

Study of Payment and Accounting Operations on the Basis of Matrix Modeling

Kopytin V.Y, Meteab H.L.M

Abstract—The article discusses the characteristics of the payment and settlement relationships, and the structure, objects and subjects of payment systems. Provides a brief overview of the principles of international payment systems and regulatory procedures to ensure settlements and payments in Russia. The problem of harmonization of accounting and analytical support to the settlements and payments systems to analyze the possibility and efficiency of interaction between economic subjects. The ways of the development of analytical and control procedures in the field of accounting and payment technologies on the basis of matrix modeling accounting, payments and settlements.

Index Terms—audit, accounting, matrix, payment.

I. INTRODUCTION

Efficiency of financial interaction of all economic system depends largely on the reliability and optimality of the commission payment and settlement operations. Payment systems participant combines production and financial cooperation, i.e. are financial infrastructures for the joint operation of regional entities, federal and international economic systems. Therefore, to study the characteristics of payment systems, analysis of their elements, structure and capacity is a very important economic objective. Matrix modeling accounting procedures and calculations is objective and universal method of studying the characteristics of the payment and settlement relationships, this method allows the presentations of financial information is compact and uniformly formulate judgments in the field of payment and settlement on the basis of formal methods. These formulations, in turn, can affect the development of the practice of payment and settlement and accounting procedures. Expressed as matrix models payment instructions, procedures, clearing and settlement, as well as the credentials becomes clearer and specific images, you can analyze the advantages and disadvantages of payment and settlement procedures, based on quantification of accounting information. Stylized accounting, payment and settlement procedures, allows an objective analysis of economic entities by separating ethical, qualitative and quantitative characteristics of financial activities.

II. GENERAL CHARACTERISTICS OF TRANSFER PROCEDURES

To investigate the characteristics of the payment and settlement of relations is necessary to analyze the structure of objects and subjects that make up the

payment system, as well as procedures for the implementation of payment and settlement operations in the payment system. The term “payment system “usually refers to a set of tools, procedures and rules for the transfer of funds between the parties. This system comprises members and organization, which is its operator. Tools to make payments, it is now very diverse. They represent both the traditional methods of cost sharing on the basis of cash and paper documents, and innovative tools committing funds transfer based on modern electronic and communication technologies. Using a payment instrument generated a payment instruction, which is the order for payment and may relate either to a credit or debit transfer. The main procedures that make the process of transferring funds from the payer to the recipient are initiating the payment exchange information about the participants and the parameters of a particular payment transaction, as well as clearing and settlement. Terms of payment and settlement operations establishes operator - an organization that is responsible for the functioning of the entire payment system. The operator can perform the payment and settlement operations independently, and can attract other organizations to perform certain procedures. Functionally distinguish payment system operators and service operator’s payment infrastructure. Payment infrastructure is a set of network equipment, technologies and procedures for accessing the system and transactions with payment instruments, as well as for processing, clearing and settlement of the relevant payments. Payment systems participants are divided into two types: - direct and indirect participants (indirect). Direct participant shall be responsible for payment on their own payments, their customers and indirect participants, on whose behalf he makes transfers. Unlike indirect participants from direct is that indirect participants have no right to perform some of the actions in the payment system (for example, entering orders for a transfer payment, etc.), offering direct participants on behalf of indirect. The initial stage of the transfer of funds procedure begins with the initiation of the payment, which is carried out by means of payment instruments. The process of transfer - the calculation, which is the procedure, terminates the obligations between the payer and the recipient. According to the principles of the settlement of transactions between participants of payment systems distinguish gross settlement systems and net settlement system. Synthesis characteristics of gross and net settlement systems are mixed calculations. Payment on a gross basis suggests that, in accordance with each order

or requirement of a separate operation carried out by a corresponding transfer of funds. Payments are performed sequentially as they arrive or in accordance with the established order of execution. Net payment - Ladder obligations agreed between the parties to the agreement to settle on a net basis, which reduces the number or amount of payments required for the transfer. Final net settlement position combines all the mutual obligations between the parties to settlement. Clearing is the transfer (sending), reconciliation and, in some cases, confirmation of the transaction prior to the calculation, possibly including the netting of payment instructions and the establishment of final positions for settlement. As part of the exchange of information to participants and clients payment systems provided the data necessary for execution, registration, alert and coherent implementation of the process transfer of funds. For registration of the facts associated with the transfer of funds transfer operations are accompanied by recordings of the settlement asset in accounting organizations involved in translation.

III. RECOMMENDATIONS, GUIDELINES AND REGULATIONS

Main recommendations and principles of operation of payment systems, which are aimed at harmonizing the rules and procedures of operations, as well as the harmonization process of observation, management and control systems operators and participants, are set out in the documents of the Committee on settlement and payment systems of the Bank for International Settlements (CPSS). International principles and standards for payment systems traditionally perform two main functions. The first function - a reflection of global experience in the development of payment systems. The second function - to restrict the monopoly of the use of advanced technology solutions and payment, as well as improving the efficiency of payment systems and the interaction of the participants. Development of existing and new recommendations, rules and standards occurs as a result of selecting the best common practice of the common set of innovations that constantly appear in payment systems. CPSS publications in the field of the Lessons Learned and harmonization of international and national procedures for the operation of payment systems are open and available for use [9, 6]. They contribute to the development of competition in the field of making payments, reducing the cost of providing a uniform interaction systems, and limit costs to minimize the risks. Currently, one of the major international developments, which summarizes the current practice of committing the payment and settlement procedures, and principles of operation of payment systems and observe their activities, the report is "Principles for financial market infrastructures." The paper payment system named one of four financial market infrastructures (FMI). This report identifies which arise in payment and settlement operations risks, formulated the principles and standards

developed IGF activity. The same report stated responsibilities to competent authorities for implementation and enforcement of these standards. The report also covers the area of responsibility of the relevant authorities in the field of regulation, supervision and monitoring of the IGF. In addition to the principles and standards for the IGF, developed a methodology for assessing compliance with the principles and responsibilities of regulators and disclosure standards for payment system 24 principles contained in this work are divided into nine major characteristics FMI: general organization, the management of credit risk and liquidity risk calculations, the central securities depository and settlement systems on the basis of an exchange of assets, management of default, the management of general business and operational risk; access, efficiency, transparency. These characteristics define the key elements needed for reliable and efficient design and operation of the FMI. Developed principles, standards and assessment methodology [7] aimed at harmonizing international standards for IGF by defining requirements, detailed recommendations and expand the scope of the standards to encompass various aspects of risk management. These documents are a guideline for the development of regulatory and legislative procedures to ensure the transfer of funds at the national level. In the Russian Federation on the basis of the Federal Law on the National Payment System (NPS) normative documents [8] which govern the operations of money transfer rules and regulation, supervision and monitoring of activities of organizations providing payment services. These legislative and regulatory documents define the practice of the payment and settlement operations and principles of control subjects NPC. Obligation for the implementation of the common principles of conduct settlements and payments, as well as the regulation of payment services legislation entrusted to the Central Bank of the Russian Federation (Bank of Russia). It should be noted that the international recommendations, legislative and regulatory documents focus mainly on the quality characteristics of the functioning of payment systems. However, the most important indicator of economic agents is quantitative methods of providing information, which reflect the financial condition and interference of these subjects at each other. In addition, based on quantitative and formal methods for obtaining performance of settlement and payment systems can improve the efficiency of payment transactions and to optimize payment and settlement relations. On the basis of these studies can be quantitatively express the influence of the activity of payment intermediaries on the condition of other business entities, as well as international and national economic systems.

IV. ACCOUNTING FOR PAYMENT AND SETTLEMENT OPERATIONS AND STRUCTURE OF THE NPC RUSSIA

Accounting subjects payment systems and their clients is a natural source of information for research purposes of payment and settlement operations. Since all procedures remittance reflected in the accounting organizations involved in this translation. Thus, information regarding the interaction between subjects and the cumulative impact of their business transactions with each other can be summarized under the quantitative analysis of accounting data. In this synthesis of these data will reflect the quantitative performance characteristics of financial cooperation. Meanwhile, the practices of the accounting in different countries have significant differences, which are determined by differences in national cultural and legal systems. However, on the basis of formalized representation of the primary data and summarizing account information to reconcile the quantitative characteristics and present them as objective. In our view, objectivity can be achieved only when the quantitative information about the activities of economic entities will be separated from their ethical interpretations. This does not mean that the formalization of quantitative information requires the rejection of ideological beliefs. Conversely, representatives of various cultural and legal positions can objectively analyze the validity of certain financial transactions, as well as to determine the admissibility of these operations in the national economy. To overcome the limitations associated with the ethical interpretation of accounting events and payment transactions, in our opinion, we need a meta model accounting and settlement. This meta model can be represented in the form of compact and uniform formulas that are invariant to these primary accounting and payment and settlement technology, but easily adaptable to existing national systems. One of the effective methods for creating metamodels accounting and settlement is mathematical modeling, using basic concepts and operations of matrix algebra [1, 3].

Modeling accounting transactions based on matrix algebra is as follows.

- Primary accounts - postings and formed on the basis of their transaction log are assigned to their equivalent in the form of matrices;
- Transformation of the primary data in the balance sheets are mapped to their equivalents in the system operations of matrix algebra;
- Connection of incoming and outgoing balance set using the basic accounting equation in matrix form;
- Conversion of the fundamental equations using matrix algebra operations allow us to find the formula for solving the problem of formation of the balance sheets of the system matrix algebra ;
- These matrix formulas and relationships are the equivalent figures presented in the tables of balance

sheets in any financial accounting system based on the method of double entry.

In Russia, the accounting procedure is based on the Federal Law "On Accounting", federal and industry standards, the recommendations of the competent authorities, as well as the standards of the economic entity. Institutional structure of the banking system in Russia can be divided into two parts. The first portion and the upper level of the banking system is the Bank of Russia, the other part is represented by credit institutions that operate in the form of banks and non-bank credit organizations as well as non-bank credit organizations carrying out money transfers without opening bank accounts. Russian national payment system is defined as the set of operators to transfer funds (including operators of electronic cash), bank payment agents (subagents), paying agents, the federal postal communication in the provision of payment services in accordance with the legislation of the Russian Federation, payment system operators, operator services payment infrastructure (subjects of the national payment system.) Oversight in the national payment system are included as credit institutions that operate remittance , payment systems and services payment infrastructure (operating, clearing and settlement centers) as well as organizations that are not credit cards. The subjects of the banking system, which are credit institutions supervision is carried out within the framework of banking supervision with his tools and impact measures. For organizations that are not credit , the Bank of Russia carried out the supervision and monitoring directly on the basis of the rules of the federal law on the NPC. Subjects banking system carried out the transfer of funds from bank accounts and without opening bank accounts in accordance with federal laws and regulations of the Bank of Russia in the framework of the forms of non-cash settlements. The main subjects of the NPC are credit institutions. Accounting procedure in these organizations is regulated by the Bank of Russia on the basis of the provisions defining the general methodology of accounting, chart of accounts, principles and rules reflect accounting events. The Bank of Russia on the one hand regulates the activity of subjects of the payment system on the other hand, defines the rules reflect these transactions in the accounting. In this regard, the regulator responsible for the harmonization of payment and settlement and accounting operations , both at the national and international level. Therefore, the Bank of Russia should be interested in the implementation of formalized research methods of payment and settlement procedures and quantify the characteristics summarizing performance indicators payment systems.

V. FORMALIZATION OF THE PAYMENT-SETTLEMENT PROCEDURES

Through formalized representation of clearing, settlement and payment procedures can be expressed compactly real relationships, financial and public sectors for further analysis and forecasting, as a result of solutions of matrix equations. Matrix modeling of payment and settlement procedures may be used as a tool to quantify the indicators characterizing the relationship between all economic players involved within the industrial and financial cooperation [4]. System matrix modeling and analysis of production -financial relations have a minimal amount of initial self-evident statements explaining the actual display objects (rawdata) in mathematical objects. By formulating two axioms determine a match between the primary data and reflect their mathematical objects. Matrix - mail expresses object relations, and the matrix - wiring (transaction) reflects quantitative measure of this relationship. Subjects of relations defined by the intersection of rows and columns of matrix correspondence. Model adopts a matrix of dimension equal to the number of subjects, consisting of numerical values of the matrix entries. All other characteristics of the financial ties are derived by matrix transformation. The participants' payment and settlement operations depending on the calculation methods can be summarized as follows. When performing calculations gross method in real-time calculation operation is carried out on each payment instructions between two parties calculations specified in this manual. To make a batch generated consolidated gross settlement payment, consisting of all payment instructions between two specific settlement participants; these instructions are accumulated over a period of time and then are processed in batches. Sided net payment is made by transfer of funds on the basis of the net position, which is defined as the difference of all liabilities and claims between the two parties calculations, accumulated within a certain period (the clearing cycle). At the multilateral net settlement calculation of the net position on the results of the clearing cycle is based on determining the difference between the obligations and requirements of one participant's account with all other stakeholders, ie bilateral relations of one participant's account with one other change to the attitude of one party with all the others. Matrix expression payment instructions allow you to explore relationship issues in payment systems as a result of the analysis of solutions of matrix equations. Such a representation of payment and settlement relations participants calculations relating the individual is not the number, but different structures of numbers arranged in a tabular structure analogues: matrices, vectors (individual rows and columns) and individual numerical values - scalars allows compact and at the same time systemically express basic calculation methods. Modeling technique calculation methods as follows. Any type of payment instruction can be mapped its equivalent matrix - matrix-

transaction (payment). Analogues actual payment transactions that are committed using payment instruments are various types of instructions to transfer funds. On the basis of vector-matrix formulas basic calculation methods (gross and netting) are expressed in quantitative characteristics of these methods. Transitions from one to another calculation method defined vector-matrix transformations, which are numerically determined by the values of sums translation. The above leads to the following generalization: any type of payment instructions can fit a mathematical object "matrix-transaction", as a consequence by the formulas, methods of calculations and their transformations, regardless of the variety of payment instruments and procedures, it is possible to express formalized and analyze various quantitative characteristics of the relations of participants payment and settlement operations. Using matrix models of payment instructions and calculation methods and gross netting calculations are presented as a system of following each other vector-matrix formulas, which can be useful for a common understanding of the clearing and settlement procedures, as well as to conduct research aimed at optimizing the use of liquidity participants of payment systems and minimize the financial risks arising in payment systems.

VI. DEVELOPMENT OF RESEARCH METHODOLOGY RELATIONS OF ECONOMIC SUBJECTS

Modeling methodology accounting and payment and settlement operations on the basis of the matrix representation of production and financial relations, allows you to build a global model of the economy with the general principles of synthesis and analysis of data on the activity of economic entities. This model will compile information on the basis of quantifying production and financial linkages and identify the interdependence of economic actors as well as the impact of their activities on each other. Matrix model, which builds on the two axioms, definitions, built entirely by mathematical transformation of raw data and formulas, generalizing accounting, reporting, payments and settlements. It logically reproducible compact and uniform, and at the same time universal, as defined on the set of all existing accounting models and calculations. In this sense, the matrix model is a metamodel accounting and settlement, as it:

- Exists separately from the object that it represents;
- Mathematical language describes the original data structure and transformation of models accounting, payments and settlements;
- Allows on the basis of a unified methodology to simulate the activities of individual economic entities and combine this activity within the payment and settlement interaction.

In our view, the development of the research methodology of financial relations in the prediction

results of these relations is connected with the use of methods of "constant accounting" on the basis of matrix modeling [2]. This term is used for accounting and settlement of financial transactions on the basis of a system of fixed values and formulas for calculating the sums of these operations. In constant basis accounting system put situational matrix models, but instead of the usual amounts of transactions denominated in monetary units values are relative financial transactions given to a certain benchmark.

Applying matrix modeling methodology for the analysis and audit of the payment systems, as well as their clients, you can express the quantitative characteristics of the subject's interactions with justification objectivity of these characteristics. In this technique, which is used within the "constant accounting" allows efficient forecasting the effect of individual indicators of the economic entities, the results of their activities. Using the methods of matrix modeling allows complement regulatory procedures, control and audit based on the qualitative characteristics of functioning of subjects and users of payment systems quantitative parameters. Thus, the performance of economic entities may be formed on the basis of primary data, and the financial condition of these subjects may be expressed numerical values of the functions that reflect their interaction.

VII. ACKNOWLEDGMENT

My thanks connected for ministry for higher education and scientific researches in Iraq for support me and also my supervisor

REFERENCES

- [1] O.I. Colva. "Matrix model of accounting matrix as a means of developing the theory of accounting in modern software and information technology. Audit and Financial analyze. - 2000. Number 3. Pp. 29-41.
- [2] O. I.Colva. and S.A. Sbitneva . "Matrix model of financial accounting and its forecasting. Audit and Financial Analysis. - 2013. Number 2. Pp. 133-145.
- [3] V.Y. Kopytin .and O.I .Colva. "Matrix and Adaptive models- the way to harmonization of accounting and reporting .credit. - 2003. Number 8. Pp. 27-34.
- [4] V.Y. Kopytin . "Simulation of clearing and settlement procedures in payment systems financial analytics: problems and solutions. - 2011. Number 30. Pp. 39-48.
- [5] V.Y. Kopytin and H.L.M. Meteab "Investigation of the payment and settlement relations matrix method simulation. Abstracts of the international scientific-practical conference "Transformation of national models of economic development in the context of globalization." - 2013. Pp. 36-37.
- [6] General principles for international remittance services .January. 2007. Committee on Payment and Settlement Systems and the World Bank.www.bis.org.
- [7] Principles for financial market infrastructures .April. 2012. Disclosure framework and assessment methodology .December. 2012. Committee on Payment and Settlement Systems and Technical Committee of the International Organization of Securities Commissions. www.bis.org.
- [8] Legislation National Payment System. Payment and settlement systems. Central Bank of the Russian Federation. MY. 35, 37, 38. 2012-2013. www.cbr.ru.
- [9] General guidance for national payment system development .January .2006.Committee on Payment and Settlement Systems.www.bis.org.