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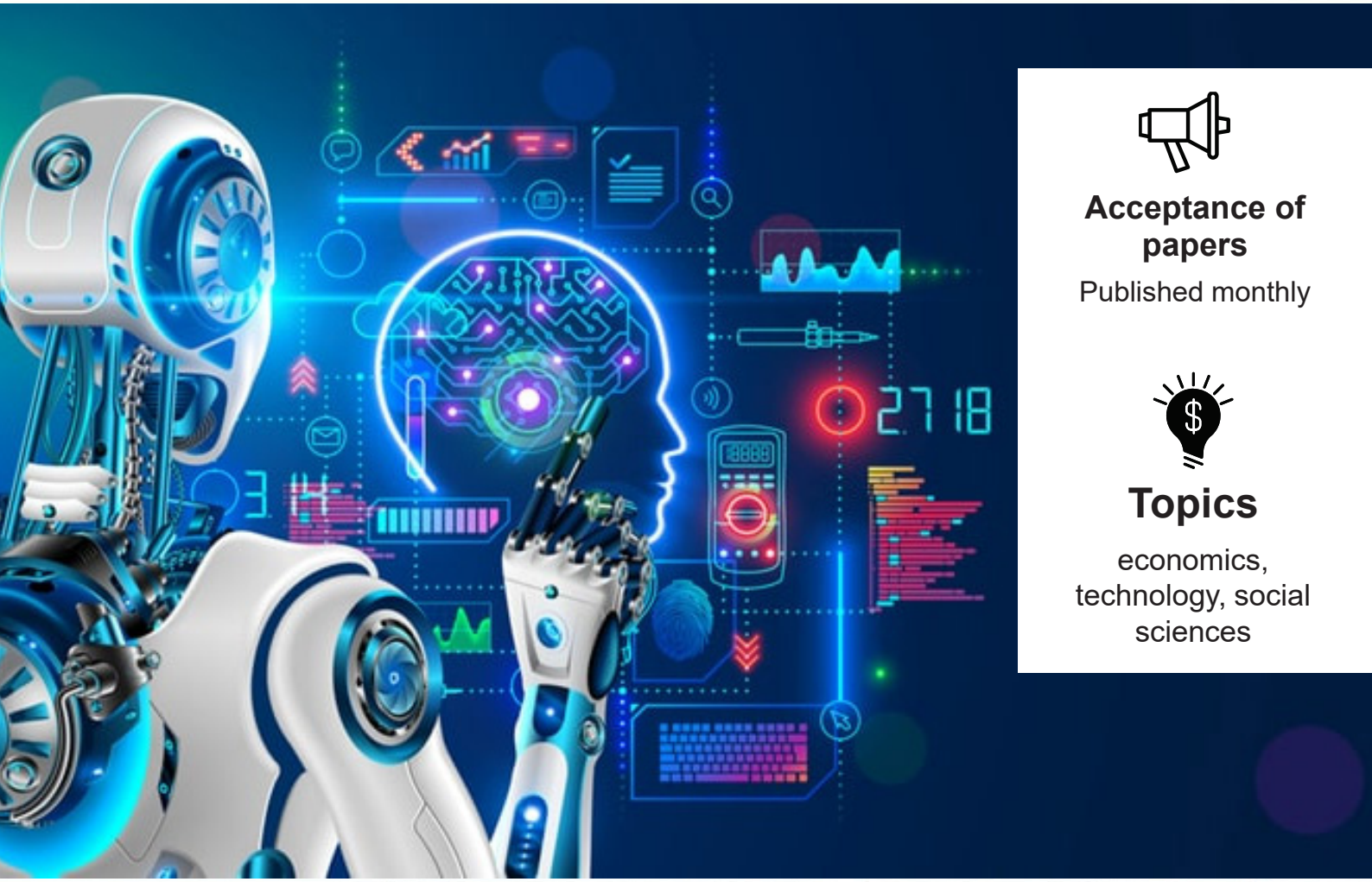

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## Editorial board:

# CONTENTS

# ECONOMETRIC MODELS OF CASHLESS SETTLEMENTS AMONG ECONOMIC ENTITIES

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Abstract: In the economy, the main part of monetary funds circulates through business entities. Payments between business entities are carried out in a cashless manner. When analyzing the movement of funds through cashless payments, it is important to develop econometric models that reflect the current state of these payments. If econometric models that accurately and adequately reflect the current state of cashless payments between business entities are not developed, it will not be possible to analyze the sequence of money flows through these payments or the degree of balance in the circulation of funds across economic sectors and regions of the country.

Key words: cashless payments between business entities, the current state of cashless payments, a unified database of completed cashless payments, econometric models of cashless payments.

Annotatsiya: Iqtisodiyotda pul mablag‘larining asosiy qismi xo‘jalik subyektlari orqali aylanadi. Xo‘jalik subyektlari o‘rtasidagi hisob-kitoblar naqd pulsiz tarzda amalga oshiriladi. Naqd pulsiz hisob-kitoblar orqali aylanayotgan pul mablag‘larini tahlil qilishda, mazkur hisob-kitoblarning joriy holatini aks ettiruvchi ekonometrik modellarni shakllantirilishi muhim ahamiyatga ega. Xo‘jalik subyektlari o‘rtasidagi naqd pulsiz hisob-kitoblarning joriy holatini to‘g‘ri, aynan mos tarzda ifodalovchi ekonometrik modellar shakllantirilmasa, mazkur hisob-kitoblar orqali aylanayotgan pul mablag‘lari ketma-ketligini yoki aylanayotgan mablag‘larni iqtisodiyot tarmoqlari va mamlakat hududlari bo‘yicha mutanosibligi qay darajada ekanligini tahlil qilish imkoniyati bo‘lmaydi.

Kalit so‘zlar: xo‘jalik subyektlari o‘rtasidagi naqd pulsiz hisob-kitoblar, naqd pulsiz hisob-kitoblarning joriy holati, amalga oshirilgan naqd pulsiz hisob-kitoblarga doir axborotlarning yagona bazasi, naqd pulsiz hisob-kitoblarning ekonometrik modellari.

Аннотация: В экономике основная часть денежных средств циркулирует через хозяйствующие субъекты. Расчёты между хозяйствующими субъектами осуществляются безналичным способом. При анализе движения денежных средств через безналичные расчёты важно формирование эконометрических моделей, отражающих текущее состояние этих расчётов. Если не будут сформированы эконометрические модели, точно и адекватно отражающие текущее состояние безналичных расчётов между хозяйствующими субъектами, то не будет возможности проанализировать последовательность движения денежных средств через эти расчёты или степень сбалансированности циркуляции средств по отраслям экономики и регионам страны.

Ключевые слова: безналичные расчёты между хозяйствующими субъектами, текущее состояние безналичных расчётов, единая база данных по проведённым безналичным расчётам, эконометрические модели безналичных расчётов.

## INTRODUCTION

In today’s era of information technologies, the share of cashless payments is high in most developed countries that operate on market principles. Therefore, analyzing the current state of funds circulating through cashless payments carries significant importance.

Indeed, assessing the current condition of cashless settlements in the economy is crucial for economic governance, regulating economic relations, and making well-grounded decisions aimed at finding optimal solutions to existing macroeconomic problems. This is because a market economy is fundamentally based on “goods–money–goods” relations.

At the same time, throughout its long history of development, humanity has not created any settlement method that is more convenient and efficient than cashless payments.

During our research, we came to the conclusion that, in order to conduct macroeconomic-level analysis of the current state of cashless settlements across various criteria, special attention must first be given to constructing econometric models of these transactions.

If econometric models are developed that accurately, fully, and appropriately reflect the real situation of cashless settlements, it becomes possible to analyze these transactions in detail across different dimensions and criteria, as well as to make well-justified decisions when needed.

For this reason, the role and significance of econometric models that reflect the current state of cashless payments are invaluable today.

## REVIEW OF LITERATURE ON THE SUBJECT

The economy is a complex and dynamic system composed of multiple elements. The system of cashless settlements is an integral part of this economy. To identify cashless settlement systems, the funds circulating through them, the parties involved, and to determine the sequence and direction of these financial flows, a systematic approach to cashless settlements is required.

Since our goal is to analyze cashless transactions and the funds circulating through them among economic entities, it is first necessary to form a unified database of electronic files related to these transactions and then process this information through several stages.

One of the important stages of data processing is the construction of economic-mathematical models that reflect the current state of cashless settlements carried out among economic entities.

In this regard, a Russian scholar has emphasized the importance of econometric models in economic research: “Mathematical models of the economy, by reflecting the main characteristics of economic processes and phenomena through mathematical relationships, serve as an effective tool for studying complex economic issues. Mathematical models of economic processes and phenomena are referred to as economic–mathematical models” [1].

Indeed, forming econometric models of economic processes and phenomena—processes that can often be fully understood only through abstract thinking—including cashless settlements between economic entities, is the most accurate and effective direction for studying and analyzing them.

The textbook Microeconomics states: “Economic theory deals with developing models of social phenomena. By ‘model’ we mean a simplified representation of reality. Here, the main emphasis is on the word ‘simplified.’ … The strength of a model lies in its ability to disregard details irrelevant to the issue being studied, while enabling the economist to focus on the essential characteristics of the economic reality they seek to understand” [2; pp. 15–16].

Thus, economic-mathematical models must fully reveal the essential, intangible characteristics of the phenomena and processes under study, including cashless settlements among economic entities.

Economist L. Terekhov also noted: “Economic-mathematical developments are extremely important for the optimal functioning of the economy. Based on the theory of optimal economic activity and modern mathematical methods, a set of economic-mathematical models must be formed to reflect the quantitative characteristics, relationships, and processes that constitute all the fundamental regularities of the economy” [3; p. 6].

Summarizing the grounded opinions of the scholars mentioned above, it can simply be stated that creating economic-mathematical models reflecting all the laws of economic processes and relationships is of vital importance for optimal economic management today.

It should be emphasized that the ultimate goal of constructing econometric models that reflect the current state of cashless settlements among economic entities is not limited to merely analyzing these completed transactions. Using economic-mathematical models, we seek to examine the chain-like sequence of funds circulating through cashless payments, determine where and in what amounts monetary resources circulate, and ultimately create a mechanism that enables well-justified and effective decision-making for ensuring the most balanced circulation of monetary funds in the economy.

Foreign scholars describe the link between economic-mathematical models and management as follows: “Effective decision-making is essential for performing management functions. Therefore, it is not surprising that the decision-making process lies at the core of management theory. The science of management strives to improve organizational effectiveness by enhancing managers’ ability to make well-justified, objective decisions, even in highly complex situations, using models and quantitative methods” [4; p. 219].

Indeed, if the econometric models we construct merely describe the current state of cashless settlements, our research would yield no practical outcome.

## RESEARCH METHODOLOGY

At the initial stage of our research, the methods of analysis, synthesis, and classification were applied to process electronic file–based information reflecting the current state of cashless settlements.

In the second stage of processing this information, comparative analysis was carried out using methods such as comparison, induction and deduction, as well as expert evaluation. In addition, our study extensively employed comparative and systematic analysis methods. As a result, the econometric models constructed to reflect the current state of cashless settlements among economic entities were scientifically justified as being highly important for analyzing and regulating the movement of monetary resources in various dimensions. Furthermore, the possibilities of applying these econometric models in the context of Uzbekistan were also substantiated.

## ANALYSIS AND RESULTS

In analyzing the current state of cashless settlements among economic entities, we placed special emphasis on constructing econometric models of these transactions.

For this purpose, we proposed organizing the information on cashless settlements among economic entities in a compact form within the following table (Table 1).

Table 1. Information on cashless settlements carried out among economic entities

| Economic entities | $B_1$ | $B_2$ | $B_3$ | ... | $B_j$ | ... | $B_f$ | ... | $B_n$ |
|---|---|---|---|---|---|---|---|---|---|
| $A_1$ | $S_{11}$ | | $S_{13}$ | ... | $U_{1j}$ | ... | $S_{1f}$ | ... | $U_{1n}$ |
| $A_2$ | $S_{21}$ | $U_{22}$ | | ... | $U_{2j}$ | ... | $S_{2f}$ | ... | $S_{2n}$ |
| $A_3$ | | $S_{32}$ | $U_{33}$ | ... | | ... | $U_{3f}$ | ... | $S_{3n}$ |
| : | : | : | : | : | : | : | : | : | : |
| $A_i$ | $S_{i1}$ | $U_{i2}$ | | ... | $U_{ij}$ | ... | $S_{if}$ | ... | $U_{in}$ |
| : | : | : | : | : | : | : | : | : | : |
| $A_p$ | | $S_{p2}$ | $U_{p3}$ | ... | $S_{pj}$ | ... | $U_{pf}$ | ... | |
| : | : | : | : | : | : | : | : | : | : |
| $A_m$ | $S_{m1}$ | | $S_{m3}$ | ... | $U_{mj}$ | ... | | ... | $U_{mn}$ |

Source: Author's elaboration.

Here:

$\mathbf{A_{(p)}, B_{(f)}}$ - the details of the paired participants involved in cashless settlements, namely:
a) the name of the economic entity;
b) the settlement account specified in the payment document;
c) the bank code (MFO) serving the respective account of the entity.

$\mathbf{U_{pf}}$ - the amount transferred via cashless settlement *by* entity B(f), whose details are located at the intersection of the first row and column f, *to* entity A(p), whose details appear at the intersection of the first column and row p.

$\mathbf{S_{pf}}$ - the amount transferred via cashless settlement *by* entity A(p), whose details appear at the intersection of the first column and row p, *to* entity B(f), whose details are located at the intersection of the first row and column f.

$A_{(P)}$ $p = \overline{1,m}$

$B_{(F)}$ $f = \overline{1,n}$

Number of rows in the table: $i = \overline{1,m}$

Number of columns in the table: $j = \overline{1,n}$

This Table 1 makes it possible to arrange and compactly structure information on cashless settlements carried out among m + n economic entities. The information placed in Table 1 serves as the unified and primary database for the subsequent stages of our research.

Now, based on the data in Table 1, we can construct the following econometric models reflecting the cashless settlements carried out among economic entities:

a) The economic–mathematical models of cashless settlements conducted by economic entities A(p) (p = 1…m), whose details appear in the first column of Table 1, can be expressed as follows:

$$\begin{cases} N(A_1) = S_{11}P_{11} + S_{13}P_{13} + \cdots + U_{1j}P_{1j} + \cdots + S_{1f}P_{1f} + \cdots + U_{1n}P_{1n} \\ N(A_2) = S_{21}P_{21} + U_{22}P_{22} + \cdots + U_{2j}P_{2j} + \cdots + S_{2f}P_{2f} + \cdots + S_{2n}P_{2n} \\ N(A_3) = S_{32}P_{32} + U_{33}P_{33} + \cdots + U_{3f}P_{3f} + \cdots + S_{3n}P_{3n} \\ \quad\vdots \qquad\qquad \vdots \qquad\qquad \vdots \qquad\qquad \vdots \\ N(A_i) = S_{i1}P_{i1} + U_{i2}P_{i2} + \cdots + U_{ij}P_{ij} + \cdots + S_{if}P_{if} + \cdots + U_{in}P_{in} \\ \quad\vdots \qquad\qquad \vdots \qquad\qquad \vdots \qquad\qquad \vdots \\ N(A_p) = S_{p2}P_{p2} + U_{p3}P_{p3} + \cdots + S_{pj}P_{pj} + \cdots + U_{pf}P_{pf} \\ \quad\vdots \qquad\qquad \vdots \qquad\qquad \vdots \qquad\qquad \vdots \\ N(A_m) = S_{m1}P_{m1} + S_{m3}P_{m3} + \cdots + U_{mj}P_{mj} + \cdots + U_{mn}P_{mn} \end{cases} \quad (1)$$

In equation (1) and in all econometric models presented below, P_pf represents the existence of mutual relationships in cashless settlements between economic entity A_p, whose details are located at the intersection of the first column and row p of Table 1, and economic entity B_f, whose details appear at the intersection of the first row and column f of the table.

b) The economic–mathematical models of cashless settlements carried out by economic entities B(f) (f = 1…n), whose details are located in the first row of Table 1, can be expressed as follows:

$$\begin{cases} N(B_1) = S_{11}P_{11} + S_{21}P_{11} + \cdots + S_{i1}P_{11} + \cdots + S_{m1}P_{m1} \\ N(B_2) = U_{22}P_{22} + S_{32}P_{32} + \cdots + U_{i2}P_{i2} + \cdots + S_{p2}P_{p2} \\ N(B_3) = S_{13}P_{13} + U_{33}P_{33} + \cdots + U_{p3}P_{p3} + \cdots + S_{m3}P_{m3} \\ \quad\vdots \qquad\qquad \vdots \qquad\qquad \vdots \qquad\qquad \vdots \\ N(B_j) = U_{1j}P_{1j} + U_{2j}P_{2j} + \cdots + U_{ij}P_{ij} + \cdots + S_{pj}P_{pj} + \cdots + U_{mj}P_{mj} \\ \quad\vdots \qquad\qquad \vdots \qquad\qquad \vdots \qquad\qquad \vdots \\ N(B_f) = S_{1f}P_{1f} + S_{2f}P_{2f} + U_{3f}P_{3f} + \cdots + S_{if}P_{11} + \cdots + U_{pf}P_{pf} \\ \quad\vdots \qquad\qquad \vdots \qquad\qquad \vdots \\ N(B_n) = U_{1n}P_{1n} + S_{2n}P_{2n} + S_{3n}P_{3n} + \cdots + U_{in}P_{in} + \cdots + U_{mn}P_{mn} \end{cases} \quad (2)$$

c) In addition, based on the information in Table 1 regarding cashless settlements carried out among economic entities, it is also possible to conduct analytical work by isolating and constructing an economic–mathematical model for the cashless settlements involving a single economic entity of interest.

For example:

for economic entity A(p), whose model is presented within the group of econometric models in equation (1):

$$N(A_p) = S_{p2}P_{p2} + U_{p3}P_{p3} + \cdots + S_{pj}P_{pj} + \cdots + U_{pf}P_{pf} \quad (3)$$

or for economic entity B(f), whose model is presented within the group of econometric models in equation (2):

$$N(B_f) = S_{1f} + S_{2f} + U_{3f} + \cdots + S_{if} + U_{if} + \cdots + U_{pf} + \cdots + S_{mf} \quad (4)$$

we can analyze the model according to the relevant directions and criteria.

d) Furthermore, it is also possible to conduct analytical work by isolating the economic–mathematical model of cashless settlements involving a single economic entity of interest, based on:

- funds credited to the entity's bank account;
- funds debited or transferred from the entity's bank account.

For example, for economic entity A(p) in econometric model (3):

the econometric model representing the funds credited to its account through cashless settlements is as follows:

$$N(A_p) = U_{p3}P_{p3} + \cdots + U_{pf}P_{pf} \quad (5)$$

the econometric model representing the funds debited from its account through cashless settlements is as follows:

$$N(A_p) = S_{p2}P_{p2} + \cdots + S_{pj}P_{pj} \quad (6)$$

Thus, we can construct econometric models reflecting the current state of cashless settlements carried out among economic entities based on various dimensions and criteria of interest.

## CONCLUSIONS AND SUGGESTIONS

The formation of a unified database of information on the current state of cashless settlements among economic entities, and the consolidation of this information into a compact, structured table, creates the foundation for developing econometric models that accurately and adequately reflect the actual condition of these settlements.

Regarding this, economist L. V. Kantorovich noted: “Difficulties in modeling and forming the necessary information base can be overcome by enriching the set of tools used in economic research through new, original findings, and by further developing mathematical apparatus, technology, and the integration of these tools through human sensitivity, consciousness, and experience.” [5].

Indeed, in an era where information technologies are rapidly advancing, conducting scientific research on the proportionality of funds circulating through cashless settlements—without constructing econometric models that reflect the current state of these transactions—will not yield the expected results.

Therefore, today, in conducting scientific research on any macroeconomic problem, one of the primary tasks is the correct, rigorous, and adequate construction of its economic–mathematical models.

Another important conclusion that can be drawn here is that analyzing cashless settlements does not simply involve studying the process of transferring money from one bank account to another or examining the form or method of the settlement itself. Because the current state of cashless settlements carried out among economic entities can be analyzed based on:

- the specific economic entities directly involved in the cashless settlements;
- the chain-like (multi-stage) sequence of cashless settlements among entities;
- the purposes indicated in the payment documents that serve as the basis for executing cashless settlements;
- the sector of the economy or the geographical region in which the entities involved in the settlements operate.

Thus, in order to perform the analytical tasks listed above, the primary requirement is to construct econometric models that reflect the current state of cashless settlements carried out among economic entities.

The results of our analytical work demonstrate that relying on indicators reflecting the current state is crucial in scientific research. Making decisions based solely on final indicators—calculated after the completion of a month, quarter, or year—does not produce the desired effect. This is because the economic system and its elements are constantly in motion, and therefore, the state of the economy continually changes.

For this reason, from the very beginning of our research, we focused on forming a unified database of electronic file–based information on the current state of cashless settlements among economic entities, and using this information to construct economic–mathematical models of these settlements across various dimensions and analytical perspectives.

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