

Assessment of the general macroeconomic balance model of the export-oriented economies (on the basis of Kazakhstani and Russia economies)

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Abstract

This article contains the econometric analysis of usability of the general macroeconomic balance based on the IS-LM model in open economy. The authors also examine the correspondence of the model conclusions concerning macroeconomic policy in the export oriented countries (Russia and Kazakhstan). The quarterly date over the twenty years for Russia and ten years for Kazakhstan are used for this survey.

The research is based on the estimations of the behavioral equations such as consumption, investment, net export, monetary demand and balance payment line.

The authors identify the peculiarities of interconnection between crucial macroeconomic variables: household expenditures and net disposable income, gross accumulation and interest rate, net export and real exchange rate, money demand and interest rate and income.

Primary goods of high export share restricts on the application of the classical monetary tools. Therefore, the influence on consumer and investment behavior via interest rate is poorly performing due to underdevelopment of credit channel of monetary policy transmission.

Econometric calculations prove the low capital mobility in Russia and Kazakhstan. The connection between net financial account and interest rate changes is not detected. As a result of the analysis, it is identified that the direct and portfolio investments dynamics is determined by the leading industries' profitability and exchange rates.

These identified features of interconnection impose significant (almost overwhelming) restrictions on applying the IS-LM model in open economy to implement the macroeconomic regulation and forecasting in export oriented countries.

Keywords: IS-LM, IS-LM-BP extended model, export-oriented economies, model of general economic equilibrium (balance).

Түйін

Мақалада жалпы макроэкономиканың тепе-теңдік моделінің (кеңейтілген IS-LM) экспорты-бағдарланған экономикаларда қолданылуы мен модельден туындайтын ұсынастырдың мемлеттің экономикалық саясаты үшін тиімділік сондай-ақ эксперттық бағдарланған экономикалардың макроэкономиканың айнымалылары арасында өзара байланысты айырықша нысандарын анықтау болып табылады.

Түйін сөздер: кеңейтілген IS-LM, IS-LM-BP моделі, экспортқа бағдарланған экономика, жалпы экономикалық тепе-теңдік моделі.

Аннотация

В статье проведена оценка применимости модели общего макроэкономического равновесия (расширенная модель IS-LM) к экспортно-ориентированным экономикам, эффективности рекомендаций, вытекающих из модели, к экономической политике государства, а также выявления специфических форм взаимосвязей между макроэкономическими переменными экспортно ориентированных экономик.

Ключевые слова: расширенная модель IS-LM, IS-LM-BP, экспортно ориентированные экономики, модель общего экономического равновесия.

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Introduction

The current scientific literature quite often deals with the challenges of the relation of the developed economic models with the real life. This issue is considered in the works of Russian economists such as: Varkhotov T., Koshovets O., Leiashvili P. [1, 2, 3].

Evaluation of the applicability of macroeconomic models is crucial for the macroeconomic policy of the state. Carrying out the forecast function, macroeconomic models allow us to determine the vector, and sometimes even make a quantitative assessment of the results of the implementation of a particular macroeconomic policy. In the academic environment, when training specialists in the field of economics in the framework of the courses "Macroeconomics" (second and third levels), general macroeconomic equilibrium (balance), we widely use the models, in particular the expanded IS-LM model for an open economy⁴. The significance of this model lies in the fact that on its basis it is possible to determine the influence of monetary and fiscal impacts on a number of macroeconomic variables: output, interest rate, etc., under conditions of varying degrees of capital mobility and with different exchange rate systems. This model has gained wide practical application in developed countries. How adequate are the interrelations between macroeconomic variables mentioned in the model (for example, investment - interest rate, net export - exchange rate), and how adequate are the recommendations derived from the model for the economies of Kazakhstan and Russia? The search for answers to these questions determines the purpose of the present article.

Literature review

The following economists have previously conducted evaluations of the expanded IS-LM model for Russia: S. Aivazyan, B.Ye. Brodsky; Kravtsov M.K. and etc.; Shulgin A.G. and economists of Kazakhstan Ashimov A.A. and others; Bekeshov et al. [3, 4,5,6,7].

A number of researchers [Dildebayeva, Saylaubekov, 2014] used this model to build predictive values of macroeconomic indicators when modeling situations of regulatory impact for Kazakhstan. [8] The results obtained by the authors did not contradict the theoretical conclusions of the model, which causes doubts for several reasons.

So, according to the data for 2015-2016 Russia and Kazakhstan have a share in the global output of 2.8% and 0.2%, respectively. [9] Export-oriented economies (the share of mineral products in Russian exports is about 63%, and in Kazakhstan's exports - 69% [10], imposes its own specificity on the relationship between key macroeconomic variables, and hence on the results of the macroeconomic policy of the country. The change in foreign conjuncture has a direct impact on the economic situation of the countries as well.

Particular attention should be paid to the used methods of econometric estimation of the system of equations describing the model of general macroeconomic equilibrium (balance). Building regression equations independently of each other can lead to false results, and the absence of lag variables can lead to unrealistic results.

Methodology

In this paper, we use the method of econometric estimation of a system of simultaneous equations based on quarterly data from 2005 to 2017 for Kazakhstan and from 1995 to 2017 for Russia. All calculations were carried out in the statistical package Gretl. For building of the model we used the indicators given for the base year and not the nominal ones.

⁴ This model is an integral part of the work programs on Macroeconomics-2 of leading Russian universities: Moscow State University named after MV Lomonosov, National Research University Higher School of Economics (<https://www.hse.ru/ba/nes/courses/153645297.html>).

Alternant (Variables) referred to in this article

Designation in model equations	The name of the indicator
Y_real	GDP, calculated by the method of final use in Kazakhstan in 2005 prices, billion tenge, in Russia in 2003 prices, billion rubles
C_real	Final consumption expenditure of households in Kazakhstan in 2005 prices, billion tenge, in Russia in 2003 prices, billion rubles
G1_real	Final consumption expenditures of state administration in Kazakhstan in 2005 prices, billion tenge, in Russia in 2003 prices, billion rubles
G2_real	Final consumption expenditure of non-profit organizations serving households in Kazakhstan in 2005 prices, billion tenge, in Russia in 2003 prices, billion rubles
I_real	Gross accumulation in Kazakhstan in 2005 prices, billion tenge, in Russia in 2003 prices, billion rubles
Ex_real	Exports of goods and services in Kazakhstan in 2005 prices, billion tenge, in Russia in 2003 prices, billion rubles
Im_real	Imports of goods services in Kazakhstan in 2005 prices, billion tenge, in Russia in 2003 prices, billion rubles
NX_real	Net exports in Kazakhstan in 2005 prices, billion tenge, in Russia in 2003 prices, billion rubles
M0_real	M0 monetary unit in Kazakhstan in 2005 prices, billion tenge, in Russia in 2003 prices, billion rubles
r_real	The real interest rate of banks on loans issued in the Republic of Kazakhstan, in Russia
r_real_usa	Real interest rate of banks on loans issued in the USA
oil_price	The price of oil, dol.
Y_China	China's real GDP, billion dollars
oil_export_share	Share of oil and gas condensate in the export of the Republic of Kazakhstan / in the export of Russia
ε	The real exchange rate of Kazakhstan (Russia), the value of which reflects the proportion of exchange of one American consumer basket for n-number of similar Kazakhstan (Russian) consumer baskets. The growth of the real exchange rate indicates a cheapening of the national currency, a decline, on the contrary, is a rise in price. ⁵
real_perv_income	Primary income in Kazakhstan in 2005 prices, billion tenge, in the Russian Federation in 2003 prices, billion rubles
real_vtor_income	Secondary income in Kazakhstan in 2005 prices, billion tenge, in the Russian Federation in 2003 prices, billion rubles
real_COA	Current account in Kazakhstan in 2005 prices, billion tenge, in the Russian Federation in 2003 prices, billion rubles
real_CAB	Capital account in the Republic of Kazakhstan in 2005 prices, billion tenge, in the Russian Federation in 2003 prices, billion rubles
real_NFA	Financial account without reserve assets in the Republic of Kazakhstan in 2005 prices, billion tenge, in the Russian Federation in 2003 prices, billion rubles
real_EO	Net errors and omissions in Kazakhstan in 2005 prices, billion tenge, in the Russian Federation in 2003 prices, billion rubles
real_RA	Reserve assets in the Republic of Kazakhstan in 2005 prices, billion tenge, in the Russian Federation in 2003 prices, billion rubles
delta_r_lending	Difference between real interest rates of banks on loans issued in Kazakhstan and the USA, Russia and the USA

⁵ This method of calculating the real exchange rate differs from the method used, in particular, by the National Bank of Kazakhstan, where the real exchange rate is the proportion of the exchange of one Kazakhstani consumer basket for the n-th number of American consumer baskets. In this case, the growth of the real exchange rate indicates a rise in the national currency, a decrease indicates a cheaper price.

Description of the model and its modification

The methodological basis of the study is the general macroeconomic equilibrium (balance) model IS-LM-BP (extended IS-LM model) for a small open economy [11,12,13]. The model describes the equilibrium in a short period between the commodity and money markets at a constant price level and is given by the following equations:

$$\begin{cases} \text{IS: } Y = C(Y-T) + I(r) + G + NX(\varepsilon) & (1) \\ \text{LM: } \frac{M}{P} = L(Y, r) & (2) \\ \text{BP: } NX(\varepsilon) = -CF(r) & (3) \end{cases}$$

where Y is the total income; (Y-T) - net income; C - consumption, which is directly dependent on net income; I - gross investment, which is inversely related to the real interest rate; r is the real interest rate; G - government procurement, NX - net export or current account (explanation below), which is inversely related to the real exchange rate; ε is the real exchange rate of the national currency; M / P - money supply in real terms; L (Y, r) is the demand for real cash balances that are directly dependent on income and vice versa on the real interest rate; CF - capital account, which positively depends on the difference between domestic and world interest rates (r-r*).

Special attention should be paid to equation (3), due to which the IS-LM model was expanded. Equation (3) describes the relationship between macroeconomic variables with a zero balance of payments.

It should be noted that there exist a significant discrepancy in terminology when describing external equilibrium. [14] Thus, according to the Balance of Payments Manual and the International Investment Position (sixth edition of the International Monetary Fund 2009) and other guidelines of the methodological nature of international organizations⁶ adhered to by the National Bank of Kazakhstan, the difference between exports and imports of goods and services represents the balance of trade, rather than a current account, as it is considered in the model [15]. In this regard, the left side of equation (3) of the system in future calculations will include all

elements of the current account (trade balance, primary income balance, secondary income balance).

The right side of equation (3) in its content reflects transactions with financial assets and liabilities between residents and non-residents are called "financial account" and not "capital flow account". Thus, equation (3) will be transformed taking into account the recommendations on drawing up the balance of payments of the IMF:

$$COA + CAB + EO = NFA + RA \quad (4)$$

where COA⁷ is the current operations account, CAB⁸ is the capital account balance, EO⁹ is the net error and omission, NFA¹⁰ is the financial account, RA¹¹ is the change in reserve assets.

The consumer function reflected in equation (1) also requires additional attention. Dependence of consumption (C) on the «net income» (Y-T), mentioned in [Manquiu, 1994; Castles, 2001; Tumanova, Shagas, 2004], is greatly simplified. The final consumption expenditure of households (C) is formed on the basis of the **net adjusted disposable income of the household sector**, the receipt of which includes a number of iterations using indicators of the system of national accounts. This indicator is published by the national statistical bodies of both Russia and Kazakhstan.

1) Net income of households sector (balance of primary incomes of households sector (gross)) = Gross income of households sector - consumption of fixed capital of households sector.¹²

2) Net adjusted disposable income of the household sector = Net household income of the household - current taxes on income, property, etc. - social security contributions + social benefits + other current transfers + social transfers in kind.

7 Current operations account

8 Capital account balance

9 Net errors and omissions

10 Net financial account

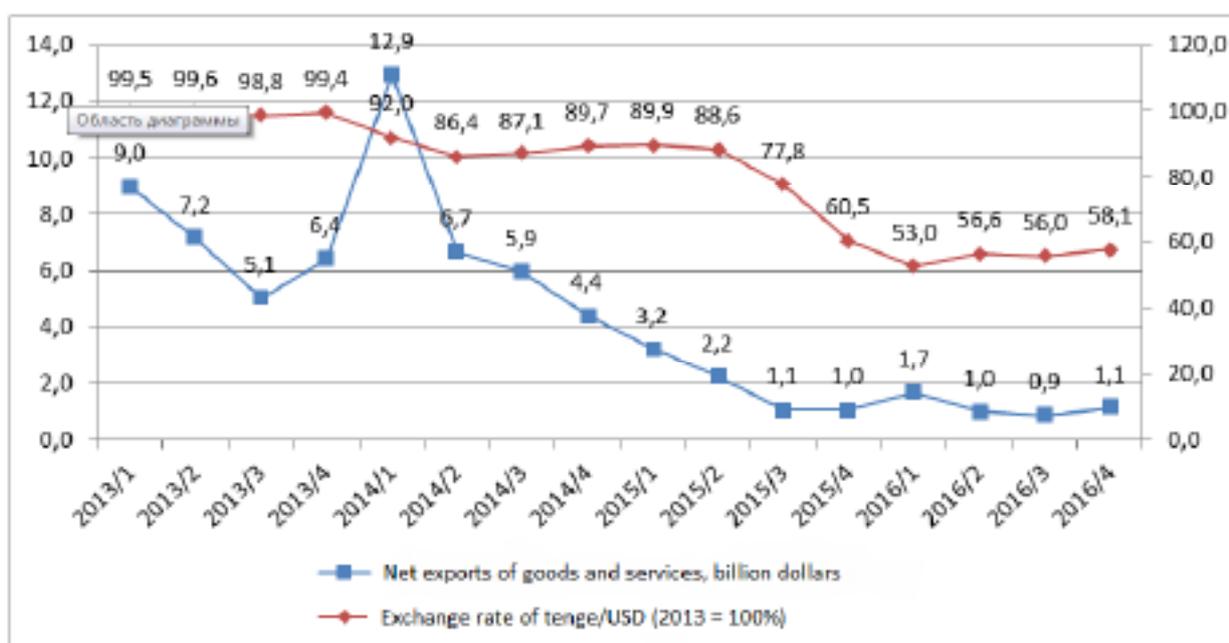
11 Changes in reserve assets

12 System of national accounts 2008. European commission. International monetary fund. Organization for economic cooperation and development. United Nations. World bank. New York. 2012, p. 28.

6 International Monetary Fund, UN group organizations, Organisation for Economic co-Operation and Development, Bank for International Settlements, Eurostat, world Bank, others.

To calculate the consumer function of Kazakhstan, the indicator of the net disposable income of the household sector will be used, which differs from the presented formula in paragraph 2) by the amount of social transfers in kind. Thus, the consumption function will be represented as a functional relationship of household final consumption expenditures (C) of the net adjusted disposable household income (Yd).¹³

The net export equation (NX (ε)) also requires adjustment. The classical inverse relationship between net exports and the real exchange rate does not quite adequately describe Kazakhstan and Russian reality. Thus, the weakening of the national currency contributes to improve the competitiveness of domestic goods and services due to their cheaper prices. However, the statistics of Kazakhstan and Russia do not confirm this relationship (Figure 1).



Note: built by the authors based on data from the National Bank of Kazakhstan

Figure 1 - Dynamics of net exports (billions of dollars) and the real exchange rate of the tenge (2013 = 100%) in Kazakhstan from 2013 to 2017.

The decline in the real exchange rate index¹⁴, which testified the depreciation of the national currency, was simultaneously accompanied by a fall in net exports. This circumstance is explained by the bias in the commodity structure of exports towards mineral products, whose share in 2016 was 71.3%¹⁵. The decline in oil prices had a more

significant negative impact from a decrease in revenues on world markets than a positive impact from other goods, whose competitiveness increased.

These specifics (imbalance in the export structure) should be reflected in the model by improving the net export equation. A similar course has already been applied in the article by Sinyakov A. and Yudaeva K. [16]. In particular, the authors classify all the goods produced in the economy into three groups: non-tradable, tradable and commodity traded goods.

In this case, the function of net exports will depend on the export and import of traded goods, as well as income from oil and gas exports is a “gift” for the economy, according to the authors of the article:

13 Ibid

14 In this case, the real exchange rate refers to the proportion of the exchange of one Kazakhstani consumer basket to the n-th number of similar American baskets. The increase in the value of the real exchange rate reflects the appreciation of the national currency, and the decline – cheapening.

15 Balance of payments and external debt of the Republic of Kazakhstan for the 2016 national Bank of Kazakhstan, may 2017 – 192 p.

$$NX = Ex(\varepsilon, Y, Y^f) + p_{oil} * X - Im(\varepsilon, Y), \quad (5)$$

where NX is net export; Ex-volume of export of traded goods, ε - real exchange rate; Y - income in the economy; Y^f - income of the rest of the world¹⁶, $p_{oil} * X$ – raw materials export; Im- volume of import of traded goods.

Thus, the system of equations describing the general macroeconomic equilibrium (IS-LM-BP), taking into account the aforementioned remarks implemented through equations (4) and (5), takes the form:

$$\begin{cases} IS: Y = C(Y^d) + I(r) + G + Ex(\varepsilon, Y, Y^f) + p_{oil} * X - Im(\varepsilon, Y) \\ LM: \frac{M}{P} = L(Y, r) \\ BP: CDA + KAB + ED = NFA + RA \end{cases} \quad (6)$$

Results and discussion

Analysis of consumer function

Building the IS-LM-BP model for Kazakhstan and Russia will begin with the consumption function as a function of personal disposable income. The general view of Keynes's consumer function is: $C_{real} = Ca + bYd$, where Ca is autonomous consumption, b is the marginal propensity to consume, Yd is personal disposable income. This is based on statistical data for the period 2005-2015. The consumption function for Kazakhstan has the following econometric estimate:

$$C_{real} = -579,177 + 1,66Y^d \quad (7)$$

$$R^2 = 0,874318$$

The coefficient b characterizes the marginal propensity to consume, which shows the change in consumption in response to a change in personal disposable income per unit. This value fluctuates within $0 \leq b \leq 1$, the larger this indicator is, the lower is the level of welfare of the population, since most of the disposable income is spent on consumption, and less on saving. In the resulting equation, the marginal propensity to consume was 1.66. In our opinion, this value was not obtained by chance.

16 The authors of this article use the income of the largest trading partner as a variable "income of the rest of the world".

Excess consumption over personal disposable income may indicate the presence of shadow income among consumers, as well as a high level of consumer spending. Due to the Statistics Committee of the Ministry of National Economy of the Republic of Kazakhstan (hereinafter the Constitutional Court of the MNE RK), in 2015 the share of the non-observed economy was 28%¹⁷, and the volume of loans issued by commercial banks to the population for consumer spending in 2015 amounted to 8.2%¹⁸ of household spending for final consumption (respectively, in the low potential of domestic sources of investment financing).

The dynamic equation, which includes the independent variables of past periods, is characterized by a higher index of determination. Ignoring lagged variables can lead to "cut off" results from reality, since it is impossible not to deny the effect of income growth in previous periods on consumption in the current period.

$$C_{real} = -520,476 + 1,71Y_t^d - 0,66Y_{t-1}^d + 0,5Y_{t-2}^d \quad (8)$$

$$R^2 = 0,887280$$

The negative dependence of consumption on income in the previous quarter can be explained by the action of Keynes' psychological law, when, in response to income growth in a short period (precisely in a short one), most of it is spent on savings.

As can be seen from equation (7) and (8), the estimate of autonomous consumption is negative. The free parameter in the regression equation can be negative provided that the growth rate of the dependent variable exceeds the growth rate of the independent variable. In our case, the growth of personal disposable income causes a more substantial increase in consumption over the entire range of data under consideration.

On the basis of the quarterly data for the last 20 years, a consumer function for the Russian economy has also been built:

17 According to the statistics Committee of the Ministry of national economy http://www.stat.gov.kz/faces/wcnav_externalId/homeNationalAccountIntegrated?_afLoop=3844260119848008#%40%3F_afLoop%3D3844260119848008%26_adf.ctrl-state%3D11qwobccx4_54

18 According to the National Bank of Kazakhstan <http://www.nationalbank.kz/?docid=306&switch=russian>

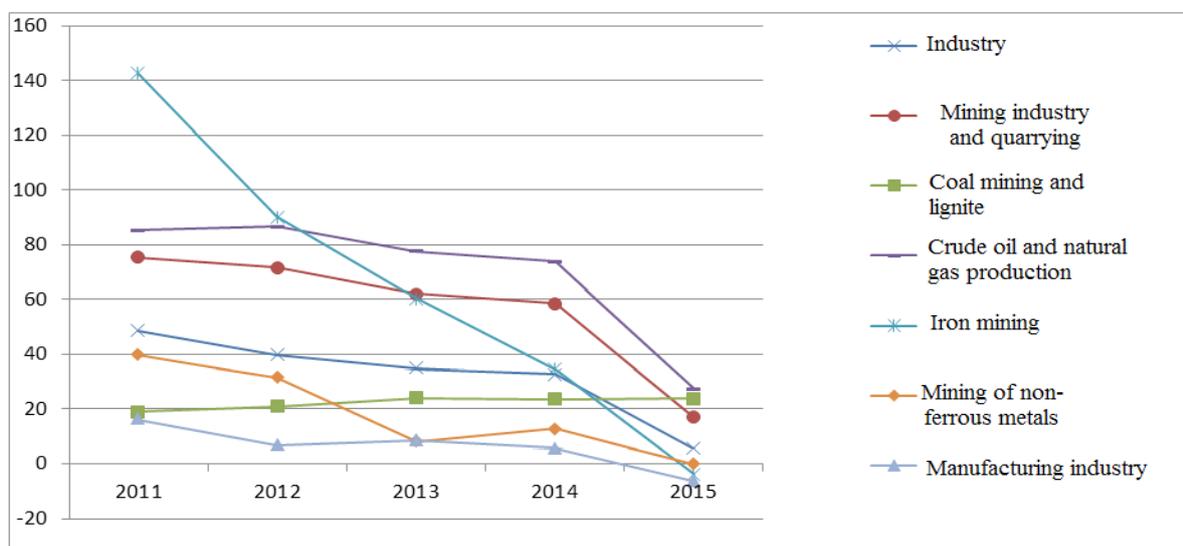
$$C_{real} = -17,4962 + 0,746283Y^d \quad (9)$$

$$R^2 = 0,935189$$

The resulting regression equation does not have coefficients similar to equation (7) and (8). The marginal propensity to consume is 0.74. That is, with an increase in net adjusted disposable income per unit, 74% will be directed to consumption. Such a significant difference in the obtained equations can be explained by the method of calculation of some indicators by national statistical agencies. Thus, the peculiarity of the calculation of the remuneration

of employees in Russian national accounts is that it includes, in addition to the hidden remuneration of employees, and hidden mixed incomes¹⁹ In this regard, the coefficients obtained are comparable with theoretical assumptions.

The estimate of autonomous consumption, as in equation (9), turned out to be insignificant. A positive relationship is noted between consumption expenditures and net adjusted disposable incomes of the previous quarter and six months. The dynamics of the calculated and observed values is reflected in Figure 2.



Note: the figure is built by the authors based on the data of the Constitutional Court of the MNE RK

Figure 2 - Dynamics of profitability by type of activity of the industrial sector of Kazakhstan, in %

Investment function analysis

The analysis of the investment function is one of the key positions in this study, since investment is the source of economic growth. In the expanded IS-LM model, the investment function is presented as an inverse relationship between the value of investment and interest rate: $I_{real} = I_a - dr$, where I_a is an autonomous investment; d - coefficient of investment sensitivity to interest rate; r - the real interest rate. When building the investment function for Kazakhstan, quarterly indicators of the average real interest rate of banks on loans issued for 10 years were used.

The size of this rate depends on the policy of the National Bank of Kazakhstan (Bank of Russia), the dynamics are determined by the refinancing rate until 2015, and currently by the base rate (in

Russia, the key rate) as shown in the figure below.

As a result, a regression equation was obtained for the investment function for Kazakhstan:

$$I_{real} = 994,657 - 1085,84r \quad (10)$$

$$R^2 = 0,020039$$

As you can see, the coefficient of determination is extremely low (2%), which indicates the absence of a functional relationship between variables (the coefficient of sensitivity of investments to interest rates also turned out to be statistically insignificant). Could this be? Similar results were obtained when evaluating the regression model of investment for Russia:

¹⁹ National accounts in Russia in 2011-2016: Stat. SB. / Rosstat. –M., 2017 – S. S. 263 18

$$R_{y_{real}} = 870,877 - 67,3502r \quad (11)$$

$$R^2 = 0,035998$$

The structure of investments in fixed capital of Kazakhstan in the direction of use, according to sources of financing has its own specifics. Thus, 55% of investments in fixed capital go to industry, with 60% of this amount going to the mining industry and quarrying. High profitability in this type of activity relative to other sectors of the economy is a key factor of investment attractiveness. So, only in the Atyrau region (the flagship region for the extraction of natural resources) in 2015 was sent a fifth of all investments in fixed assets.

For these types of activities, the determining factor will not be the rate of interest on loans, but the level of profitability of the industry. In the manufacturing industry, on the contrary, with fluctuating profitability with an average value of 6.24% over the past 5 years, the interest rate plays a key role. The lack of a relationship between the interest rate and the amount of investment is also explained through the prism of the investment structure by sources of financing: the share of borrowed funds has not changed over the past 5 years and does not exceed 5% for Kazakhstan. In 2015, the bank loans in Russia amounted to 8% (almost 2% were loans from foreign banks). The main source of investment both in Kazakhstan and in Russia with a share of almost 60% and 50.2%, respectively, are own funds.

For instance, in Kazakhstan in 2016 foreign direct investments have been increased for 39.9% comparing to 2015 and reached 20,6 billion dollars. Such a significant increase is associated with the start of commercial oil production under the Kashagan project. In total, investments in the oil and natural gas industry have increased for 2.1 times.

The inclusion of lagged variables in the investment model of both Russia and Kazakhstan does not significantly increase the quality of the regression equation (only by 1%), which cannot be because of the above mentioned reasons.

Thus, the classical interrelation between investments and interest rates is not adequate for the national economies of Russia and Kazakhstan. At the same time, the IS curve in coordinates (output, interest rate) will be absolutely inelastic, creating the threat of an investment trap. This

conclusion does not question the significance of the interest rate for the economies of Kazakhstan and Russia. The fact is that interest rate fluctuations do not significantly affect the aggregate amount of investments, due to the low share of borrowed funds. However, its fluctuations will significantly affect the development of small and medium enterprises.

Net export analysis

Based on quarterly data for Kazakhstan and Russia, regression equations were described based on (5) for net exports. We remind that the classical determinants that determine the value of exports in the expanded IS-LM model (taking into account the specifics of export-oriented economies) are income in the economy, income of the outside world, the real exchange rate, and the world price of oil. When numerating the equation for Kazakhstan, the indicator of China's GDP in the base year prices was used as the variable "income of the outside world", since China is the largest trading partner for Kazakhstan. The share of Kazakhstan's exports to China in 2015 amounted to more than 30 percent. A regression export equation was charged for Kazakhstan with lagged variables (the equation without lags turned out to be with a low coefficient of determination):

$$Ex_{y_{real}} = 536,63 + 1,303Ex_{y_{real},oil} - 0,669Ex_{y_{real},oil,t-1} + 1,506\epsilon_2 \quad (12)$$

$$R^2 = 0,4517$$

In this equation, the variables of total income in the economy and GDP of China have dropped out. The coefficient of determination is close to 50%, which indicates a high proportion of unexplained variance and a low quality of the equation.

As can be seen from Figure 1, against the depreciation of the tenge exchange rate, there was no increase in net exports, which contradicts the classical assumptions of the model. The modified equation (5) allows you to break the effect of two effects simultaneously occurring: a decline in exports due to a decrease in oil prices and an increase in non-oil exports due to the depreciation of the national currency. In the resulting equation (11), exports are directly dependent on the real exchange rate with a lag of two quarters (we remind that in this case, the real exchange rate is calculated as a proportion of the exchange of one American basket for n-number of Kazakhstan baskets. A growth rate means a depreciation of the national currency - rise

in price). Growth rate means the depreciation of the national currency, reduction - appreciation).

A similar modified equation with lags was obtained for Russia with a higher determination coefficient than for Kazakhstan:

$$Ex_{treal} = -984,34 + 0,383Y_{treal} - 1847,19Ex_{treal,t-1} + 2954,24Ex_{treal,t-2} + 9,682t \quad (13)$$

$$R^2 = 0,862894$$

The resulting export function in the lagged interpretation for Russia is similar to the export function of Kazakhstan in basic parameters. This confirms that countries with a commodity-oriented economy have similar functional dependencies of macroeconomic variables.

The Kazakhstan import model confirms the generally accepted patterns in economic theory:

$$Im_{treal} = -315,555 + 0,377915Y_{treal} - 16,7900t + 20,0823t_{t-1} \quad (14)$$

$$R^2 = 0,359659$$

The import function shows that with an increase in total income, the import of goods and services is growing in Kazakhstan, and with an increase in the real exchange rate, import is declining. Growth in income among the population is accompanied by an increase in consumption of imported goods, and an increase in the real exchange rate makes imported goods more expensive, which leads to a reduction in the demand for them.

For Russia, the resulting import function is also similar to the import function of Kazakhstan:

$$Im_{treal} = -720,450 + 0,575799Y_{treal} - 8,37814t \quad (15)$$

$$R^2 = 0,899704$$

Therefore, analogic conclusions can be made. The increase in income allows Russians to buy more imported goods, at the same time, when the exchange rate rises, imported goods become more expensive than domestic ones, and as a result, import is reduced.

Thus, based on the analysis of the commodity market of Kazakhstan and Russia, you can establish the type of the IS curve: since the analysis of the investment function showed no interrelation between the interest rate and the value of investments, in this relation there is no need to derive the cumulative IS curve equation in analytical form. In classical coordinates, this line will be vertical, which contradicts the results obtained in [Ashimov et al., 2010; Bekeshova et al., 2013; Dildebaeva, Sailaubekov, 2014].

Analysis of the demand function for money

The economic theory highlights the classical and Keynesian approaches to explaining the demand for money. According to the classical approach, the demand for money depends positively on the number of completed transactions, i.e. from the level of total income, and the Keynesian approach complements this theory, highlighting in addition to the transactional (operational) demand for money, the demand for money on the basis of precautionary and speculative motives.

The functional dependence of the demand for money is written as followed below:

$$M^d/P = L(Y_{real}, r_{real})$$

Thus, the indicator of gross domestic product in prices of the base year (Y_{real}) was chosen as a variable that reflects the scale of transactions in goods and services, and the real remuneration rate is used as a variable that reflects the imputed costs of storing money (money demand for a speculative motive) banks on loans.

The most common method used to evaluate the money demand function is the least squares method. However, researchers using this method can face a serious problem. So, in this case, the monetary aggregate M0 is used as the explained variable, that is, the demand for money is determined by the influence of the level of real income and the real interest rate. At the same time, the hypothesis of the influence of money on interest rates and income is rejected.

To avoid getting incorrect estimates will allow the method of estimating simultaneous equations used in this work. For Kazakhstan, the money demand equation is as followed below:

$$\frac{M^d}{P} = 311,727 + 0,130191Y_{treal} - 544r_{treal} \quad (16)$$

$$R^2 = 0,324934$$

The coefficient of determination of the equation is below 50%: a high proportion of unexplained dispersion (68%) may indicate a poor quality of the regression equation. The demand for money depends positively on the real output and negatively on the interest rate. At the same time, the growth of output by 1 unit increases the value of the demand for money by 0.13 units. However, the low statistical significance of the coefficient at the interest rate shows that the demand for money almost does not respond to its change. The result

may indicate the underdevelopment of speculative demand for money. Liquidity is used primarily for transactional and precautionary motives. Underdevelopment of the financial market, weak financial literacy of the population can confirm the conclusions. The coefficient of monetization of the economy, which is determined by the degree of development of the financial and credit system in 2015 in Kazakhstan amounted to 0.42, while in developed countries it reaches 2 or more [18].

The model can be improved with the inclusion of lag variables, but the quality of the model has only deteriorated (the coefficient of determination is 6%):

$$\frac{M^d}{P} = 595,723 + 0,569625Y_{real,t} - 0,505282Y_{real,t-1} - 3340,14r_t - 4469,96r_{real,t-1} + 6648,35r_{real,t-2} \quad (17)$$

$$R^2 = 0,064224$$

For Russia, the equation for the demand for money was also calculated:

$$\frac{M^d}{P} = -189,48 + 0,882743Y_{real,t} - 5,23956r_{real,t} \quad (18)$$

$$R^2 = 0,928603$$

The resulting money demand function, in contrast to the Kazakhstan equation, when adding lag variables becomes better (the coefficient of determination increases to 95%):

$$\frac{M^d}{P} = -1570,04 + 0,414980Y_{real,t} + 0,400555Y_{real,t-1} \quad (19)$$

$$R^2 = 0,951053$$

In equation (12), the real interest rate turned out to be an insignificant variable and in (13) it disappears altogether.

Thus, the analysis of the function of the demand for money allows us to make the following conclusions:

1) Equations of money demand for Russia and Kazakhstan are presented as functional dependencies on real income; dependence on interest rates is insignificant, due to poor financial literacy of the population about alternative ways of investing money. This circumstance imposes some restrictions on the monetary authorities in the implementation of monetary policy.

2) Perhaps there is a need to modify the money demand equation due to the proliferation of other forms of payments, in particular the use of bank credit and debit cards.

3) The LM curve also becomes completely inelastic at the interest rate in the coordinates (real output level, real interest rate)

4) The role of the interest rate is questioned, as a result of a change in which the equilibrium of the commodity, money market and balance of payments is ensured.

Balance of Payments Evaluation

Given the specification of the extended IS-LM model, the balance of payments equation (4) is as follows:

$$COA + CAB + EO = NFA + RA$$

The left side of the equation has already been partially dismantled: the current account (COA) includes the trade balance (net exports), the equation of which was considered above and the balance of primary and secondary incomes (taken as exogenous parameters), the capital account (CAB) - adopted as an exogenous variable; net errors and omissions (EO) are also set exogenously.

The right side of the equation reflects the financial account (NFA) and the change in reserve assets (RA). All variables were adjusted to the base year prices using the real exchange rate.

The balance of a financial account is the difference between net changes in external assets and net changes in external liabilities. The excess of liabilities over assets (a negative financial account value) provides for financial transactions a net capital inflow or “net borrowing from the outside world” and, conversely, the excess of assets over liabilities (a positive financial account value) characterizes capital outflow or “net lending to the outside world”. According to the assumptions of the model, the balance of a financial account depends on the difference between domestic and global interest rates. That is to say, if the internal interest rate is higher than the world one, then this leads to an inflow of capital from the outside world (increase in liabilities), which means that the balance of the financial account will be negative, which in turn will strengthen the national currency.

So, to make the equation, the differences between real interest rates of banks' remuneration on loans issued in the Republic of Kazakhstan

(RF) and in the United States by quarters (delta_r_lending) were calculated.

A regression equation was obtained taking into account the lagging variables of the financial account for Kazakhstan:

$$NFA = -423,782 + 3258,15\Delta r_{lending} - 33,0652E_t + 33,9436E_{t-1} \quad (20)$$

$$R^2 = 0,377455$$

The resulting equation has a low coefficient of determination. The excess of the internal interest rate over the world has a positive effect on the financial account, and the coefficient is statistically insignificant. The national currency exchange rate has the exact opposite effect in the current period compared to the previous one.

It is rather difficult to interpret the relation between the financial account and the real exchange rate of the national currency, since their dependence is interdependent: on the one hand, the positive balance of the financial account can lead to a depreciation of the national currency, on the other hand, the depreciation of the national currency can

lead to capital outflow because of course instability with the exception of situations with a speculative nature.

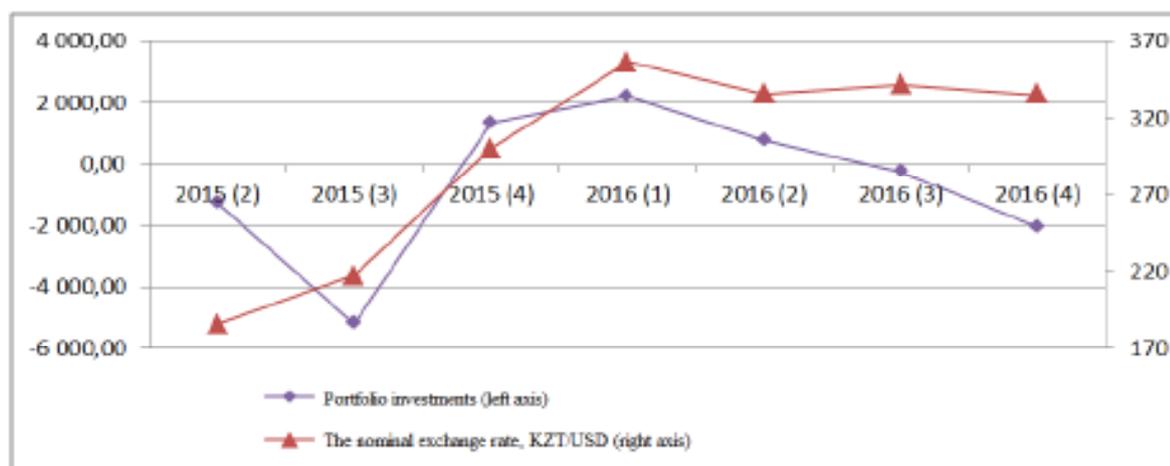
Similar results were obtained for the equation of the financial account of Russia with lag variables:

$$NFA = 280,197 + 138,876E_t - 145,934E_{t-1} \quad (21)$$

$$R^2 = 0,036967$$

The extremely low coefficient of determination indicates the insignificance of this equation.

There is no need to make the balance of payments equation, since, as for the cases with the investment function and the money demand function, it will be absolutely inelastic at the interest rate. The results obtained allow us to conclude that the mobility of capital is extremely low, that is, changes in the internal interest rate have virtually no effect on capital flows. Similar conclusions were obtained in D.O. and Mukanov N.S. [19]. A more detailed study of the dynamics of individual positions in a financial account over the last two years provides some important conclusions.



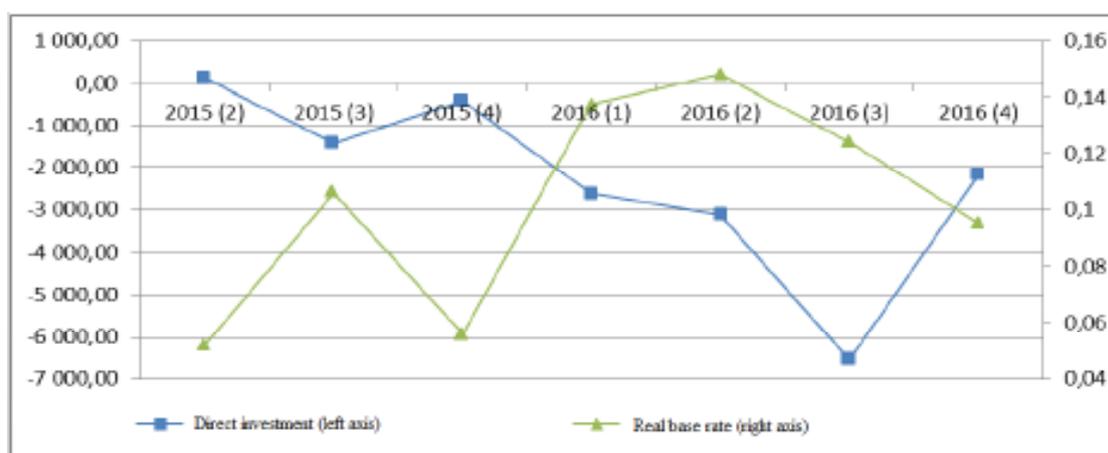
Note: the figure is compiled by the authors according to the National Bank of Kazakhstan

Figure 3 - Dynamics of portfolio investment and nominal exchange rate of Kazakhstan

Thus, the dynamics of portfolio investment balance was predetermined by the dynamics of the nominal exchange rate. Up to the first quarter of 2016, net outflow of portfolio investments²⁰ occurred amid a weakening national currency. After the stabilization of the course in the third quarter of 2016, net liabilities exceeded the net acquisition of assets.

The dynamics of the balance of direct investments, by contrast, over the past two years indicates a net inflow of foreign assets, especially

in the third quarter of 2016. In the structure of the gross inflow of direct investments into Kazakhstan from foreign direct investors by types of economic activity of residents, more than a quarter is occupied by crude oil and natural gas production, another quarter by geological exploration and survey activities, 18.37% - by the metallurgical industry and the production of finished metal products, except machines and equipment. Thus, in this case, too, the interrelation between interest rates and direct investments is inadequate, as is shown in the figure below.



Note: the figure is compiled by the authors according to the National Bank of Kazakhstan

Figure 4 – Dynamics of direct investments and the real base rate of Kazakhstan

Thus, the balance of payments equation in the form in which it is represented in the expanded IS-LM model cannot correspond to the realities in the economy. Individual balance of payments items are complex functional dependencies on a large number of determinants. To obtain a stable function in the classical form for export-oriented countries is not possible.

²⁰ According to the balance of payments methodology, a surplus in the financial account and for individual items (net acquisition of assets – net liability) means a net outflow of financial resources from the country due to an increase in foreign assets and / or a decrease in liabilities. Net lending of the rest world.

Conclusion

1. The system of equations for the extended IS-LM model has been modified. Thus, the balance of payments equation has been brought in line with the methodology of the International Monetary Fund, and an explanation has been made about the discrepancies in the terminology used in the model with the IMF methodology. In the main macroeconomic identity, the net export equation is presented taking into account the specifics of export-oriented economies. In constructing the consumer function, theoretical simplifications were overcome, according to which consumption is presented as a dependence on «net income» (total income minus taxes). For this function, we used the indicator of net adjusted disposable household income, which allows taking into account disposable income of the population.

2. The resulting consumption function of Kazakhstan and Russia demonstrated a positive dependence of household consumption on the net adjusted disposable income of households. The consumption equations for Kazakhstan and Russia differ significantly from each other. Thus, the Kazakhstan consumption function is characterized by a high marginal propensity to consume (more than one), indicating the presence of shadow incomes and consumption on credit, a negative assessment of autonomous consumption, indicating an excess of consumption growth rates as compared to income growth rates.

For the consumer function of Russia, the marginal propensity to consume is 0.72. The estimate of autonomous consumption was statistically insignificant. Differences in the obtained estimates of the equations of Kazakhstan and Russia are explained by discrepancies in the methods of accounting for a number of macroeconomic variables (accounting for hidden wages of employees and hidden mixed incomes).

3. The investment function of Kazakhstan and Russia indicates an extremely weak dependence of investments on the interest rate. In export-oriented countries, the dynamics of investment is predetermined by world prices for exported goods, that is, the profitability of the industry. Only borrowed funds as a source of financing investments depend on the interest rate negatively, but their share in the structure of investments in Kazakhstan and in Russia is insignificant. In this case, the action of the transmission mechanism of monetary policy is ineffective, since a change in the interest rate does not affect the aggregate investment demand (investment trap). [20]

4. The modified export equation in lag interpretation for Russia and Kazakhstan are similar in their basic parameters. The resulting equation reflects the opposite effects of two effects: a change in exports due to a change in commodity prices and a change in the real exchange rate. Eventual result will depend on the strength of the impact of a particular effect. As shown by net export data for Kazakhstan from 2013 to 2016, despite the depreciation of the national currency, net export dynamics was negative, indicating a more significant impact of lower prices on major traded goods.

5. The resulting equation for the demand for money shows that the demand for money is almost

independent of the interest rate. In both Russia and Kazakhstan, cash for the population is necessary only for making current transactions and only a small proportion of cash forms speculative demand for money.

6. The IS and LM curve for Kazakhstan and Russia in coordinates (real output level, real interest rate) will be completely inelastic as opposed to the results of some studies.

7. It is not possible to create a classical equation of the balance of payments due to the existence of interdependent non-linear relationships between elements and accounts of the balance of payments. Thus, the dynamics of portfolio investment in Kazakhstan over the past three years has been predetermined by the dynamics of the nominal exchange rate; the dynamics of direct investment is the profitability of the dominant sectors of the economy. The classical relationship between capital inflows and the excess of the domestic real interest rate over the world is not found.

8. Thus, the specifics of the interrelationships between the main macroeconomic variables for economies that are export-oriented, as well as the non-linearity of real economic processes, impose significant (insurmountable) restrictions on the use of the expanded IS-LM model for macroeconomic forecasting and regulation.

References

1. Varhotov T., Koshovec O. Jepistemologicheskiy status modelej i myslennyh jeksperimentov v jekonomicheskoy teorii [Epistemological Status of Models and Thought Experiments in Economics] // *Voprosy ekonomiki* []. 2015. №2. S. 123-124.
2. Leishvili P. Jekonomiks v tiskah jempirizma i dogmatizma (prichiny zastoja v jekonomicheskoy nauki). M: Direkt-Media, 2013. 62 s.
3. Ajvazjan S. A., Brodskij B. E. Makrojekonometricheskoe modelirovanie: podhody, problemy, primer jekonometricheskoy modeli rossijskoj jekonomiki [On Educating Economists-Statisticians and Economists-Mathematicians: Trends, Problems, Prospects] // *Prikladnaja jekonometrika* [Applied econometrics]. 2006. № 2. S. 75-81.
4. Kravcov M.K., Burdyko N.M., Gaspadarec O.I., Shinkevich N.N., Kartun A.M. Jekonometricheskaja makromodel' dlja analiza i prognozirovaniija vazhnejshih pokazatelej belorusskoj jekonomiki [An Econometric Macroeconomic Model for Analysis

and Forecasting of Key Indicators of the Belarusian Economy] // Prikladnaja jekonometrika [Applied econometrics]. 2008. № 2(10). S. 21–43.

5. Shul'gin A.G. Optimal'nye pravila valjutnoj i denezhno-kreditnoj politiki v DSGE-modeli, ocenenoj na rossijskikh dannyh [Optimal monetary policy rules in DSGE model estimated on Russian data] / A. G. Shul'gin; Nac. issled. un-t «Vysshaja shkola jekonomiki» [National Research University Higher School of Economics]. M.: Izd. dom Vysshej shkoly jekonomiki [Higher School of Economics Publ. House], 2014. 38 s.

6. Ashimov A.A., Sultanov B.T., Borovskij Ju.V., Dil'debaeva Zh.T., Novikov D.A., Nizhegorodcev R.M. Makrojekonometrijskij analiz sostojanija nacional'noj jekonomiki na baze ravnovesnyh regressionnyh modelej i optimizacija parametrov gosudarstvennogo regulirovanija [Macroeconomic analysis of the national economy on the basis of the equilibrium regression models and optimizing the parameters of state regulation] // Izvestija Volgogradskogo tehničeskogo universiteta. Serija Aktual'nye problemy reformirovanija rossijskoj jekonomiki (teorija, praktika, perspektiva). 2010. № 13. S. 139-148.

7. Bekeshova A.Sh., Dil'debaeva Zh.T., Sajlaubekov N.T. Ocenka ravnovesnyh makrojekonometrijskikh pokazatelej nacional'noj jekonomiki (na statističeskikh dannyh RK) [Evaluation of equilibrium macroeconomic indicators of the national economy (on statistics RK)] // Vestnik KazNU. Serija jekonomičeskaja. №5 (99). 2013. S. 21-26.

8. Dil'debaeva Zh.T., Sajlaubekov N.T. Makrojekonometrijskij analiz nacional'noj jekonomiki na baze modeli obshhego jekonomičeskogo ravnovesija (na statističeskikh dannyh RK) [Macroeconomic analysis of the national economy on the basis of general equilibrium models (statistical data on RC)] // Vestnik KazNU. Serija jekonomičeskaja. № 3 (103). 2014. C. 15-21.

9. Buklemishev O., Danilov Ju. Jekonomičeskoe liderstvo i «liderskaja renta» [Global Economic Leadership and the «Leadership Rent»] // Mirovaja jekonomika i mezhdunarodnye otnoshenija [World Economy and International Relations]. 2015. № 10. S. 5–17.

10. BP Statistical Review of World Energy. June 2016. Available at: <http://www.bp.com/statisticalreview>

11. Mjenk'ju N.G. Makrojekonomika [Macroeconomics]. Per. s angl. M.: Izd-vo MGU, 1994. 736 s.

12. Tumanova E.A., Shagas N.L. Makrojekonomika. Jelementy prodvnutogo podhoda. Uchebnik. M.: INFRA-M, 2004. 400 s.

13. Zamkov O.O. Jekonometričeskie metody v makrojekonometričeskom analize: kurs lekcij. M.: Izdatel'skij dom GU-VShJe, 2001. / Zamkov O.O. Jekonometričeskie metody v makrojekonometričeskom analize. M.: Dialog-MGU, 1999. S. 110-130.

14. Rukovodstvo po platezhnomu balansu i mezhdunarodnoj investicionnoj pozicii [Balance of payments and international investment position manual] (Shestoe izdanie (RPB6)) – Vashington, okrug Kolumbija. Mezhdunarodnyj Valjutnyj Fond [International Monetary Fund], 2012. 463 s.

15. Platezhnyj balans i vneshnij dolg Respubliki Kazahstan za 2016 god // Nacional'nyj Bank RK [National Bank of Kazakhstan], Maj 2017 g. 192 s.

16. Sinjakov A., Judaeva K. Politika central'nogo banka v uslovijah znachitel'nyh shokov platezhnogo balansa i strukturnyh sdvigoj [Central bank policy under significant balance-of-payment shocks and structural shifts] // Voprosy ekonomiki. 2016. №9. S.5-39.

17. Sinel'nikova-Muryleva E.V. Spros na den'gi: jevoljucija teoretičeskikh predstavlenij i jempiričeskie issledovanija (na primere RF). Dissertacija na soiskanie uchenoj stepeni kandidata jekonomičeskikh nauk. Moskva, 2012. 222 s.

18. Mishhenko S.V. Vlijanie urovnja monetizacii jekonomiki na dinamiku denezhnoj massy [The impact of the level of monetisation of economy on money supply dynamic] // Jekonomika i banki [Economy and banks]. 2014. № 1. S. 16-24.

19. Chernjavskij D.O. Mukanov N.S. Vnedrenie pravila denezhno-kreditnoj politiki v kvartal'nuju prognostičeskiju model' Kazahstana [Introducing the Monetary Policy Rule into a Quarterly Predictive Model in Kazakhstan]. Den'gi i kredit [Money and Credit]. №5. 2017. S 40.

20. Glaz'ev S.Ju. «O targetirovanii infljacii [On inflation targeting]» // Voprosy ekonomiki. 2015. № 9. S.1-12.

21. Kudrin A. Vlijanie dohodov ot jeksporta neftegazovyh resursov na denezhno-kreditnuju politiku Rossii [The Influence of Oil and Gas Exports on Russia's Monetary Policy] // Voprosy jekonomiki. 2013. № 3. S.4-19.