purpose of the article. The aim of the article is to assess the level of development of cashless payment in the European Union countries between 2019 and 2023. The following research question was formulated – which European Union countries are leading, and which are at the bottom of the ranking in terms of the level of development of cashless payment?

Methodology. The source of data on non-cash transactions was statistical data from the European Central Bank's ECB Data Portal. The method of linear ordering – standardized sums – was used to create a ranking of the European Union countries in terms of the level of development of cashless payment.

Results of the research. An empirical study using the method of standardized sums made it possible to compare the level of development of cashless payment in the EU-27 countries and to identify the leaders and laggards in this respect. The results of the study proved that in the EU-27 countries, non-cash trading develops at a high and medium level. The leaders in this respect included Germany, France and Italy, while the worst ranked countries were Malta, Bulgaria, Latvia, Estonia and Cyprus. The reason for the underdevelopment of cashless payment in these countries can be attributed to an underdeveloped payment infrastructure, fewer institutions offering payment services, lower levels of investment in modern technology, and a payment culture that may be due to a tradition of attachment to cash and a lack of confidence in cashless forms of payment. In addition, the lack of appropriate regulation and government initiatives may influence their lower popularity.

Keywords: non-cash transactions, standardized sum method, payment instruments.

JEL Class: E42, G21, G28.

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Assessment of the Level of Development of Cashless Transactions in the European Union Countries Between 2019–2023

Non-cash transactions play a key role in the economy. They influence its development, as well as influence the economy itself by, among other things, reducing the size of the shadow economy, reducing the costs of sending and receiving payments, creating gross domestic product (the more non-cash transactions accompanying the purchase of products and services, the higher the value of gross domestic product). In addition, the availability of non-cash forms of payment allows the financial needs of consumers, which are basic needs, to be met.

There are many measures of non-cash transactions, including both general and specific ones. Generic measures come from the payment systems of individual EU countries and are collected using IT tools by the European Central Bank (ECB) and stored in the European Central Bank's Statistical Data Warehouse (SDW), now the ECB Data Portal. Examples of general measures are the number of transactions with payment cards, credit transfers, direct debits, cheques, e-money, the value of transactions with these payment instruments, and the payment infrastructure – the availability of POS terminals, ATMs, payment service outlets. Specific measures of goods transactions are created by transforming general measures, often considering the size of the population, e.g., the number of payment terminals per capita, or related to a country's population of one million. Due to the substantial number of available measures, cashless turnover should be studied in multi-criteria research.

The aim of the article is to assess the level of development of cashless transactions in the European Union countries between 2019 and 2023. This assessment can be helpful for payment market stakeholders, e.g., national central banks, payment organizations, as well as payment card issuers, i.e., commercial banks, who use reliable statistical information to compare the level of development of a country's payment system with other countries. Knowledge of the level of development of non-cash transactions is also necessary to make decisions aimed at promoting non-cash transactions in countries where they are underdeveloped. The following research question was formulated: Which countries of the European Union are leading, and which are trailing at the bottom of the ranking in terms of the level of development of non-cash transactions?

Non-Cash Transactions and Their Importance

Non-cash turnover is an important part of the payment system. The term of cashless transactions is understood as ‘monetary settlements in which at each stage of the settlement cycle funds are transferred from and to bank accounts (or banks’ own accounts or other payment accounts), i.e. both on the debtor's (payer's) side, as well as on the creditor's (beneficiary's) side, and in settlements between banks, settlement takes the form of entries only in the bank/payment accounts of the settling entities (with the exception of payment with an e-money instrument, where a transfer of funds from the e-money instrument to a device accepting it takes place’ (NBP, 2013, p. 3).

This article fills a gap in the lack of a single synthetic indicator of the level of development of non-cash transactions that would allow for comparisons between a country and the rest of the Community, as highlighted in reports such as (Fundowicz et al., 2022, pp. 22–23). Data on measures of non-cash transactions that may be helpful in creating a synthetic measure of non-cash transactions are collected by national and European financial institutions, e.g., national central banks or the European Central Bank. The economic scale of the use of non-cash transactions is reflected in the value of transactions, while the frequency of use of non-cash payments is reflected in the number of transactions (Iwańczuk, 2011, p. 121). Variables depicting the value and number of transactions using traditional payment instruments, i.e., payment card, credit transfer, direct debit, cheque, and e-money in the empirical part of the article were included in the catalogue of potential variables describing the development of non-cash transactions. Since the use of non-cash payment instruments, both traditional and innovative, including mobile payments, online requires a relationship with a bank, e.g., to fund a prepaid account and thus to have a savings and checking account (ROR), called a personal account, the number of accounts was also included in the catalogue of potential variables.

It should also be noted that the execution of non-cash transactions requires the use of devices that accept electronic payment instruments. This means that among the variables describing non-cash transactions, it was decided to also include the basic elements of the payment infrastructure. Their presence in the set is due to the fact that payments take place using electronic payment elements in POS terminals – the so-called terminal payments (Zarańska & Zborowski, 2018, p. 15; Borcuch, 2016, p. 58) and multifunctional ATMs, which allow not only cash withdrawals, but also provide information on the bank account held and enable banking operations such as opening an account, making a transfer order or applying for a payment card (Łabenda, 2006, p. 7).

The development of non-cash transactions is beneficial both for the participants in the payment system, including consumers, and for the economy as a whole because of increased lending following the transfer of some cash from cash to bank deposits. The use of payment services by consumers makes it possible to satisfy financial needs, which are basic needs in the modern economy. Access to a wide range of financial services through the financialization of social relations is considered a key factor in consumer welfare (Soliwoda, 2015, p. 86). Furthermore, decisions on the use of cashless forms of payment by household members are an important ‘link in the decision tree of microfinance’, which originates from the institutional finance stream (Solarz, 2012, p. 171). In addition, the development of cashless payments by reducing the circulation of cash in the economy results in a reduction in the size of the shadow economy. This trend is confirmed, among other things, by cyclical studies conducted by Schneider and the research team of the A.T. Kearney consulting firm (Schneider, 2015, p. 6).

In addition, it should be emphasized that the development of cashless payments, e-payments, stimulates overall economic growth, consumption and trade and thus has a positive impact on the economy (Hasan, et. al., 2012, pp. 1–41; Cirasino & Garcia, 2008, pp. 1–78; Slozko & Pelo, 2014, pp. 130–140). In addition to this, previous studies have shown that a country that switches from a completely

paper-based payment system to an electronic system can see savings of at least 1% of GDP per year (Humphrey et al., 2006, pp. 1631–1652).

Description of The Research Method

The study used the method of standardized sums, which is a model-free method of linear ordering. The method consisted in the construction of a synthetic index, based on which it was possible to rank the objects (countries of the European Union) from the best to the worst, where the criterion of ordering was the level of a complex phenomenon, i.e., the development of non-cash transactions. A characteristic feature of this method is both simplicity and low loss of information during the aggregation of diagnostic variables.

The selection of variables to describe a complex phenomenon is most often substantive. This method makes it possible to juxtapose measurement values for distinctive characteristics, even if expressed in different units. This is because the first operation to be carried out was the standardization of the z_{ij} variables. The standardization of the diagnostic variables was aimed at bringing them to a comparable scale, the so-called unmeasured scale, and therefore unrelated to the unit of measurement. In constructing the synthetic index, the authors of the article refrained from assigning weights to individual variables. It was assumed that each characteristic has the same weight in the calculation of the synthetic indicator.

In the study, consideration is limited to the situation where all diagnostic variables are stimulants. A stimulant is a variable having a positive impact on a given phenomenon, a higher value of which indicates a higher level of the phenomenon under consideration (Młodak, 2006, p. 33). Stimulants were standardized according to the following formula (Balicki, 2013, p. 327; Turczak, 2013, p. 79):

$$z_{ij} = \frac{x_{ij} - \overline{x_j}}{s_j}$$

where: z_{ij} – the variable after normalization; x_{ij} – value for object i and j – of this variable; $\overline{x}_j$ – arithmetic mean for j – that variable; s_j – standard deviation for j – that variable.

Standardization results in standardizing the values of all variables in terms of variability measured by standard deviation, which means eliminating variability as a basis for differentiating objects (Kądziołka, 2021, p. 72). If there are destimulants, it would be necessary to convert them into stimulants by multiplying their standardized values by –1 (Kopyściański & Rólczyński, 2013, p. 118). The standardized sums method was carried out in two stages (Dziechciarz, 2003, p. 290).

In the first step, sums of variable values were calculated for each site (country) according to a formula in which all variables are assumed to have a one-to-one effect on the level of the composite phenomenon:

$$p_i = \sum_{j=1}^{m} z_{ij}$$

where: z_{ij} – the value of the i-th object of the j-th variable.

In the next step, a so-called development measure was calculated for each site according to the formula:

$$m_i = \frac{p_i - p_0}{p_0 - p_{-0}},$$

for i = 1, 2, …, n,

where:

$$p_0 = \sum_{j=1}^{m} z_{0j} * w_j$$

$$p_{-0} = \sum_{j=1}^{m} z_{-0j} * w_j$$

w_j – weight of the j-th variable.

z_{0j} oraz z_{-0j} – values of the variables for the abstract objects, i.e., the pattern and the anti-pattern:

$$z_{0j} = \max z_{ij}$$

$$z_{-0j} = \min z_{ij}$$

Based on the mi sum values obtained, the objects were ranked from best to worst. The construction of the mi development measure was aimed at obtaining normalized values in the interval [0;1]. Thus, the higher the value of m_i the higher the level of the complex phenomenon in each object (Bartosiewicz, 1992, pp. 256–261). The study used a classification of the study sites into four typological groups due to the value of the synthetic measure m_i (see Table 1).

Table 1

Division of sites into typological groups according to the value of the synthetic measure

Value of the development measure	Class	Country's level of development in terms of non-cash trade
$m_i \geq \bar{x}+S_d$	I	Very high
$\bar{x}+S_d > m_i \geq \bar{x}$	II	High
$\bar{x} > m_i \geq \bar{x}-S_d$	III	Medium
$m_i < \bar{x}-S_d$	IV	Low

Source: Nowak (1990).

The resulting four typological groups dependent on mi values were created based on the arithmetic mean ($\bar{x}$) and standard deviation (S_d) of these measures (Nowak, 1990).

Results of Own Research

The objects of the study were 27 countries of the European Union. The time scope of the analysis covered the years 2019–2023. The study of the development of cashless trading in the European Union countries during the indicated period was justified by the following considerations:

1. The period covered by the analysis included the pandemic caused by the SARS-CoV-2 virus, which significantly affected consumer payment preferences (Konishi et al., 2024, pp. 140–169; Wisniewski et al., 2021); many people started to avoid cash for hygienic reasons for fear of infection, accelerating the development of cashless payment methods, which is confirmed, among others, by the results of an international UN study (UNCTAD, 2020), as well as a study conducted in Poland (Kotkowski et al. 2021, p. 24; Kotkowski and Polasik, 2021) or Italy (Graziano et. al., 2024).
2. Payment technologies such as mobile payments, digital wallets and proximity technologies have developed rapidly during the period under review (Capgemini Research Institute, 2023; NBP, 2020, pp. 33–50).
3. During the time under review, the European Union introduced several regulations and initiatives to promote cashless trading, including the PSD2 (Payment Services Directive 2), implemented in Poland from 14.09.2019 (Directive of the European Parliament and of the Council (EU) 2015/2366).

In the set of potential diagnostic variables, the variables analyzed by the National Bank of Poland in its annual reports "Comparison of selected elements of the Polish payment system with those of other EU countries" (NBP, 2023) were used. Among the selected variables in the authors' study were the following characteristics, labelled X_1 to X_{16}, converted per capita:

- X_1 – number of credit transfer (ECB, 2024a);
- X_2 – number of direct debits (ECB, 2024b);
- X_3 – number of payment card transactions (ECB, 2024c);
- X_4 – number of cheques (ECB, 2024d);
- X_5 – number of e-money transactions (ECB, 2024e);
- X_6 – number of total transactions excluding cash withdrawals (ECB, 2024f);
- X_7 – value of transactions by credit transfer (ECB, 2024g);
- X_8 – value of direct debit transactions (ECB, 2024h);
- X_9 – value of payment card transactions (ECB, 2024i);
- X_{10} – value of cheque transactions (ECB, 2024j);
- X_{11} – value of e-money transactions (ECB, 2024k);
- X_{12} – value of all transactions excluding cash withdrawals (ECB, 2024l);
- X_{13} – number of all institutions offering payment services to entities that are not part of monetary financial institutions (non-MFI's) (ECB, 2024m);

- X_{14} – number of bank accounts for entities that are not part of monetary financial institutions (non-MFI's) (ECB, 2024n);
- X_{15} – number of payment terminals (ECB, 2024o);
- X_{16} – number of ATMs (ECB, 2024p).

For most of the variables indicated, the NBP assesses annually the position of Poland in comparison with other EU countries from the point of view of the development of cashless trading.

For the selected potential diagnostic variables, coefficients of variation (V) were calculated, being the quotient of the arithmetic mean and the standard deviation, in order to verify whether these variables had the ability to discriminate between the analyzed EU countries, i.e., whether they had an ability to identify and classify various features and characteristics of individual EU countries, which made it possible to distinguish them from one another. The critical value of the coefficient of variation adopted in the study was V = 5%, which resulted in the final inclusion of all mentioned potential variables in the set of diagnostic variables. The results of the variability of characteristics X_1 to X_{16} in the study period are presented in Table 2.

Table 2

Coefficients of variation for potential diagnostic variables in 2019–2023

Variable/Year	2019	2020	2021	2022	2023
X_1	137,6%	136,3%	132,8%	137,0%	129,5%
X_2	273,3%	276,2%	273,9%	258,3%	250,1%
X_3	136,9%	131,8%	129,0%	148,3%	134,2%
X_4	438,6%	439,8%	443,7%	453,6%	450,8%
X_5	387,0%	384,7%	362,9%	336,3%	335,3%
X_6	141,9%	139,7%	135,2%	149,1%	135,4%
X_7	182,8%	181,9%	174,8%	218,2%	184,7%
X_8	275,6%	274,8%	268,5%	273,2%	294,7%
X_9	154,3%	151,1%	146,5%	159,5%	149,9%
X_{10}	244,3%	246,6%	243,1%	246,1%	245,0%
X_{11}	397,3%	384,1%	347,1%	308,2%	296,9%
X_{12}	180,7%	180,8%	176,5%	197,6%	181,4%
X_{13}	133,1%	132,9%	131,6%	130,8%	154,5%
X_{14}	140,0%	138,9%	137,3%	137,0%	141,1%
X_{15}	164,2%	168,6%	172,5%	144,6%	140,7%
X_{16}	49,3%	50,8%	53,6%	56,6%	65,7%

Source: own compilation based on data from ECB Data Portal – European Union.

Table 2 shows that the variables X_4 – number of cheques (volatility above 400%), X_5 – number of e-money transactions and X_{11} – value of e-money transactions (above 300%) and X_2 – number of

direct debits, X_8 – value of direct debit transactions and X_{10} – value of cheque transactions (above 200%) had the highest volatility.

The next stage of the study was to use the method of standardized sums to sort the EU countries in terms of non-cash transactions by a level of development class created as shown in Table 1. The results of the ordering over the study period are shown in Table 3.

Table 3

Ranking of the EU27 countries in terms of the level of development of cashless trading between 2019 and 2023

Development level class/Year	2019	2020	2021	2022	2023
I	Germany	Germany	Germany	Germany	Germany
	France	France	France	France	France
	Italy	Italy	Italy	Italy	Italy
II	Spain	Spain	Spain	Spain	Spain
	Poland	Poland	Poland	Luxembourg	Poland
	Luxembourg	Luxembourg	Netherlands	Netherlands	Netherlands
	Netherlands	Netherlands	Luxembourg		Luxembourg
	Portugal	Portugal			
III	Belgium	Austria	Belgium	Ireland	Ireland
	Austria	Belgium	Ireland	Austria	Austria
	Ireland	Ireland	Portugal	Portugal	Portugal
	Denmark	Denmark	Sweden	Belgium	Belgium
	Sweden	Sweden	Austria	Polska	Greece
	Greece	Greece	Greece	Greece	Czech Republic
	Finland	Finland	Finland	Czech Republic	Finland
	Croatia	Czech Republic	Denmark	Finland	Romania
	Czech Republic	Croatia	Czech Republic	Lithuania	Hungary
	Hungary	Romania	Lithuania	Romania	Lithuania
	Romania	Hungary	Romania	Croatia	Slovakia
	Slovenia	Slovakia	Hungary	Denmark	Denmark
	Slovakia	Lithuania	Slovakia	Hungary	Slovenia
	Estonia	Slovenia	Bulgaria	Slovakia	Latvia
	Cyprus	Cyprus	Croatia	Sweden	Malta
	Lithuania	Estonia	Cyprus	Slovenia	Sweden
	Latvia	Latvia	Latvia	Latvia	Cyprus
	Bulgaria	Bulgaria	Estonia	Cyprus	Estonia
	Malta	Malta	Slovenia	Estonia	Bulgaria
			Malta	Bulgaria	Croatia
				Malta	

Source: own research.

The results presented in Table 3 show that, considering the number, value of transactions using basic non-cash payment instruments and payment infrastructure, countries such as Germany, France and Italy performed best in the analyzed period. The countries indicated were assigned to the first class, within which countries with an extremely high level of cashless development were concentrated. Germany, France, and Italy were ranked top for several key reasons such as (CNPS, 2019):

- developed payment infrastructure: these countries have a well-developed payment infrastructure, including a wide network of payment terminals and ATMs, which facilitates cashless transactions;
- a high number of financial institutions: the substantial number of banks and other financial institutions offering a variety of payment services contributes to the popularity of cashless transactions;
- technological innovation: France, Germany and Italy are investing in nova payment technologies, such as mobile and contactless payments, which increases the convenience and security of transactions;
- policy and regulation: the governments of these countries actively support the development of cashless payments through appropriate regulations and initiatives that promote their use;
- payment culture: there is a high culture of using cashless payments in these countries, which is supported by educational and promotional campaigns.

Within the second tier (indicating a high level of development of cashless trading), five countries were included in the 2019–2022 period: Spain, Poland, the Netherlands, Luxembourg and Portugal. In 2022 Poland (due to the lack of most data on the number of transactions with payment instruments) was displaced from Tier II by Austria. In 2023, only four countries (Spain, Poland, the Netherlands and Luxembourg) were concentrated in Class II. In the last year under review, the position of Austria and Portugal deteriorated in terms of non-cash transactions, which translated into their drop in ranking to Class III (medium level of development in terms of non-cash transactions). It is noteworthy that over the entire period analyzed, no EU27 country was assigned to Class IV, indicating a low level of development in non-cash transactions. On this basis, it can be concluded that in the EU27, non-cash transactions are developing at a high and medium level, and only in a few countries at a very high level. In contrast, in the last group of countries according to the value of the development level measure, the following countries were included in almost every analyzed year: Malta, Bulgaria, Latvia, Estonia and Cyprus. The distant ranking of these countries may be due to their attachment to cash as the preferred means of payment, or the lack of adequate legal regulations and government initiatives to support the promotion of cashless forms of payment, as well as underdeveloped payment infrastructure and low levels of use of modern technologies. The deterioration of Croatia's position in 2023 – last position in the ranking is due to the lack of data provided by the country's national bank to the ECB on the number of accounts and the number of ATMs.

Summary

The study conducted to assess the level of development of cashless trading between 2019 and 2023 showed that European Union countries ranked similarly in each of the years analyzed. Germany, France and Italy were among the leaders in terms of the development of cashless trading. The worst ranked countries were Malta, Bulgaria, Latvia, Estonia and Cyprus. In addition, the study showed that there were countries that improved their ranking year on year, such as Lithuania, Ireland, and Romania, as well as those that deteriorated, such as Denmark.

The analysis of statistical data from various EU-27 countries allows for a comparison of the level of development of non-cash transactions, the identification of leaders and the worst in the ranking and provides a voice in the discussion in understanding the factors influencing these differences. The information from the study can be of significant use to national central banks or payment organizations and commercial banks that are interested in intensifying cashless solutions.

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OCENA POZIOMU ROZWOJU OBROTU BEZGOTÓWKOWEGO W KRAJACH UNII EUROPEJSKIEJ W LATACH 2019–2023

STRESZCZENIE

Cel artykułu. Celem artykułu było dokonanie oceny poziomu rozwoju obrotu bezgotówkowego w krajach Unii Europejskiej w latach 2019–2023. Sformułowano następujące pytanie badawcze – które kraje Unii Europejskiej są liderem, a które znajdują się na końcu rankingu pod względem poziomu rozwoju obrotu bezgotówkowego?

Metoda badawcza. Źródłem danych na temat obrotu bezgotówkowego były dane statystyczne pochodzące z bazy Europejskiego Banku Centralnego ECB Data Portal. Do stworzenia rankingu krajów Unii Europejskiej pod względem poziomu rozwoju obrotu bezgotówkowego wykorzystano metodę porządkowania liniowego – metodę sum standaryzowanych.

Wyniki badań. Przeprowadzone badanie empiryczne z wykorzystaniem metody sum standaryzowanych pozwoliło na porównanie poziomu rozwoju obrotu bezgotówkowego w krajach UE-27 oraz identyfikację liderów i opóźnionych pod tym względem. Wyniki badań dowiodły, że w krajach UE-27 obrót bezgotówkowy na ogół rozwija się na wysokim i średnim poziomie, Do liderów pod tym względem należały Niemcy, Francja i Włochy, natomiast najgorsze pozycje w rankingu zajmowały: Malta, Bułgaria, Łotwa, Estonia i Cypr. Przyczyn średniego rozwoju obrotu bezgotówkowego w tych krajach należy upatrywać w niedostatecznie rozwiniętej infrastrukturze płatniczej, ograniczonej liczbie instytucji oferujących usługi płatnicze, ograniczonych inwestycjach w nowoczesne technologie, a także kulturze płatności, co może wynikać z tradycji przywiązania do gotówki oraz braku zaufania do bezgotówkowych form płatności. Ponadto brak odpowiednich regulacji prawnych i inicjatyw rządowych może wpływać na niższą ich popularność.

Słowa kluczowe: obrót bezgotówkowy, metoda sum standaryzowanych, instrumenty płatnicze.

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