CREDIT TO THE ECONOMY: NEW ANSWERS TO STANDARD QUESTIONS

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SUMMARY

The article explores the dynamics of claims made by the banking system of the Republic of Belarus on the economy. It employs cross–country comparisons and econometric modeling techniques. Based on the findings the authors drew conclusions about optimal growth rates of real credit, factors behind the demand for and the supply of credit in Belarus, the most efficient methods of credit gap estimation, as well as about the possibility of identifying incipient imbalances in monetary and financial spheres with the help of the credit gap indicator. Proposals for enhancing the efficiency of the credit process management at the macro level are formulated in the concluding section.

JEL classification: E5

Key words: banking system's credit to the economy, optimal growth rates of credit, credit gap, credit supply, and credit demand.

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Contents

The first and most important lesson that history teaches about what monetary policy can do — and it is a lesson of the most profound importance — is that monetary policy can prevent money itself from being a major source of economic disturbance

Milton Friedman, 1967

Introduction

Throughout the last decade the Republic of Belarus actively used bank lending as one of the key factors in stimulating the economic growth. This produced the desired result. At the same time, the maintaining of high rates of lending to the economy, including on non–market terms, at a time of significant external shocks (a hike in prices for gas imports from Russia, deteriorating terms of trade in crude oil and oil products, and the adverse impact of the implications of the 2008—2009 global financial and economic crisis) resulted in the growth of macroeconomic imbalances, which caused an almost threefold depreciation of the Belarusian ruble and a twofold increase in prices in 2011. Tense situation in monetary and foreign exchange spheres in 2011 Q2 and Q3 made the Government and the National Bank radically change approaches to lending: the number of government programs and the amount of lending to investment projects declined, interest rates on fresh credits in the national currency rose nearly five times, and legislation on soft lending to housing and investment activities has been significantly tightened since 2012. As a result of measures taken in combination with the effects of other factors, the real demand for credit resources declined by 16% in 2011, with this indicator having grown by 27.5% a year ago. How justified are such considerable and sharp fluctuations in credit to the economy? Why is it so difficult to ensure that the growth rates of bank credit are consistent with fundamental factors behind the development of the economy by preventing this indicator from material changes due to the shock? Is it possible to predict potential threats to the stability of monetary and financial systems from the dynamics of credit?

The economic history shows that similar problems and issues came up again and again in the course of the evolution of the global monetary and financial system. The 2008—2009 global financial and economic crisis, which made choice of the trade–off between monetary and financial stability topical, cites recent example. At that time the development of high technologies in the industrialized countries and investors' unwarranted optimism caused the boom in asset markets. Under such circumstances — against the background of low inflation, low interest rates, and dynamic growth of the economies — central banks, which preferred price stability to other objectives, did not change their policy thus offering credit in excess. In turn, this encouraged the formation of price bubbles in the asset market, while inflation was low, threatening sustainability of the financial system [De Grauwe, and Gros, 2009].

Eventually, many central banks came to the conclusion that a more comprehensive analysis of credit processes is one of the ways to prevent the emergence of crisis situations in the monetary and financial sphere in the future. Recent publication by the European Central Bank [ECB, 2010] pointed out that carrying out monetary and credit analysis is a complex and non–trivial task: statistical methods, econometric models, and economic interpretation must be continually improved and updated as structural changes in the financial sector and beyond it are taking place. The analysis of credit indicators is a dynamic and evolutionary process, the enhancement of which requires a broader and more profound understanding of the relationships between factors affecting the dynamics of credit, banks' balance sheet ratios, and their impact on macroeconomic processes.

The National Bank of the Republic of Belarus is continually streamlining its approaches to the analysis and design of monetary policy [N. Mironchik and others, 2011]. The impact exerted by lending on the economy's real sector is explored with the help of different methods, including by carrying out relevant surveys of enterprises as part of monitoring their activities with their findings having been published since 2005 [NBRB, 2011a]. It is expected that the monitoring of bank lending conditions and the attraction of deposits, which is based on the findings of bank surveys and has been launched in 2011 Q3, will also contribute significantly to the study of the processes of lending and attracting bank deposits [NBRB, 2011b, 2011c]. Along with that, the subject and the objectives of this paper were predetermined by insufficient elaboration of credit analysis issues.

This paper focuses on the study of optimal growth rates of credit, factors behind credit, and credit gap indicators and the application thereof in the analysis of monetary and financial sphere. Credit to the economy from the banking system has been chosen as the object of the study. Making use of the techniques for the regression analysis, error correction models, and cross–country comparisons the authors made an attempt to define and to provide a rationale for optimal growth rates of real credit to the economy from the banking system, to identify the most significant factors behind the dynamics of bank credit in Belarus in the period from 2002 to 2011, to assess the credit gap with a view to employing this indicator for identifying threats to the monetary and financial stability, and to formulate, based on the findings, the proposals for further improvements in the analysis of credit and management of the credit process at the macro level for the Republic of Belarus.

This paper consists of the introduction, five main parts, and the conclusion. Major trends in the dynamics of bank credit to the economy over the past decade are referred to in the first part of the study; developed econometric models of the supply of and the demand for credit in the Republic of Belarus are described in the second part; the issue of the credit gap estimation and the use of the credit gap indicator with a view to identifying a threat to the monetary and financial stability are addressed in the third and the fourth parts; and a rationale for optimal growth rates of real credit to the economy from the banking system is given in the fifth part.

1. Main trends in the dynamics of the banking system's credit to the economy in Belarus during 2002—2011

Bank credit is of tremendous importance for the development of Belarus's economy. It is one of the most important sources of investments in the core capital and instruments for providing additional financial support to households. Credit serves as the main balance factor behind the change in the money supply and direction of placing monetary funds attracted by banks from households and economic entities.

In the past decade Belarus actively used bank lending for the purpose of stimulating the development of the national economy. In the period from 2002 to 2011, the annual average growth rates of credit to the economy from the banking system amounted in real terms to 24.8% per annum (data on the banking system's claims on the economy adjusted for the GDP deflator were used), with the average growth rates of GDP standing at 7.5%. As of January 1, 2012, the banking system's claims on the economy–to–GDP ratio increased to 62.6%, against 14.9% in early 2002 [Attachment 1, fig. A1.1]. Both general factors inherent in all transition economies and individual factors reflecting country features peculiar to the development of the Belarusian economy account for such high growth rates of lending. Macroeconomic and financial stabilization; an outstripping development of the financial system compared with the economy's real sector; and a significant increase in external borrowings may be referred to general factors. An active influence exerted by the state on investment activities of economic entities and banks is among internal factors. In particular, bank lending to different government programs and activities, mainly to develop housing and agriculture, provided the main alternative to budget funding. In 2006—2011, the annual average volume of soft credits extended by banks to the organizations for the purposes stipulated in government programs amounted to 7.6% of GDP, or 43.8% of long–term credits extended by banks [Attachment 1, fig. A1.2].

Lending to legal and natural persons is the main direction of placing banks' funds. At the same time, the share of banks' claims on the economy (on legal and natural persons) in banks' assets declined by 12.1 percentage points over the past three years, amounting to 60.7% as of January 1, 2012 [Attachment 1, fig. A1.3]. Credits extended in the national currency dominated the credit portfolio of banks throughout the entire period under consideration [Attachment 1, fig. A1.4], although the dynamics of the ruble credits' share in the total volume of banks' claims on the economy was characterized by one–off considerable fluctuations because of the effect of the revaluation of foreign currency credits as a result of the depreciation of the Belarusian ruble in 2009 and 2011. In 2002—2011, the share of long–term credits in the credit portfolio of banks was growing steadily and amounted to 75.6% as of January 1, 2012 [Attachment 1, fig. A1.5].

Funds attracted by banks from natural and legal persons, whose share in the structure of banks' liabilities accounted for 45.6% as of January 1, 2012 [Attachment 1, fig. A1.6], served as the main source of bank credit. Along with that, there were some differences in the dynamics of credit and money supply, which led to the formation of the so–called funding gaps [Attachment 1, fig. A1.7—8]. As a rule, these gaps were bridged at the expense of funds attracted by banks from non–residents, general government, and refinancing of the National Bank.

A 2.8 times devaluation of the Belarusian ruble against the US dollar in 2011 and the subsequent significant acceleration of inflationary processes gave rise to a radical change in approaches to lending, which were previously used by the National Bank and the Government of the Republic of Belarus. It became obvious that soft monetary policy pursued from 2009 to 2010, which contributed to maintaining high growth rates of lending to the economy by the banking system, in combination with insufficiently tight budgetary and

fiscal policy implemented with a view to stimulating domestic demand in order to avert a downturn in the Belarusian economy and to recover its growth following the adverse shock effect on the Belarusian economy exerted by a sharp increase in prices for gas imports from Russia, deteriorating terms of trade in crude oil and oil products, and implications of the global financial and economic crisis, as well as a considerable rise in wages in late 2010 and in the domestic demand for imported cars in anticipation of almost eightfold increase in customs duties resulted in the rapid deterioration in the trade balance at a time of shortage of external sources of its funding. In 2011—2012, the main changes in lending conditions were associated with the cuts made by the National Bank in emissive lending, the refusal to finance banks on non–market terms, including with a view to implementing the housing program, a downward revision of the number of government programs and the volume of financing of (including lending to) investment projects, a nearly fivefold rise in interest rates on fresh credits in the national currency [Attachment 1, fig. A1.9], as well as the tightening of legislation on lending to housing and investment activities. As a result of implemented measures in combination with the effect of other factors, first of all, a decline in paying capacity of economic entities and households in 2011, annual growth rates of the banking system's claims on the economy in real terms (adjusted for the CPI inflation) started to decelerate quickly beginning in April 2011 and September 2011 has already seen a fall in this indicator compared with the same period a year ago.

2. Econometric models of credit demand and supply

According to the authors, econometric analysis of the dynamics of the banking system's claims on the economy with the provision of a number of statistically relevant factors and indication of the extent of their impact is one of the ways to streamline credit analysis. Such analysis would make it possible to deepen understanding of the mechanism of the impact exerted by the factors on credit and reinforce the rationale for a set of measures to regulate the banking system's claims on the economy.

Models were built based on quarterly data for the period from 2002 Q1 to 2011 Q4. The credit supply (l^S) and the credit demand (l^D) functions were used as a starting point for their evaluation. According to the standard specification of the credit supply function, the latter depends on the money supply m as deposits are considered an imperfect substitute among the finance sources available for banks as well as interest rates on credits ri and corporate bonds ρ, which define the asset structure of banks' balance sheet [Cappiello, 2010]:

$$l^S = F\left(\underset{+}{m}, \underset{+}{ri}, \underset{-}{\rho}\right). \qquad (2.1)$$

Taking into consideration the changes that took place in the resource base and assets of banks of the Republic of Belarus in the period from 2002 to 2011 — namely, a steady and a growth in the share of non–residents' funds (from 7.1% in early 2002 to 19.2% by late 2011), a large excess of foreign assets over liabilities of the banking system in the period from December 2010 to November 2011, as well as considerable emissive support for banks from the National Bank at a time of adverse impact of implications of the global financial and economic crisis on the economy in the period from 2009 to 2010 — the theoretical specification of the credit supply model was expanded by incorporating the variables of foreign assets and liabilities of the banking system and banks' obligations in the national currency to the National Bank.

Also, having regard to the currency structure of the banking system's claims on the economy, the interest rate on credits denominated in foreign currency was included in the specification of the credit supply model. The interest rate on corporate bonds — which is used in the classical approach as a factor in the formation of alternative assets of banks' balance sheet — is not significant for the dynamics of credit in the Republic of Belarus, inasmuch as the market for non–bank corporate bonds in the Republic of Belarus is still in its infancy. In early 2012, investments in corporate securities of Belarusian issuers (excluding equities) accounted for less than 1% of the asset structure of banks whereas the share of credit investments in the economy stood at 57% of bank assets. As a result, the initial specification of the credit supply model is as follows:

$$l^S = F\left(\underset{+}{m}, \underset{+}{fl}, \underset{-}{fa}, \underset{+}{nbl}, \underset{+}{ri^{nc}}, \underset{+}{ri^{fc}}\right), \qquad (2.2)$$

where l^S — credit supply, m —money supply, fl — foreign liabilities of the banking system, fa — foreign assets of the banking system, nbl — banks' obligations in the national currency to the National Bank, ri^{nc} —interest rate on credits in the national currency, and ri^{fc} — interest rate on credits in foreign currency.

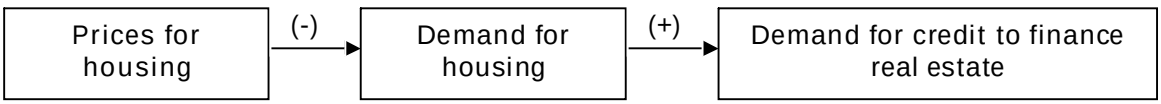
The demand for credit is directly dependent on the economic agents' income, the approximation of which requires, as a rule, that measures of gross domestic product (gdp) and

the interest rate on bonds which may be issued by economic entities with a view to financing their activities (ρ) are used and is inversely dependent on the interest rate on credits (ri):

$$l^D = F\underset{+\ \ -\ \ +}{\left(gdp, ri, \rho\right)}. \qquad (2.3)$$

The initial specification of the credit demand model for the Republic of Belarus has been also changed. Firstly, the interest rate on corporate bonds has been excluded from the initial specification, in much the same way as from the credit supply function, and the interest rate on foreign exchange credits has been added.

Secondly, taking into account numerous examples illustrating that a change in real estate prices had a significant impact on the growth rates of bank credits in different countries, the authors included the factor behind the change in dollar prices for housing in the demand function under consideration. However, unlike Greiber and Setzer [Greiber, Setzer, 2007], who discovered a positive correlation between real estate prices inflation and credit growth associated with direct wealth effect and indirect collateral value effect on the amount of credit, the authors suggest that there is a negative relationship between these variables in the Republic of Belarus. This hypothesis is explained by the fact that mortgage lending in the Republic of Belarus is largely constrained by legislative framework. Also, it is more complicated to expropriate an owner's housing in cases where borrowed funds are not repaid to the bank. The inverse dependence of the dynamics of credit on the change in prices for housing manifests itself indirectly through a negative impact of the real estate prices on the demand for housing and a positive impact of the latter on the demand for credit used to finance real estate:



Thirdly, the review of foreign empirical research papers on modeling the demand for credit showed that the use of data from the survey of banks, firms, and households which are derived from confidential and unique Bank Lending Survey, has made, in recent years, a significant contribution to the research into the credit channel of the monetary policy transmission mechanism in the euro area member states. Ciccarelli, Maddaloni, and Peydro [Ciccarelli, Maddaloni, and Peydro, 2010] point out that qualitative information, contained in the reviews, about the factors affecting the change in bank lending standards and the demand for credit from firms and households, makes it possible to identify, to a better extent, the shocks of the demand for and the supply of credit and to evaluate the significance of the credit channel in transmitting signals from the monetary policy to the economy. Thus, having regard to the foregoing, the function with the following specification was used to build the credit demand model:

$$l^D = F\underset{(+)\ \ (-)\ \ (-)\ \ (-)\ \ (+)}{\left(gdp, ri^{nc}, ri^{fc}, hp, f\right)}, \qquad (2.4)$$

where l^D — credit demand, gdp — gross domestic product, ri^{nc} — interest rate on credits in the national currency, ri^{fc} — interest rate on credits in foreign currency, hp — real estate prices, and f — expectations of the need for lending (the balance of the domestic enterprises' answers to the question about expected change in the need for lend-

ing, which are received based on enterprises monitoring conducted by the National Bank of the Republic of Belarus [NBRB, 2011a]).

Variables that were used to build credit models are listed in Attachment 2. The GDP deflator has been used to present in real terms the indicators of the banking system's claims on the economy, monetary aggregate $M2^*$, banks' ruble obligations to the National Bank, and gross domestic product at current prices. Real interest rates were calculated by adjusting nominal interest rates on credits in the national and foreign currencies for inflation in the Republic of Belarus and the USA respectively. It should be noted that the logarithm of the indicators of the banking system's claims on the economy, banks' obligations to the National Bank, foreign assets and liabilities of the banking system, monetary aggregate $M2^*$, nominal GDP, consumer price indices, and the GDP deflator has been taken and the indicators have been seasonally adjusted in advance. The indicator of expectations of the change in the need for lending has been also seasonally adjusted and the logarithm of the real estate prices has been taken.

Unit root tests showed that indicators of the banking system's claims (l), money supply (m), gross domestic product (gdp), and foreign liabilities of the banking system (fl) are first–order integrated time series (Attachment 3]. The long–term ratios between the supply of and the demand for credit were found with the help of the Johansen test, and short–term relationships — with the help of the least squares method.

Quarterly data equations:

Credit supply:

cointegrating equation:

$$Ec\_l_t^S = l_t - (\underset{[19,57]}{0,72} m_t + \underset{[10,78]}{0,40}\, fl_t); \tag{2.5}$$

short–term relationship:

$$\begin{aligned}\Delta l_t^S = &- \underset{[-6,99]}{0,62}\, Ec\_l_{t-1}^S + \underset{[3,31]}{0,3}\, \Delta m_t + \underset{[3,81]}{0,09}\, \Delta fl_t - \underset{[-3,44]}{0,09}\, \Delta fa_{t-1} + \\ &+ \underset{[5,12]}{0,09}\, \Delta nbl_t + \underset{[7,65]}{0,82}\, ri\_nc_t + \underset{[5,01]}{0,95}\, ri\_fc_{t-1}.\end{aligned} \tag{2.6}$$

Credit demand:

cointegrating equation:

$$Ec\_l_t^D = l_t - (\underset{[34,34]}{3,15}\, gdp_t - \underset{[-23,46]}{1824,1}); \tag{2.7}$$

short–term relationship:

$$\Delta l_t^D = \underset{[11,00]}{24,3} - \underset{[-3,71]}{0,53}\, Ec\_l_{t-1}^D + \underset{[3,40]}{0,50}\, \Delta gdp_t - \underset{[-3,51]}{0,20}\, \Delta hp_{t-3} + \underset{[2,90]}{0,61}\, \Delta f_{t-1} - \underset{[-8,36]}{49,10} D2011. \tag{2.8}$$

The results of modeling the supply of and the demand for the banking system's credit from the economy of the Republic of Belarus are presented in this paper (Equations 2.5—2.8). The research demonstrated that in the long run the supply of credit is dependent on the size of the banking system's resource base: to a greater extent — on households' and economic entities' ruble deposits and to a lesser extent — on the resources attracted from non–residents. The sum of coefficient values in the long–term relationship (2.5) is close to

1, which is an indication that homogeneity property of the processes for increasing the resource base and extending credit in the long run is observed.

The supply of credit in the short run is directly dependent on the change in the resource base, above all on banks' obligations to non–residents and the National Bank, the banking system's liabilities in the national currency to households and economic entities, as well as the change in banks' foreign assets and the cost of credit resources. The interest rate on credits in Belarusian rubles proved to be less significant compared with the interest rate on credits in foreign currency despite the fact that since 2005 the share of ruble credits has always been higher than the share of foreign currency credits in the total amount of the banking system's claims on the economy [Attachment 1, fig. A1.4]. It is due to several reasons: firstly, the greater significance of the credit channel compared with the interest rate channel; secondly, administrative regulation of interest rates on credits in Belarusian rubles until November 2008; thirdly, underdeveloped financial market of the Republic of Belarus; and fourthly, the banking sector's active involvement in the credit support of organizations implementing government programs and measures inasmuch as lending to the projects under government programs is associated, as a rule, with granting funds at a low interest rate and for a long period. The positive sign for the coefficients of the interest rate variables implies that the supply of credit is increasing as the cost of resources is going up.

The economy's demand for credits is increasing in the long run as revenues are or GDP is growing. In the short run its dynamics is influenced by the change in real estate prices, revenues, and expectations of the change in the need for lending. The research confirmed the hypothesis that a decline in the real estate prices increases the demand for credits from the economy. Considerable changes in the dynamics of the demand for credit took place in 2011 as a result of significant devaluation, inflation, and drastic measures aimed at tightening credit policy that followed them. A dummy variable has been introduced in the credit demand model with a view to taking into account the impact exerted by the totality of these factors (*D2011*).

The models obtained may be used to analyze the dynamics of credit in the Republic of Belarus over the studied period. However, their specification needs to be refined later on having regard to the variability of economic processes and relationships in the Belarusian economy. In particular, fluctuations in the exchange rate may be included in the credit supply model as an explanatory factor. Taking into consideration a great portion of foreign currency credits in the total amount of credits to the economy from the banking system, fluctuations in the exchange rate of the Belarusian ruble against foreign currencies directly affect the total amount of credit in the national currency (revaluation effect). For example, a 20% depreciation of the Belarusian ruble against the US dollar in January 2009 led to a 6.3% automatic increase in the banking system's claims on the economy and credit amounts owed by the economy to the banking system grew by more than 40% as a result of a threefold devaluation in 2011. Absence of this factor in the presented models is explained by the relative stability of the Belarusian ruble against the US dollar in most of the period under consideration. In the future it is expected that the interest rate will become one of the key factors behind the demand for credit. Also, gradual expansion of the market for corporate bonds and an increase in its competitiveness compared with money market should result in a greater importance of the interest rate on bonds as an alternative factor affecting the supply of and the demand for credits from the economy. With the development of the mortgage institution in Belarus it is more likely that the character of the relationships between real estate prices and the dynamics of credit will change due to the amplification of the direct wealth effect as well as indirect effect through the impact of the mortgage costs on the credit amounts.

Thus, the results of modeling the dynamics of credit in the Republic of Belarus for the 2002—2011 period showed that in the analysis of this indicator it is necessary to take into consideration — in addition to the data on the banks' resource base, GDP, interest rates, and the exchange rate — such factors as economic agents' expectations of the change in the need for lending and real estate prices.

3. Credit gap estimation

Many researchers are of the opinion that one of the most efficient methods of detecting imbalances in the economy lies in the identification of gaps in the dynamics of economic variables, i.e. identification of an equilibrium level, calculation of deviation of the variable's current value from the equilibrium level, and separation of this deviation from high–frequency fluctuations (short–term fluctuations). However, the equilibrium level (trend), cyclical movement of the variable around the trend, and random deviation (noise) are unobservable variables. Given this, filtering methods are widely used in the practice of economic analysis with a view to estimating their values.

As a rule, the gaps are calculated with the use of the prime univariate and multivariate filters, as the residuals of cointegration in the error correction models, as well as on the basis of cross–country comparisons.

In the context of interpretation of decomposition of credit indicators, it is supposed that the change in the long–term trend in the real credit dynamics is explained by the fundamental factors of development of the economy. As a rule, the cyclical component is related to the middle–term changes in the demand for and supply of credit and incorporates information on the money market situation. It is important that these fluctuations reflect adjustments in the portfolios of banks' financial assets in response to the change in the market condition, including in the interest rate, and for this reason are useful for the analysis of the monetary policy transmission mechanism. Notwithstanding their high volatility, the short–term fluctuations are an indicator of the credits' short–term response, which may differ in the periods of economic upturns and downturns, as well as in the conditions of heightened tension in the financial markets.

We shall consider a number of approaches to the credit gap estimation in the Republic of Belarus.

3.1. The univariate Hodrick—Prescott filter and the band—pass filter are pure statistical instruments as they use the values of only one filtered time series. They are easy–to–use and allow for the prompt calculation of the trend and cyclical component in the indicator's dynamics. At the same time, the univariate filters have serious deficiencies. For example, the band—pass filter does not make it possible to calculate the cyclical component for the latest observations as the future values of the time series itself are needed for such calculations, which limits the use of this instrument in the real time mode. The so–called "endpoint problem", when the trend for a number of latest observations within a selection is determined incorrectly is typical of univariate filters. They are sensitive to the length of a time series and lack the rationale for their use in the economic theory. Univariate filters are more suitable for the decomposition of long time series, including cases when the values of the latest periods are not important for the results of the research. Thus, for example, the European Central Bank (ECB) uses the band–pass filter to evaluate the low–frequency components of money supply and inflation increment to explain the long–term dependence between the dynamics of money and prices [ECB, 2010]. The Basel Committee on Banking Supervision proposed in December 2010 to use the Hodrick—Prescott filter to assess excessive credit with a view to calculating the value of the banking capital buffer[1].

[1] *The Basel Committee on Banking Supervision proposed in December 2010 to introduce a requirement with respect to the establishment of a countercyclical capital buffer as one of the macroprudential instruments designed to reduce the procyclicality of the banking sector's behavior. It is expected that this indicator will be set by the supervisory authority in the amount of 0—2.5% of risk-weighted assets (RWA) when there is an excessive credit growth. In this case, it is proposed to use, as an indicator of an excessive credit ,the excess of the ratio of the banking system's credits to GDP over its trend level calculated with the use of the Hodrick—Prescott filter based on the quarterly data for 20 years. For the exces-*

3.2. The multivariate Kalman filter is based on the Bayesian approach to the analysis of uncertainty and unobservable conditions. The Kalman filtering technique implies a successive evaluation of the unobservable variable's values applying the adopted model of autoregressive signal generation for producing the estimation. The state space model, which incorporates two types of equations — measurement equations and transition equations, is used as a signal generation model. Measurement equations describe the changes in observable variables depending on unobservable ones, while transition equations describe the changes in unobservable variables depending on their previous values and exogenous variables.

The advantage of the Kalman filter compared with univariate filters is that it makes it possible to produce a credit gap estimation consistent with the economy's structural model. This filter has low sensitivity to the observance period length and a much lower uncertainty in the estimation of the calculated time series' endpoint compared with univariate filters.

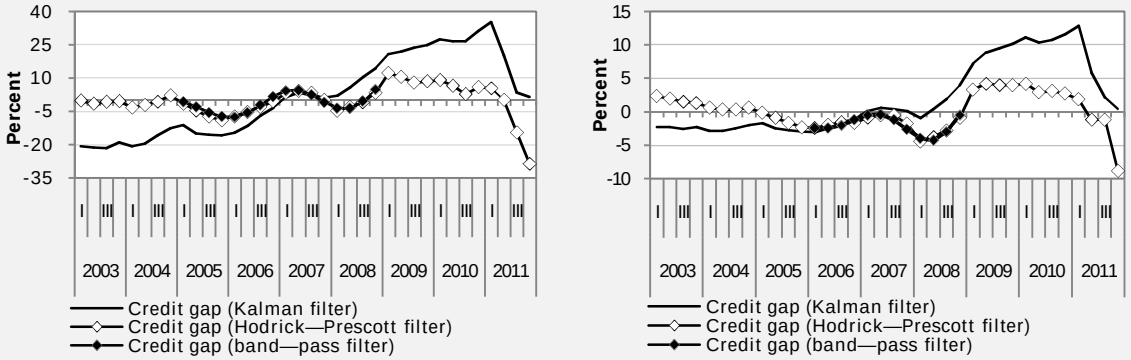
In this paper, the multivariate Kalman filter, according to which a credit gap is calculated as the difference between the credit's actual value and its equilibrium level, was used for the calculation of the credit gap [Attachment 4 (equations A4.21—23)]. The equilibrium credit level, in turn, depends on the value of this indicator in the previous period and its change in the current period. The growth rate of the real credit's equilibrium level is determined based on the theory of demand for credit with account of the growth of the equilibrium real GDP as well as fluctuations of the neutral real interest rate on ruble credits. A credit gap is calculated with account of its statistical features as a first–order autoregressive process with a high volatility of balances.

Figure 3.1 represents a comparative analysis of credit gaps calculated based on univariate filters and the multivariate Kalman filter for a number of credit indicators (banking system's claims on the economy in real terms and banking system's claims on the economy–to–GDP ratio).

Calculations made based on the univariate Hodrick—Prescott filter suggest that during 2003—2008 the credit gap ranged near its equilibrium level, which is completely inconsistent with the process of the economy disinflation in 2001—2006 and a negative output gap observed until 2006 [Attachment 5, fig. A5.1]. In 2011, the gap was evaluated as deeply negative and discordant with the dynamics of domestic demand and GDP. The obtained result was mainly due to the technique of determining the equilibrium level of the studied time series and calculating the deviation of the variable's current value from the equilibrium level based on the univariate Hodrick—Prescott filter: the filter requires all deviations to average zero, which may not happen in reality, especially, if the analyzed time series is not long enough.

sive credit from 2 to 10 percentage points the size of the countercyclical capital buffer will fluctuate proportionally within 0—2.5%. For example, if an excessive credit amounts to 6 percentage points (in the middle between 2 and 10), the buffer shall be 1.25% of RWA.

Figure 3.1 Comparative analysis of credit gaps calculated based on univariate filters and the multivariate Kalman filter for a number of credit indicators of the Republic of Belarus

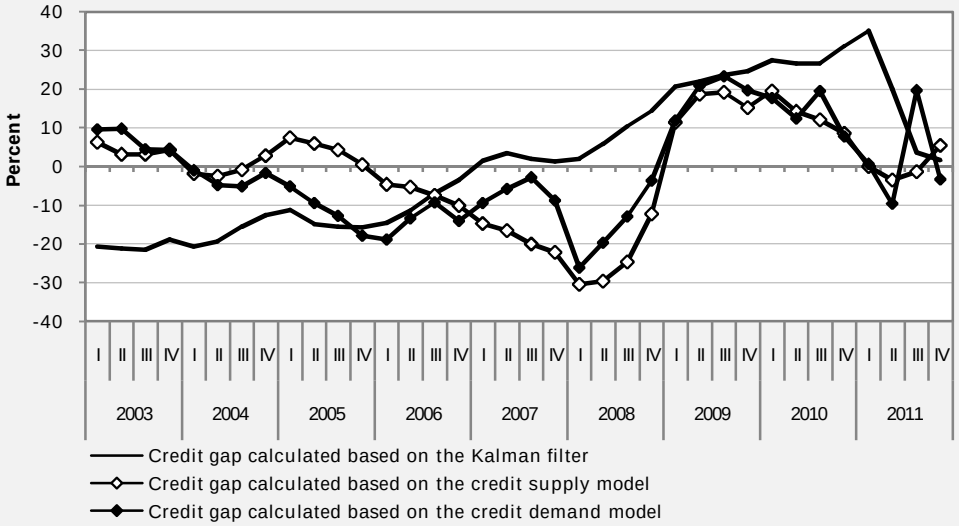


Notes. *1. For credit approximation purposes the "banking system's claims on the economy (in Belarusian rubles and in foreign exchange)" indicator was used.*
2. The value of credit in real terms was calculated by adjusting the "banking system's claims on the economy" indicator for the GDP deflator.
3. Credit gaps based on the Hodrick–Prescott filter are not separated from short–term fluctuations.

The estimation made by means of the Kalman filter evidences that until 2007 the level of the banking system's claims on the economy was much lower than its equilibrium level demonstrating the rigidity of credit conditions of the economy's development, which primarily led to a decrease in the growth of prices in the economy and stabilization of the dynamics of the Belarusian ruble exchange rate following the period of high inflation and devaluation at the end of the 1990s. Besides, the rigidness of credit conditions coincides with the estimation of the output gap, which was negative until 2006 and then, in 2006—2007, ranged within 0.2—1.3%. In 2006, the rates of lending to the economy accelerated to a great extent. As a result, in 2007 and 2008 H1 the credit was virtually at its equilibrium level. Since 2008, the positive credit gap started to grow rapidly and reached its peak in early 2011. Provision by the National Bank of resources to banks under the conditions of critical shortage of liquidity and a sharp decline in external demand and economic entities' incomes at the end of 2008— early 2009 due to the negative impact of the global crisis was the main reason for the generation and maintenance of excessive credit in 2009—2010. The period when excessive credit was observed in the Belarusian economy is consistent with the dynamics of prices. Since mid–2006, inflation started to accelerate. The estimation of the equilibrium level of credit at the end of 2011 is consistent with the dynamics of output: the rates of real GDP growth slowed down in 2011, no drastic decline in the economy occurred.

3.3. Another method of credit gap calculation is the estimation thereof as the residuals from cointegrating regression of the credit demand and supply models described in the third part hereof. The dynamics of credit gaps calculated based on these models is given in Figure 3.2. The graphical analysis revealed that the trajectories of the derived gaps are very similar. The essential difference was identified in the period from mid–2004 to 2005 (inclusive) only, when an excessive supply of credit was generated against the background of declining credit demand, and during 2007, which was characterized by the multidirectional dynamics of the studied credit gaps: the negative credit demand gap was shrinking, while the negative credit supply gap was growing.

Figure 3.2 Comparative analysis of credit gaps calculated based on error correction models and the Kalman filter



Note. *Gaps calculated based on error correction models are not separated from short–term fluctuations.*

From the point of view of coherence of credit gaps estimations obtained based on error correction models with the dynamics of other macroeconomic indicators, the problem of non–compliance of the results of model calculations with the dynamics of output and inflation in 2003–2005 (the period characterized by the negative output gap, relatively strict monetary policy, and disinflation of the economy) [Attachment 5, fig. A5.1] was identified. Besides, according to the econometric estimations of credit demand and credit supply in 2008, a considerable excess of credit demand over the actual level of the banking system's claims on the economy was observed (i.e. there was a deep negative credit gap), which is not consistent with the positive output gap. The calculations made based on the Kalman filter suggest that the positive credit gap was formed in mid–2008 already. Econometric estimations evidence that the positive credit gap started to shrink since early 2010, while the Kalman filtration, on the contrary, shows a significant widening of the positive credit gap in 2010 Q4 and its sharp reduction since 2011 Q2 only. In this case, the estimation of the credit gap based on the Kalman filter is to a greater extent consistent with the output gap estimation compared with the results of calculations made based on the econometric models. At the same time, both methods are almost totally consistent in the estimation of the endpoint — the positive credit gap closed by early 2012 and was at a nearly equilibrium level.

When building the credit supply model the cointegration ratio was assessed as an alternative as well:

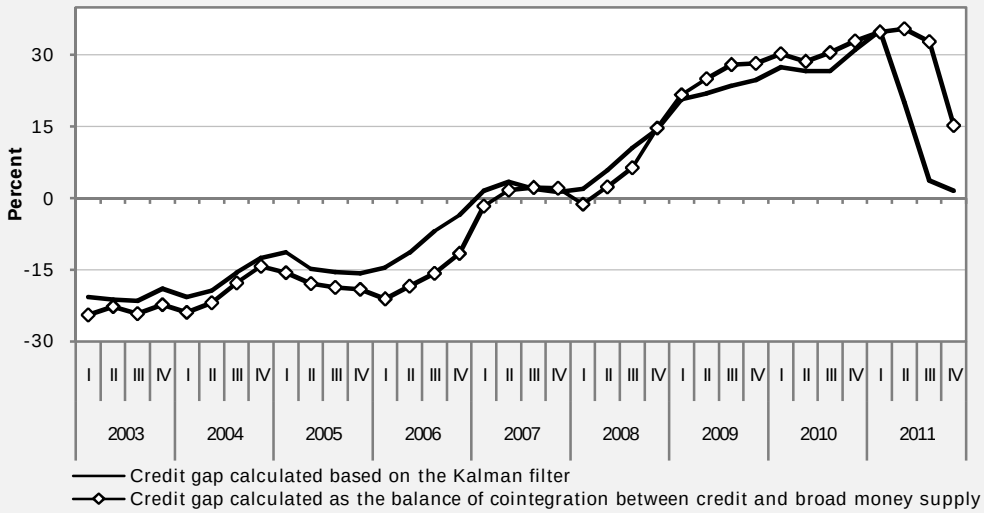
$$ec\_l_t^S = l_t - m3_t, \tag{3.1}$$

where ec_l^s — residuals of cointegration or a credit gap, l — the banking system's claims on the economy, and $m3$ — broad money supply. The estimation of this long–term ratio based on the Johansen test gave the following results:

$$ec\_l_t^S = l_t - \underset{[-238,5]}{1{,}04}\ m3_t. \tag{3.2}$$

Notwithstanding the failure to build, at a later stage, a stable short–term dependence of the real credit change on the residuals of cointegration (3.2), this ratio from the economic point of view produces rather adequate credit gap estimations similar to the model calculations made based on the Kalman filtration (fig. 3.3).

Figure 3.3 Comparative analysis of credit gaps calculated based on the Kalman filter and as the residuals of cointegration between the banking system's claims on the economy and broad money supply



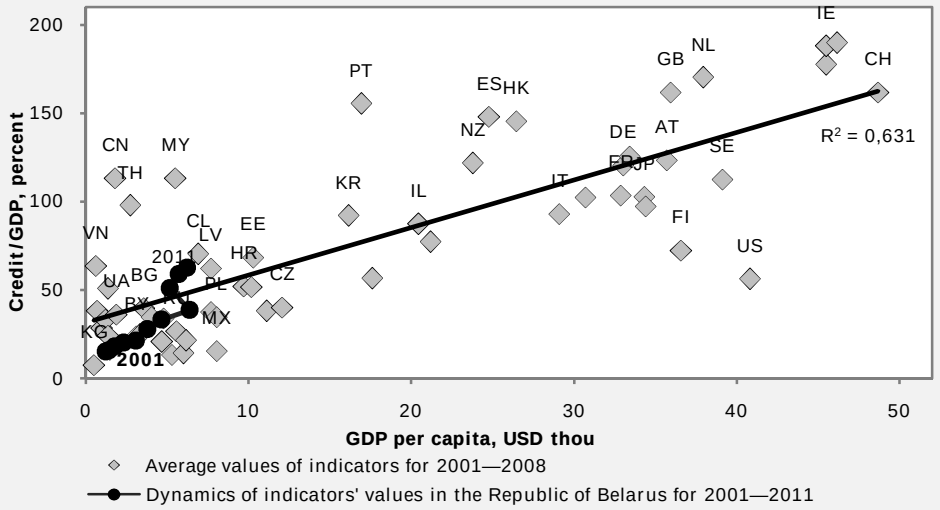
Note. *The gap calculated as the residuals of cointegration is not separated from short–term fluctuations.*

Insignificant differences are observed in the estimations of the initial point and the end–point of selection, which is, most likely, explained by the deviations in the estimations of the change in the equilibrium real credit, such estimations determining the slope in the dynamics of the long–term trend.

3.4. The estimation of the credit gap on the basis of cross–country comparisons was carried out with account of the revealed dependence of the volumes of loans provided by the banking system to the economy (to GDP) on the level of the country's economic development based on the data covering 57 countries for the 2001—2008 period [fig. 3.4 and Attachment 6]. The research has shown that in the economies with a lower income per capita (at the current US dollar exchange rate), as a rule, a lower level of the economy's debt under bank credits was observed. In 2001—2008, the average annual volumes of loans provided in the Republic of Belarus by the banking system to the economy against GDP were lower than the trend. But, if we take the annual dynamics of the indicator Credits/GDP in the Republic of Belarus, we will see that the estimated equilibrium level was attained in 2008, while in 2009—2011 it was significantly exceeded. The estimations evidence that the significant devaluation and inflation observed in 2011[2] did not influence the adjustment of the excessive credit in the Republic of Belarus which was assessed on the basis of cross–country comparisons.

[2] *In 2011, the growth (devaluation) of the Belarusian ruble exchange rate versus the US dollar accounted for 278.3%, the CPI growth (December on December) was 208.7%, the GDP deflator (December 2011 on December 2010) accounted for around 200% (according to the National Bank's estimations).*

Figure 3.4 Correlation of Credits/GDP indicator with the level of economic development (based on the average values of indicators for 2001—2008) and change in these indicators in the Republic of Belarus for 2001—2011



Note. *The figure indicates a number of selected countries: KG = Kirghizia, VN = Vietnam, CN = China: Mainland, UA = Ukraine, TH = Thailand, BY = Belarus, BG = Bulgaria, MY = Malaysia, RU = Russian Federation, CL = Chile, LV = Latvia, PL = Poland, MX = Mexico, HR = Croatia, EE = Estonia, CZ = Czech Republic, KR = Korea, PT = Portugal, IL = Israel, NZ = New Zealand, ES = Spain, HK = China: Hong Kong, IT = Italy, FR = France, DE = Germany, JP = Japan, AT = Austria, GB = Great Britain, FI = Finland, NL = Netherlands, SE = Sweden, US = USA, IE = Ireland, CH = Switzerland.*
Full information is given in Attachment 6.

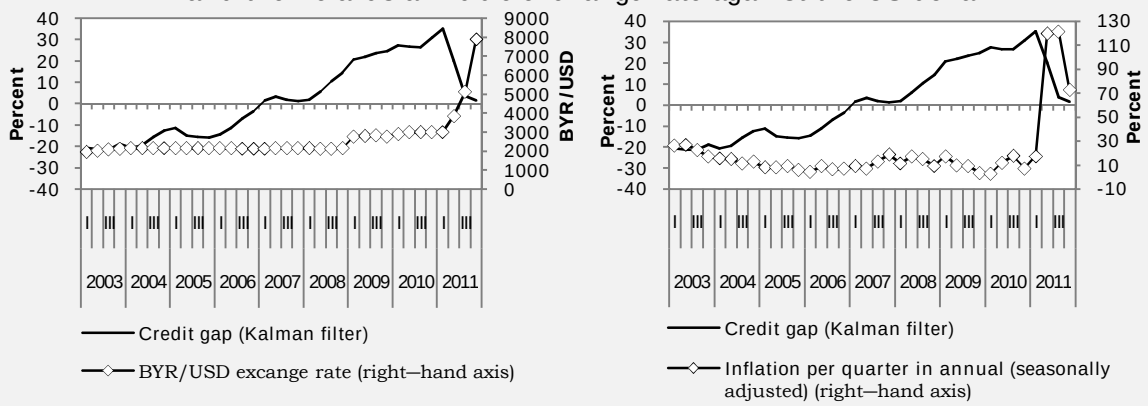
Source. *Calculated based on the statistical data provided by the IMF (International Financial Statistics) and the World Bank.*

Taking into account the deficiencies and advantages of different methods of credit gap estimation, the most suitable ones for the Republic of Belarus, according to the authors' opinion, are the estimations made with the use of model calculations based on the Kalman filter, which is consistent with the structural model of the economy, as well as the use of the residuals from cointegrating regression between the banking system's claims on the economy and broad money supply. Econometric models and the cross–country comparisons are less accurate and it is recommended to avoid using the estimations of credit gaps obtained with the use of univariate filters in the real time mode.

4. Use of the credit gap indicator with a view to revealing the threat to the monetary and financial stability

By the monetary stability the authors mean, first of all, the stability of prices and the national currency exchange rate. Given this, it is reasonable to study the case of the threefold devaluation of the national currency and considerable acceleration of inflationary processes in the Republic of Belarus in 2011. Soft monetary and fiscal policies in 2009—2010 aimed at stimulating internal demand for the purpose of preventing economic downturn and restoring the Belarusian economy growth in the context of the global financial turmoil, a considerable increase in wages at the end of 2010, which led to a sharp foreign trade balance deterioration, as well as insufficient external sources of financing the foreign trade deficit, and a low level of gold and foreign exchange reserves are considered to be the main reasons for the growth of the Belarusian ruble exchange rate versus foreign currencies and price increase. At the same time, the long–term period of maintaining a considerable positive credit gap (fig. 4.1), which served for two years as a warning about the accumulation of serious imbalances in the economy, preceded the foreign exchange crisis and considerable speeding up of inflationary processes.

Figure 4.1 Dynamics of credit gap (calculated based on the Kalman filter), inflation, and the Belarusian ruble exchange rate against the US dollar



As regards inflation, the episode of 2006—2007 is as well worth paying attention to. Following the rapid shrinking of the negative credit gap (when the actual credit growth started to outstrip the equilibrium one), the inflationary processes speeded up in 2007—2008.

Financial stability in the Republic of Belarus is associated, first of all, with the stability of the economy's banking sector, since banks account for 97% of the financial sector's total assets. From the formal point of view, the banking sector's stability manifests itself in the compliance with prudential requirements, meeting not only the national, but as well international accounting standards (IAS). For instance, accounting of losses in compliance with the IAS and failure to meet any of the key bank requirements — the regulatory capital adequacy ratio — may result in a lower confidence of foreign investors in domestic banks and a decline in the ratings of the latter, which will inevitably lead to a capital outflow from the country and decrease in the volumes and rise in the prices of banks' borrowings in the international markets, etc.

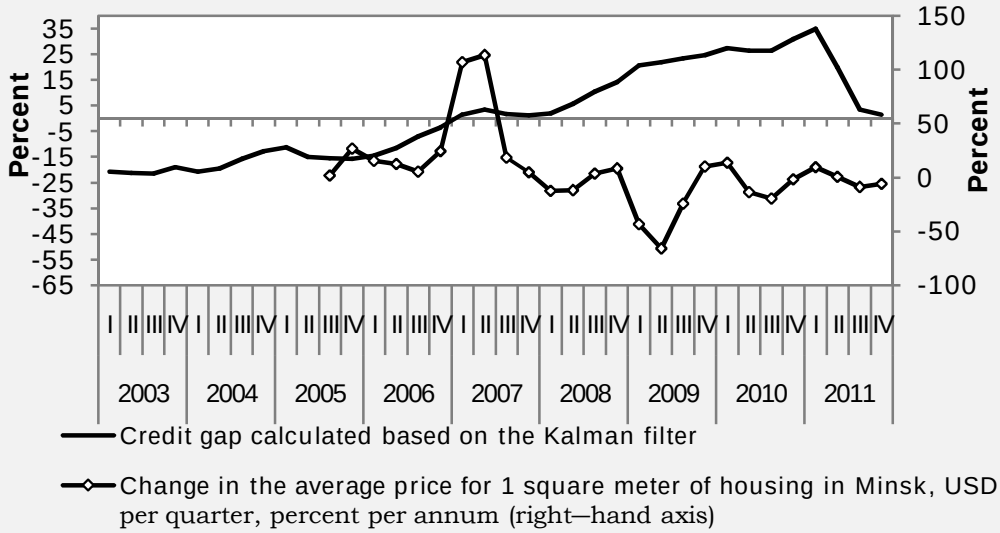
The practice of 2011 has shown that the loss of banks' capital in terms of the IAS was in some way due to the banks' operations involving the placement of deposits in foreign exchange and issuance of ruble credits at fixed rates which turned out to be significantly lower than the market ones in 2011 (being guided by the yield on Eurobonds and the National Bank's refinance rate), availability in banks of financial covenant under foreign loans, which incorporates the banks' obligation to maintain the capital adequacy ratio at a certain level

during the period of contractual commitments, as well as to the losses caused by the significant depreciation of net monetary assets in the national currency at a time of high inflation. In turn, a nearly threefold depreciation of the Belarusian ruble and considerable acceleration of inflationary processes were the reasons for the sharp increase in Belarus in 2011 in the yield on Eurobonds and nominal interest rates on the national currency.

Thus, taking into account, on the one hand, the existing direct interrelation between devaluation, inflation, nominal interest rate, risk premium on external borrowings, and banks' financial performance, and, on the other hand, the reasonableness of using credit gap indicators as the signal indicators preceding the devaluation and inflation, we may say that credit gap indicators may be also used as a signal of banks' possible financial problems.

In the international practice financial stability, as a rule, is associated with stable prices for real estate and financial assets (equities). Taking this fact into account, the authors took an interest in the possible use of credit gap indicators as a signal indicator preceding a price boom in the Belarusian housing market. The most notable and fast growth of housing prices was observed in the period from September 2006 to October 2007, when the prices for apartments in the capital grew almost twice. This was preceded, from 2006 to mid–2007, by the growth of the banking system's actual credit to the economy at the rates outpacing the equilibrium growth rates of this indicator, but, against the background of the negative credit gap reduction (fig. 4.2). Thereafter (in 2008), the outstripping growth of actual credit against the change in the equilibrium trend was observed as well, its rates being much higher than in 2006. This episode was longer in time and was observed against the background of excessive credit in the economy. However, this significant credit growth was not followed by a surge in prices for real estate. Thus, credit is an important, but not the only, factor behind the households' demand for real estate in the Republic of Belarus. Credit aggregates may be used as one of the indicators of a possible financial bubble in the housing market of the Republic of Belarus, but with a view to producing a more accurate forecast it is required to monitor the impact of all factors contributing to the changes in the demand and supply in the housing market.

Figure 4.2 Dynamics of credit gap and real estate prices in Belarus



Source. *Real estate prices data are taken from the "Real.by" portal.*

The use of the credit gap indicator as a signal indicator preceding the price bubbles emergence in the equities market of the Republic of Belarus was not considered in this paper as this market is in its nascent stage of development. As in early 2011, the equities issue totaled 36% of GDP, while market capitalization of this market amounted to only

6.8% of GDP[3]. The price bubble problem faced by the countries with developed financial markets in 2006—2008 did not affect the Republic of Belarus. The negative shock of external demand was the main factor that triggered the expansion of the negative impact of the crisis on the Belarusian economy.

Thus, a credit gap is one of the most important indicators of existing imbalances in the monetary sphere and macroeconomy as a whole. The main problem of using this indicator lies in its measurement, since a credit gap is an unobservable variable. There are a lot of ways to assess a credit gap, including univariate and multivariate filters, econometric error correction models, and cross–country comparisons. Having regard to the deficiencies and advantages of different methods, we believe that the most adequate are those estimations made with the use of model–based calculations involving the Kalman filter, which is consistent with the economy's structural model. It is yet difficult to make a final conclusion based on the results of the estimation based on the error correction models and cross–country comparisons. A credit gap serves as a reliable indicator of the existing imbalances in the monetary sphere and the economy of the Republic of Belarus. A long–term maintenance of a substantial excessive credit may be a signal of inflationary processes and depreciation of the Belarusian ruble. Credit aggregates may be viewed as one of the indicators of a possible price bubble in the housing market of the Republic of Belarus. But, to make a more accurate forecast, it is necessary to monitor the impact of all factors influencing the change in the demand and supply in the housing market. Along with the expansion of the real estate market and the equities market in the Republic of Belarus, which is an objective economic necessity, it will be necessary to strengthen the monetary and credit analysis in the country.

[3] For comparison: as in early 2011, market capitalization of the equity market against GDP accounted for 46% in Russia and 62.4% in Kazakhstan (Source: Information and Analytical Review of the CIS's Executive Committee "On the State and Development Trends of the Securities Market in the CIS member states").

5. Equilibrium and optimal credit growth

The problem of determining the equilibrium and optimal rates of credit growth is an accompanying and not less important task compared with the credit gap estimation. In this case, an equilibrium credit means a long–term trend in the real credit dynamics determined by the fundamental factors of the economy's development, which does not exert a downward or upward pressure on the inflation. By the optimal credit growth rates the authors mean the medium–term and long–term target of the equilibrium credit growth.

5.1. The growth rates of the banking system's equilibrium credit to the Belarusian economy in 2004—2011, evaluated with the use of different methods, the description of which is given in the third part, as well as the statistical characteristics of the change in this indicator are given in fig. 5.1 and in the table 5.1 respectively.

Figure 5.1 Various estimates of the real equilibrium credit growth in the Republic of Belarus for 2004—2011. (quarter on quarter a year earlier)

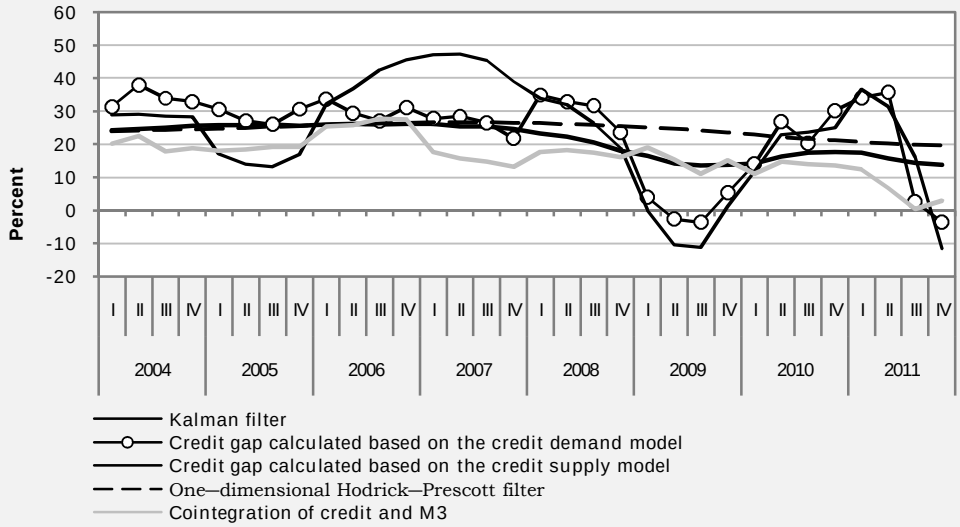


Table 5.1 **Statistical characteristics of the real equilibrium credit growth in the Republic of Belarus for 2004—2011 depending on the estimation method**

	Kalman filter	Econometric estimations			Univariate Hodrick—Prescott filter
		credit demand model	credit supply model	cointegration of credit and M3	
average	21,2	23,8	23,7	16,6	24,3
minimum	13,6	–3,5	–11,5	0,5	19,7
maximum	26,2	37,9	47,3	27,8	26,6

The calculations have shown that in 2004—2011 the annual growth of the real equilibrium credit to the economy of the Republic of Belarus, evaluated based on the Kalman filtration method, ranged within 13.6—26.2%, having averaged 21.2%. Two subperiods may be defined in the equilibrium credit dynamics. The first one — from 2004 to 2007 (inclusive) — was characterized by very high annual average growth of equilibrium credit (about 25.6%) due to high growth rates of equilibrium output in Belarus, which was significantly influenced by the external factor of the growing prices for oil and oil products against the background of temporary Russian's subsidies related to the deliveries of energy supplies at the underestimated prices. In 2003—2008, about 2.3% of the Belarusian GDP growth was due just to the "energetic" factor [M. Demidenko, A. Kuznetsov, 2010]. The second subperiod lasted from 2008 to 2011, when the annual growth of equilibrium credit dropped to 13.6% in 2009 Q3 under the influence of the negative external shocks and

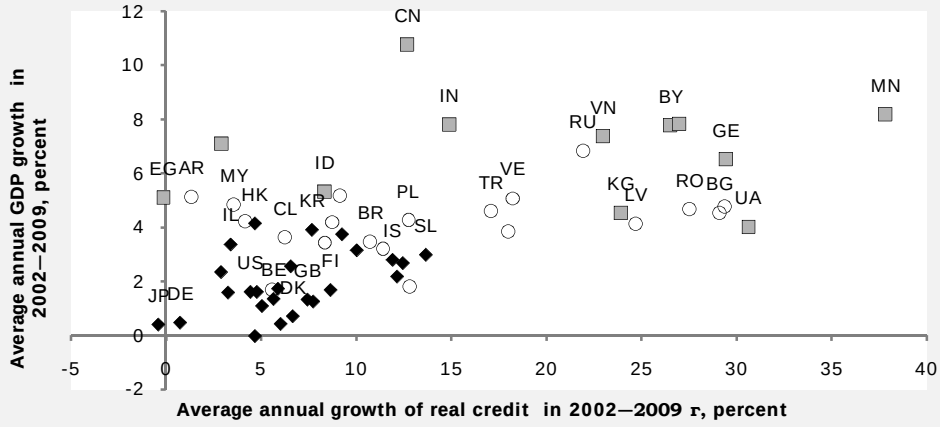
then gradually recovered and was stabilized at the level of 16%. These estimations are fully consistent with the estimations of the equilibrium output dynamics, i.e. changes in the fundamental factors of the economy's development [Attachment 5, fig. A5.2].

Estimations of the equilibrium credit made with the use of econometric models turned out to be extremely volatile, which is not typical of the equilibrium real variables dynamics. The univariate Hodrick—Prescott filter, on the contrary, has shown a really smooth dynamics of the equilibrium credit, which is not consistent with the changes in the fundamental factors of the Belarusian economy development in 2008—2011. Cointegration of the banking system's claims on the economy with the broad money supply has shown that the equilibrium credit growth in 2004—2011 was gradually decreasing from 20% to 0%. The adequacy of such estimation of the change in the long–term trend in the dynamics of real credit in Belarus raises certain doubts, especially in 2011 Q3 and Q4, and requires further monitoring.

Thus, the most credible estimations of the growth rates of the banking system's real credit to the economy, according to the authors' opinion, are obtained with the use of the Kalman filter. As at the end of 2011, they accounted for 13.7% per annum.

5.2. With a view to defining the optimal growth rates of real credit, a comparative and regression analysis of the average annual growth of the banking system's credits and GDP in real terms according to the data on 57 countries covering different time periods was carried out. This analysis revealed that the growth rates of the banking credit and GDP differ to a considerable extent across countries, as well as depend on the duration of the covered period. In 2002—2009, in the countries with a lower initial income per capita (fig. 5.2) and a lower level of debt to the banking system compared with GDP in 2001 (fig. 5.3), the higher growth rates of real credit and GDP in subsequent years compared with the countries with higher initial income per capita and the level of debt to the banking system compared with GDP in 2001 [Attachments 7 and 8] were mainly observed. At the same time, a wider scatter of points reflecting the annual growth of real credit and the economy in the subsequent years was characteristic of the countries with a low initial income per capita and a lower initial level of debt to the banking system compared with GDP. This fact is indicative of the weakening and, possibly, the lack of positive relations between the credit and economic growth in the long–term period in the case of high growth rates of the former.

Figure 5.2 Average growth of GDP and credit in real terms across countries for 2002—2009 depending on the level of GDP per capita in 2001

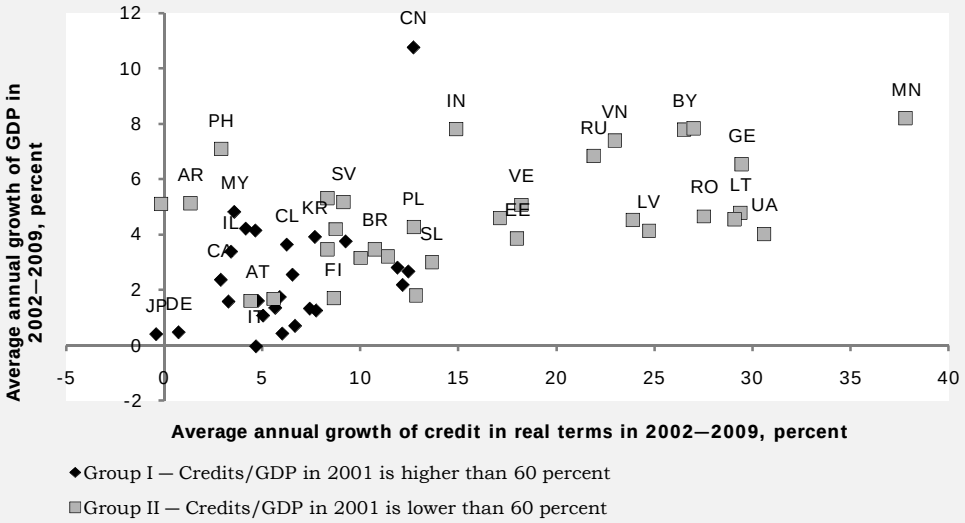


◆Group I — Countries with level of GDP per capita in 2001 exceeding USD10 thousand
○Group II — Countries with level of GDP per capita in 2001 from USD1.5 thousand to USD10 thousand
■Group III — Countries with level of GDP per capita in 2001 under USD1.5 thousand

Notes. *1. GDP per capita is calculated at the current exchange rate.*
2. The figure indicates a number of countries from Group I (SL = Slovenia, KR = Korea, IL = Israel, BE = Belgium, DE = Germany, FI = Finland, HK = China: Hong Kong, GB = Great Britain, IS = Iceland, DK = Denmark, JP = Japan, US = USA), Group II (BG = Bulgaria, RO = Romania, RU = Russian Federation, TR = Turkey, BR = Brazil, LV = Latvia, MY = Malaysia, CL = Chile, VE = Venezuela, PL = Poland, AR = Argentina), and Group III (KG = Kirghizia, VN = Vietnam, IN = India, MN = Mongolia, GE = Georgia, ID = Indonesia, UA = Ukraine, CN = China: Mainland, BY = Belarus, EG = Egypt).
Full information is given in Attachment 7.

Source. *Authors' calculations based on the statistical data provided by the IMF (International Financial Statistics) and the World Bank.*

Figure 5.3 Average growth of GDP and credit in real terms across countries for 2002—2009 depending on the credit level against GDP in 2001

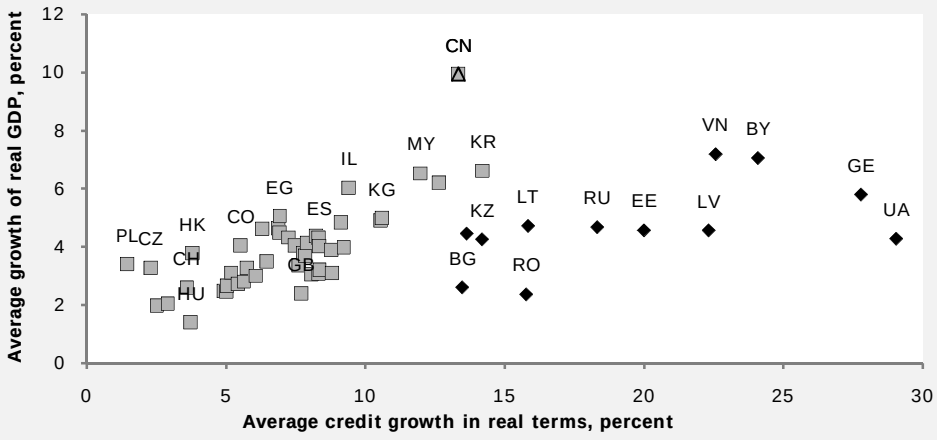


Note. *The figure indicates a number of countries from Group I (CL = Chile, IT = Italy, KR = Korea, IL = Israel, CN = China: Mainland, JP = Japan, AT = Austria, DE = Germany, CA = Canada, MY = Malaysia) and Group II (GE = Georgia, RO = Romania, MN = Mongolia, VE = Venezuela, UA = Ukraine, LT = Lithuania, BY = Belarus, RU = Russian Federation, AR = Argentina, LV = Latvia, IN = India, PL = Poland, BR = Brazil, SV = Slovakia, SL = Slovenia, VN = Vietnam, EE = Estonia, PH = Philippines, FI = Finland).*
Full information is given in Attachment 8.

Source. *Authors' calculations based on the IMF's statistical data (International Financial Statistics).*

With a view to testing this hypothesis, the time line for the calculation of average values of the considered indicators was increased to the maximum. The initial point for each country was equal to the year since which the official statistical data have been gathered on the following three indicators: GDP growth in comparable prices, GDP deflator, and banking system's claims on the economy (Attachment 9). The graphical analysis of the obtained data shows that there are two groups of countries divided depending on the credit growth rates — with low and high average rates of real credit growth relative to the average rates of GDP growth — and one exception, or "overshoot", — China (fig. 5.4).

Figure 5.4 Average growth of GDP and credit in real terms across countries for a long–term period (the period for each selected country is specified in Attachment 9)



Note. *The figure shows a number of countries from Group I (PL = Poland, CZ = Czech Republic, CH = Switzerland, HU = Hungary, HK = China: Hong Kong, CO = Colombia, EG = Egypt, GB = Great Britain, ES = Spain, IL = Israel, KG = Kirghizia, MY = Malaysia, KR = Korea) and Group II (BG = Bulgaria, KZ = Kazakhstan, RO = Romania, LT = Lithiania, RU = Russian Federation, EE = Estonia, LV = Latvia, VN = Vietnam, BY = Belarus, GE = Georgia, UA = Ukraine). CN = China: Mainland.*

Source. *Authors' calculations based on the IMF's statistical data (International Financial Statistics).*

The countries of Group 1, where the banking system's claims on the economy were growing in real terms at low rates (by about 1.5%—14% per year), with the GDP growth averaging 1.5%—6.5%, demonstrated a stronger positive interconnection between the change in real credit and GDP growth than in the countries of Group 2, where the average growth of the banking system's claims on the economy in real terms and average growth of real GDP ranged within 13.5—30% and 2.5—7% respectively. Group 2 comprises 12 countries of the studied selection: Mongolia, Kazakhstan, Lithuania, Belarus, Russia, Romania, Estonia, Latvia, Vietnam, Bulgaria, Georgia, and the Ukraine. The conclusions made on the basis of graphical analysis are confirmed by the results of the estimation of the equation of linear regression by the least square method:

$$y_i = c + \alpha cr_i D + \beta cr_i + \varphi D\_CN\,, \qquad (4.1)$$

where: i — index of a country within the studied selection, y — average growth of real GDP, cr — average growth of the banking system's credit to the economy in real terms, D — dummy variable which indicates the groups of countries ($D = 0$ — Group 1 — countries with low average credit growth compared with the GDP growth, $D = 1$ — Group 2 — countries with high average credit growth compared with the GDP growth), D_CN — dummy variable for China, c — intercept. In this specification coefficient β characterizes the elasticity of issue in terms of credit for the countries of Group 1, while the sum of coefficients α and β — elasticity for the countries of Group 2

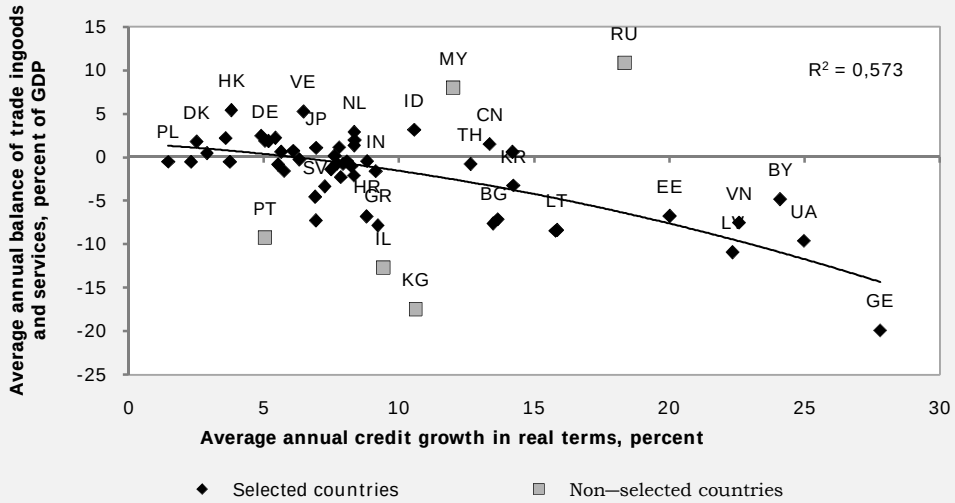
Statistical characteristics given in Attachment 10 lead to a conclusion that the model proves its good quality. The values of t–statistics ratios confirm the right choice of variables and their significance. As a result, the equation describing the interrelation between the long–term growth of credit and the economy is as follows:

$$y_i = 1{,}46 - 0{,}16 cr_i D + 0{,}33 cr_i + 1{,}46 D\_CN . \quad (4.2)$$

It will be right to say that the long–term elasticity of output in terms of credit in the countries with low average growth of the banking system's real claims on the economy amounts to 0.33, i.e. a 1% growth of the claims leads to a 0.33% growth of GDP in the long–term period. If the growth of claims in real terms is rather high (i.e. exceeding the long–term growth of real GDP more than three times the elasticity of output in terms of credit decreases to 0.16, or each per cent of credit growth leads to a 0.16% GDP growth only. This is explained by the fact that long–term maintenance of high rates of real credit growth results in the outstripping growth of internal demand over the aggregate demand, as well as imports of goods and services over exports. As a result, the increased deficit in the balance of trade "takes a heavy toll of" the GDP's growth, which is confirmed by the inverse dependence between the rates of real credit growth and trade balance among the countries within the studied selection [fig. 5.5 and Attachment 11]. At the same time, in the oil and gas–producing countries, such as Russia, for example, this effect is completely leveled out by high profits from energy exports. Four countries from Group 1, namely, Malaysia, Kirghizia, Israel, and Portugal, are an exception as well. In Malaysia the average balance of goods and services is significantly higher than the estimated level, which is explained by the unique export–oriented model of the economy, the successful implementation of which assures a stable and substantial balance of goods and services of the balance of payments in the country (17—25% of GDP in 1998—2009). Portugal, Israel, and Kirghizia, on the contrary, ran a significant deficit in the average annual balance of goods and services during the long–term monitoring period, which is not typical of the Group 1 countries. In Portugal practically half of the considerable deficit in the balance of goods and services was compensated until 2000 by the surplus of the balance of current transfers from abroad. However, since 2001, this trend has ceased, while other problems have deepened: the country started to lose drastically its competitiveness due to the outstripping growth of wages compared with that of labor efficiency; external demand dropped substantially as a result of the global financial and economic turmoil in 2008 (Spain, which has its own problems to deal with, accounts for 25% of the country's export); the economic viability of export–oriented industries was still low (unsophisticated and slowly–growing manufactories accounted for 80% of the exports structure). As regards Israel, a considerable deficit in the annual average balance of goods and services during a long–term period of monitoring was due to the data preceding 1994 (–19% of GDP for 1970—1994). In Kirghizia, on the contrary, a sharp deterioration of the foreign trade balance was observed in 2005, but it was compensated to a great extent by the surplus of the balance of current transfers

The obtained estimations of the long–term elasticity of credit in terms of output based on the cross–country comparisons comply are almost equal to the value of the calibrated parameter ψ_0 in equation A4.22 of the credit equations block in the Kalman filter [Attachment 4] set in the amount of 3.2 and, thus, confirm the adequacy of the latter.

Figure 5.5 Trade balance compared to the average growth of the banking system's real credit to the economy for a long–term period (the period for each selected country is specified in Attachment 11)



Note. *The figure shows a number of selected countries: CN = China: Mainland, TH = Thailand, ID = Indonesia, GR = Greece, IN = India, HR = Croatia, NL = Netherlands, JP = Japan, SV = Slovakia, VE = Venezuela, DE = Germany, HK = China: Hong Kong, DK = Denmark, PL = Poland, UA = Ukraine, GE = Georgia, LV = Latvia, LT = Lithuania, BG = Bulgaria, VN = Vietnam, EE = Estonia, BY = Belarus, KR = Korea. Non–selected countries include: RU = Russian Federation, MY = Malaysia, PT = Portugal, IL = Israel, KG = Kirghizia.*

Source. *Authors' calculations based on the statistical data provided by the IMF (International Financial Statistics) and the World Bank.*

Based on the elasticity of equilibrium output in terms of equilibrium credit assessed with the use of cross–country comparisons for the countries of Group 1, which is equal to 3.03 (1/0.33), the authors arrived at a conclusion that in order to be most efficient real credit growth in the Republic of Belarus should be maintained at the rates exceeding the long–term growth of the economy no more than three times. For instance, if the estimation of the equilibrium (potential) output growth amounts to 4.5—5%[4], the optimal growth rate for the real equilibrium credit will be 13.5—15% (4.5*3 and 5*3).

Consequently, if the medium–term inflation target is 5%, the long–term target for the growth of the banking system's claims on the economy in nominal terms should be 18.5—20% per year (13.5+5 and 15+5).

[4] *The estimation was obtained based on the decomposition of the Belarusian economy's growth by factors with the use of the production function [M. Demidenko, A.Kuznetsov, 2008] and exclusion of the impact of temporary subsidies of the Russian Federation related to the oil and gas deliveries at understated prices in 2003—2008, as well as with account of the potential growth of external demand after the global financial and economic turmoil in 2008—2009.*

Conclusion

Based on the findings a number of recommendations for improving the efficiency of the credit processes management at the macro level in the Republic of Belarus can be produced. First of all, with a view to preventing macroeconomic imbalances threatening the stability of the monetary, financial, or foreign exchange systems, it is necessary to maintain the growth of the banking system's real credit to the economy at the rates exceeding the long–term (equilibrium) rates of the real GDP growth no more than three times.

It is strongly advised that the National Bank should enhance its credit analysis function and the following steps should be taken in this respect:

— first, the credit gap indicator should be constantly monitored for the purpose of identifying incipient imbalances in the monetary sphere and the economy's financial sector;
— second, factors affecting the lending dynamics, including real estate prices, should undergo comprehensive analysis;
— third, the existing econometric models designed to indentify changes in the factors and the nature and scale of these factors' effect on the demand for and supply of credit in the Republic of Belarus should be maintained and developed;
— fourth, factors affecting the dynamics of equilibrium credit, and equilibrium interest rate in the first place, should be further investigated.

As regards the proposed monetary policy measures, we believe that measures designed to stabilize the devaluation expectations of economic agents and to enhance the flexibility of the Belarusian ruble exchange rate against the US dollar would be the most efficient. Such measures would contribute to reducing the dependence of credit on the economic agents' devaluation expectations, changes in the exchange rate, and interest rate on foreign exchange loans in the future. Moreover, they would be conducive to raising the significance of market interest rates on Belarusian rubles with respect to the regulation of credit demand and supply, which is as well important for enhancing the National Bank's credit processes management efficiency. Stabilization of inflationary processes in the country by way of pursuing a well–balanced monetary policy is essential as well, since high and volatile inflation adversely affects the dynamics of real variables, credit being one of them. It is recommended to keep reducing the share of soft credits to the economy and raise the significance of the market interest rate with respect to credit resources allocation.

Other advisable economic policy measures that would contribute to preventing the accumulation of excessive credit to the economy include the maintenance of a moderate growth of households' real incomes, such growth being comparable, for instance, to that of economic productivity.

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Attachment 1

Figure A1.1 Dynamics of the banking system's claims on the economy of the Republic of Belarus in 2002—2011

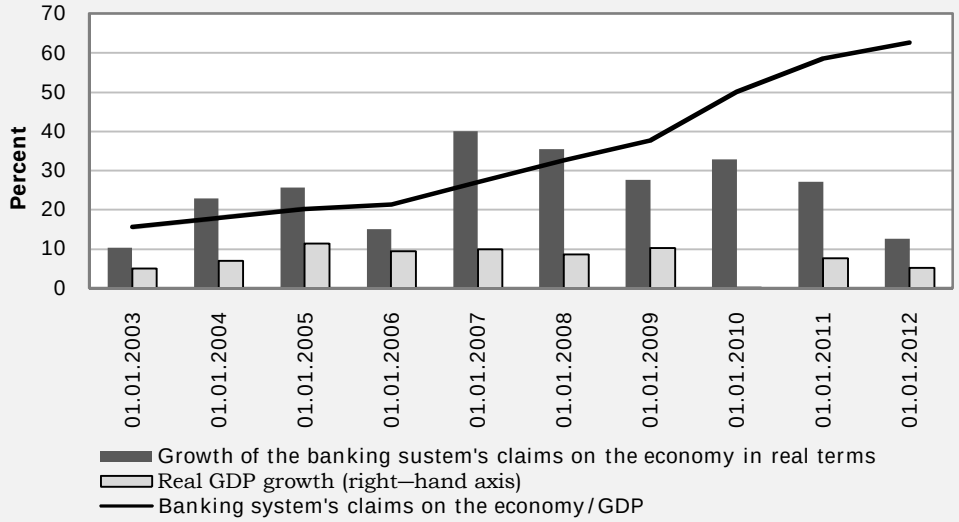


Figure A1.2 Dynamics of soft credits issued by Belarusian banks to institutions for the state programs purposes in 2006—2011

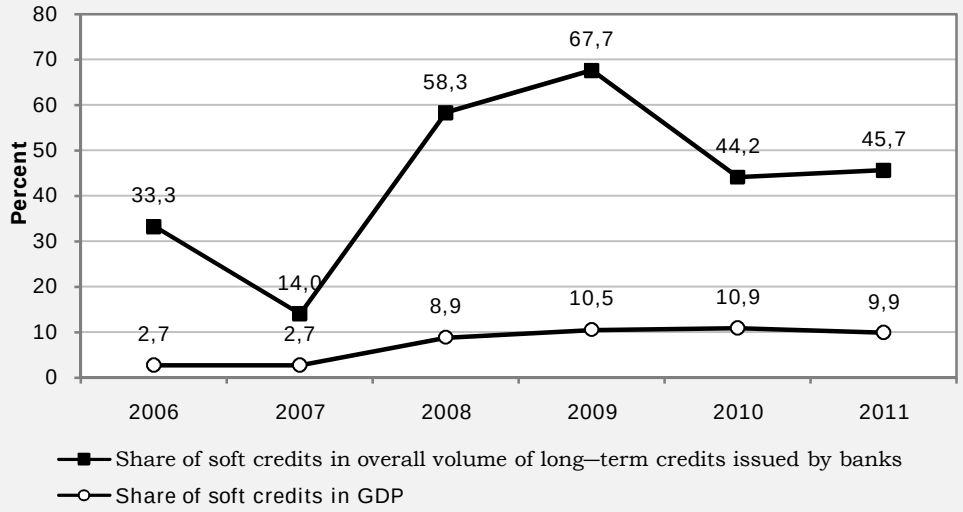


Figure A1.3 Structure of banks' assets (as of the beginning of the year)

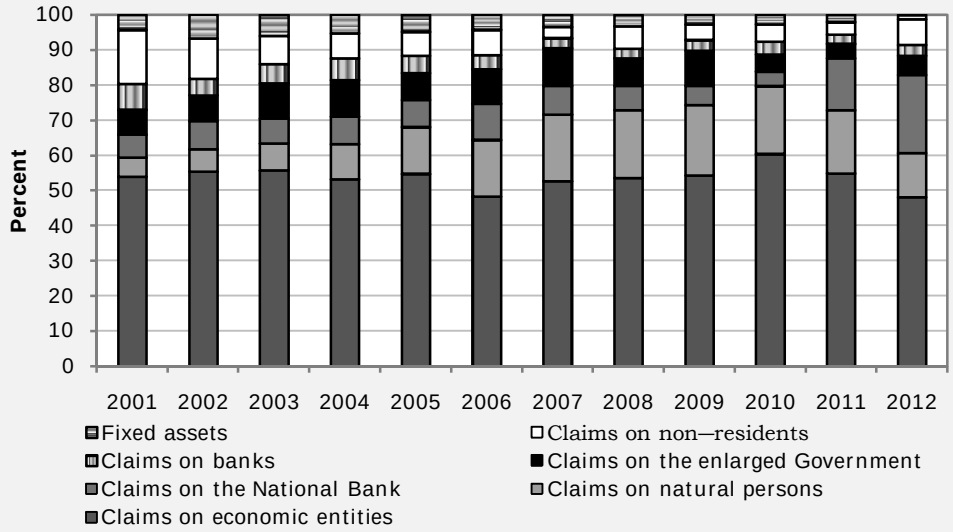


Figure A1.4 Foreign exchange structure of debt under credits issued by Belarusian banks to the economy sectors

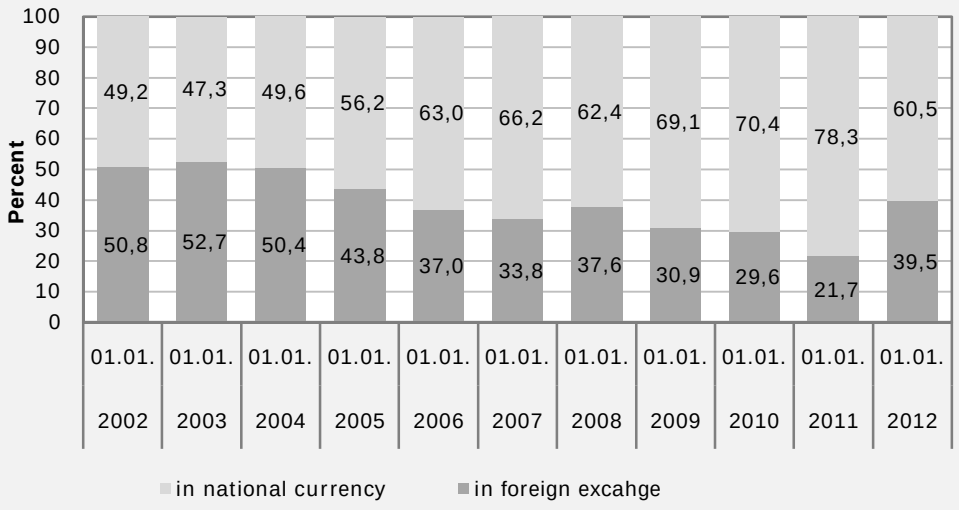


Figure A1.5 Structure of debt under credits issued by Belarusian banks to the economy sectors by maturities

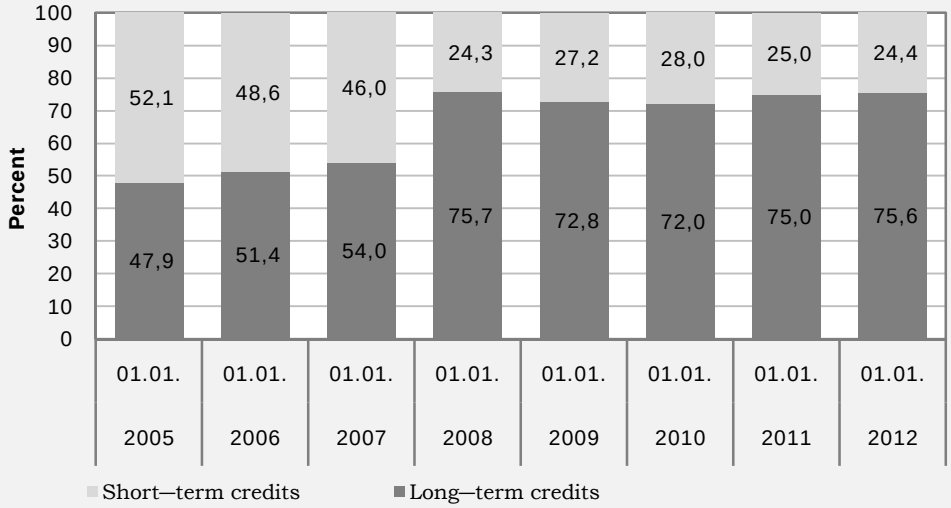


Figure A1.6 Structure of banks' liabilities (as of the beginning of the year)

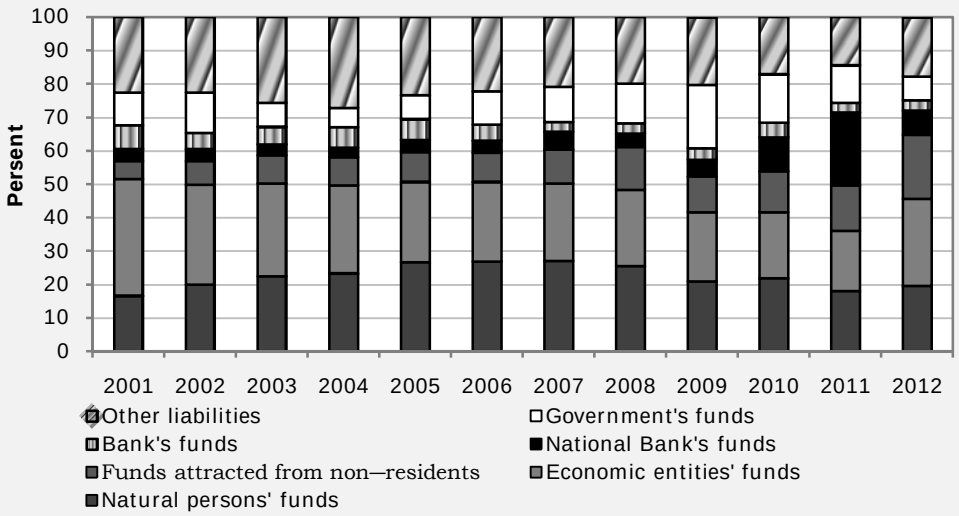


Figure A1.7 Growth of the banking system's claims on the economy and broad money supply (M3) y/y

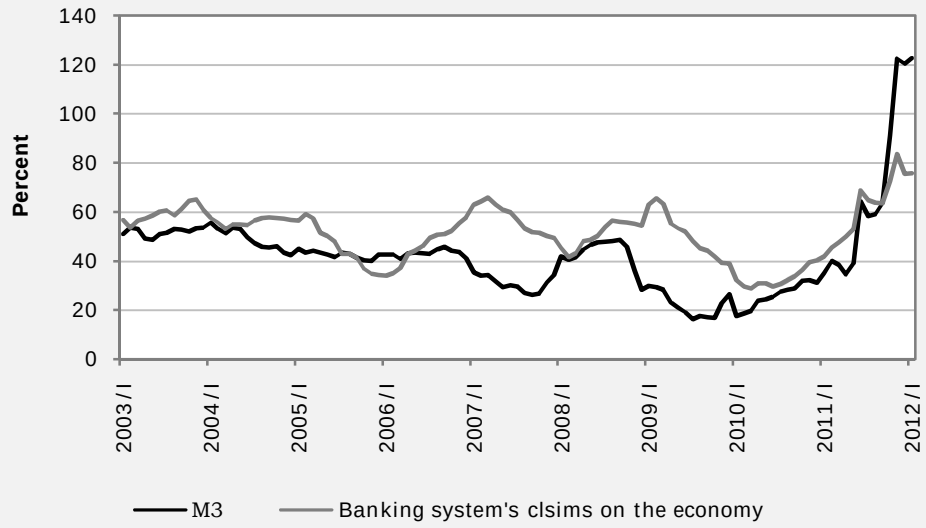


Figure A1.8 Base index of the change in the banking system's claims on the economy and broad money supply (December 2002=1)

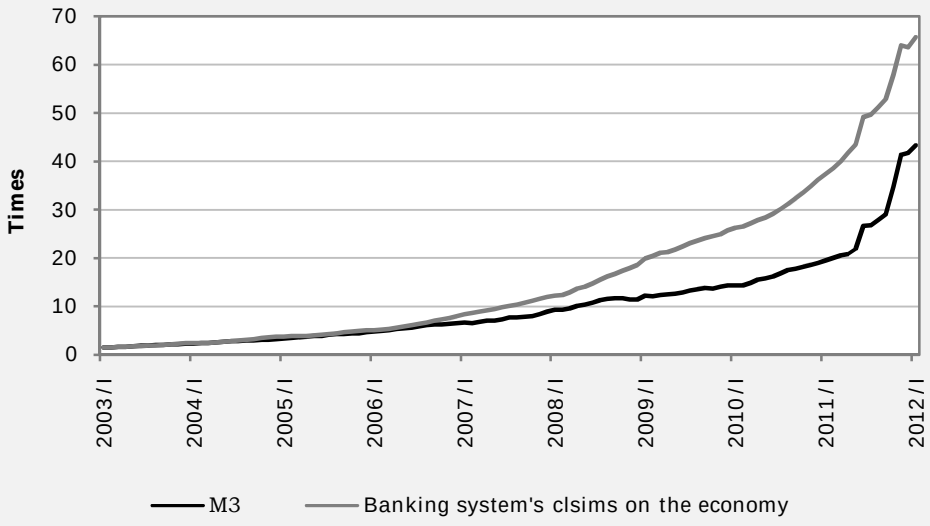
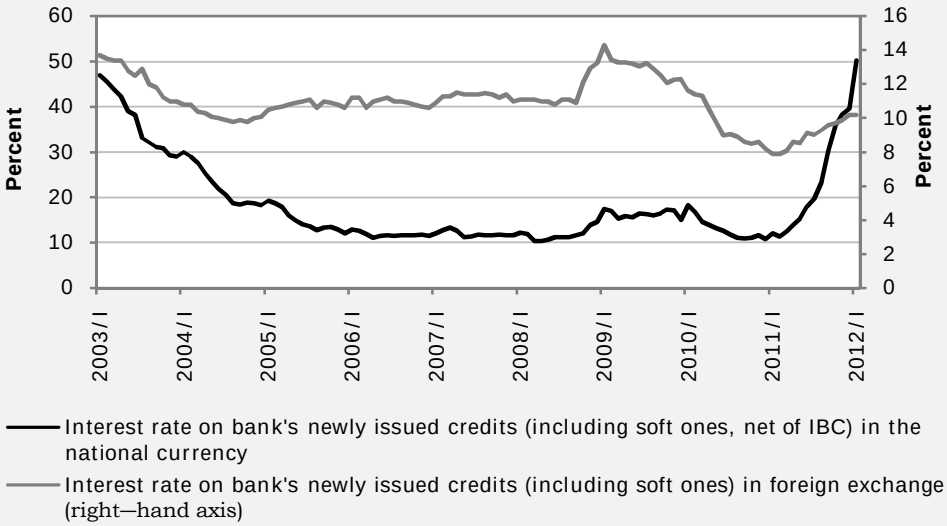


Figure A1.9 Interest rates on banks' newly issued credits



Attachment 2

Credit demand and supply models variables

Index	Indicator	Time period	Sources
l	BS's (the National Bank and banks') claims on the economy in real terms, BYR billion	2002 Q1 — 2011 Q4	NBRB (BS's claims on the economy in nominal terms), NSCRB (GDP deflator)
l^s	Credit supply		
l^D	Credit demand		
Δl	Growth of BS's (the National Bank and banks') claims on the economy in real terms, annualized %	2002 Q1 — 2011 Q4	NBRB (BS's claims on the economy in nominal terms), NSCRB (GDP deflator)
Δl^s	Change in credit supply, annualized %		
Δl^D	Change in credit demand, annualized %		
m	Average ruble money supply (M2*) in real terms, BYR billion	2002 Q2 — 2011 Q4	NBRB (M2* in nominal terms), NSCRB (GDP deflator)
$m3$	Broad money supply (M3) in real terms, BYR billion	2002 Q1 — 2011 Q4	NBRB (M2* in nominal terms), NSCRB (GDP deflator)
Δfa	Growth of BS's foreign assets, USD million	2002 Q2 — 2011 Q4	NBRB
fl	BS's foreign liabilities, USD million	2002 Q1 — 2011 Q4	NBRB
Δfl	Growth of BS's foreign liabilities, annualized %	2002 Q2 — 2011 Q4	NBRB
Δnbl	Growth of banks' liabilities to the NBRB in the national currency, annualized %	2002 Q2 — 2011 Q4	NBRB (banks' liabilities to the NBRB in nominal terms), NSCRB (GDP deflator)
gdp	Real GDP in average annual prices for 2000, BYR billion	2002 Q1 — 2011 Q4	NSCRB
Δgdp	Growth of real GDP in average annual prices for 2000, annualized %	2002 Q1 — 2011 Q4	NSCRB
Δhp	Change in real estate prices in the secondary market: change in the average price for 1square meter of housing in Minsk in US dollars, annualized %	2005 Q2 — 2011 Q4	Belarusian web–portal Realt.by
Δf	Change in the expected need for lending: change in the balance of domestic enterprises' answers regarding the expected change in the need for lending, the answers being obtained as part of enterprises monitoring	2005 Q2 — 2011 Q4	NBRB
ri_nc	Real interest rate on banks' newly issued credits (net of IBC) in the national currency, including those granted at the expense of the NBRB and Government's resources, adjusted for the change in the CPI inflation in the Republic of Belarus, % per annum	2002 Q2 — 2011 Q4	NBRB (nominal rate), NSCRB (CPI in the Republic of Belarus)
ri_fc	Real interest rate on banks' newly issued credits (net of IBC) in foreign exchange, including those granted at the expense of the NBRB and Government's resources, adjusted for the change in the CPI inflation in the USA, % per annum	2002 Q2 — 2011 Q4	NBRB (nominal rate), Bureau of Labor Statistics of USA (CPI in the USA)
$D2011$	Dummy variable indicating the shock change in the credit demand caused by the substantial depreciation of the Belarusian ruble in 2011	0 — from 2002 Q1to 2011 Q1 and 1 — from 2011 Q2 to 2011 Q4	

Note. *BS — banking system; NBRB — National Bank of the Republic of Belarus; NSCRB — National Statistical Committee of the Republic of Belarus; Δ — change in the indicator per quarter.*

Attachment 3

The unit root test results

Time series notations	Note	ADF–test (in brackets the exogenous variables are given)		Comment
		for the level	for the first difference	
l	1)	–0,38 (trend and intercept)	–3,46** (intercept)	Nonstationary I(1)
m	1)	0,42 (trend and intercept)	–3,38** (intercept)	Nonstationary I(1)
m3		–1,72 (intercept)	–5,80* (intercept)	Nonstationary I(1)
Δfa		–5,67* (intercept)	—	Stationary
fl		–2,71 (trend and intercept)	–2,89***	Nonstationary I(1)
gdp	1)	–1,22 (trend and intercept)	–5,01* (intercept)	Nonstationary I(1)
Δnbl		–3,75*	—	Stationary
ri_nc	2)	–2,18**	—	Stationary
ri_fc		–4,93* (intercept)	—	Stationary
Δhp		–2,22**		Stationary
Δf		–4,31*	—	Stationary

Notes.
1) — In the course of testing the time series' first difference the points of 2011 Q3 and Q4 were excluded due to the shock impact of the significant increase in the GDP deflator in 2011.
2) — In the course of testing the time series the points of 2011 Q2—Q4 were excluded due to the shock impact of the significant increase in consumer prices in 2011.
** The unit root null hypothesis is rejected at a 1% significance level.*
*** The unit root null hypothesis is rejected at a 5% significance level.*
**** The unit root null hypothesis is rejected at a 10% significance level.*
I(1) — first–order integrated series.

Attachment 4

The Kalman filter

(a) Block of equations of the consumer prices index:

$$\pi_t = a_0\pi_{t-1} + a_1\pi_t^e + a_2\pi_t^{imp} + a_3\pi_{t-2}^{eng4} + a_4 gdp_{t-1}^{gap} + \varepsilon_t^{\pi_t},$$
$$i\,?e\ \ onei\,aee:\ a_0 + a_1 + a_2 + a_3 = 1, \qquad \text{(A4.1)}$$

$$\pi_t^e = \mu\pi_{t+1} + (1-\mu)\pi_{t-1}, \qquad \text{(A4.2)}$$

$$\pi_t^{imp} = \gamma(ru\_\pi_t - \Delta s\_rub_t + \Delta z\_rub_t^{eq}) + (1-\gamma)(us\_\pi_t - \Delta s\_usd_t + \Delta z\_usd_t^{eq}), \qquad \text{(A4.3)}$$

$$\pi_t^{eng4} = \rho\ (\pi_t^{oil4} - \Delta s\_usd4_t) + (1-\rho\ )(\pi_t^{gas4} - \Delta s\_usd4_t). \qquad \text{(A4.4)}$$

(b) Block of equations of the equilibrium output and output gap:

$$gdp_t = gdp_t^{eq} + gdp_t^{gap}, \qquad \text{(A4.5)}$$

$$gdp_t^{gap} = \beta_0 gdp_{t-1}^{gap} - \beta_1 rr_{t-1}^{gap} - \beta_2 z\_rub_{t-1}^{gap} + \beta_3 ru\_gdp_t^{gap} + \varepsilon_t^{gdp_t^{gap}}, \qquad \text{(A4.6)}$$

$$\Delta gdp_t^{eq} = \lambda\Delta gdp_{t-1}^{eq} + (1-\lambda)\cdot 7/4 + \varepsilon_t^{gdp_t^{eq}}. \qquad \text{(A4.7)}$$

(c) Block of equations of the real equilibrium exchange rates and gaps therein:

$$z\_rub_t = z\_rub_t^{eq} + z\_rub_t^{gap}, \qquad \text{(A4.8)}$$

$$\Delta z\_rub_t^{eq} = \xi\ \Delta z\_rub_{t-1}^{eq} + (1-\xi)\left(-4{,}5/4\right) + \varepsilon_t^{z\_rub_t^{eq}}, \qquad \text{(A4.9)}$$

$$z\_rub_t^{gap} = \phi\ z\_rub_{t-1}^{gap} + \varepsilon_t^{z\_rub_t^{gap}}, \qquad \text{(A4.10)}$$

$$z\_usd_t = z\_usd_t^{eq} + z\_usd_t^{gap}, \qquad \text{(A4.11)}$$

$$\Delta z\_usd_t^{eq} = \varpi\ \Delta z\_usd_{t-1}^{eq} + (1-\varpi)7/4 + \varepsilon_t^{z\_usd_t^{eq}}, \qquad \text{(A4.12)}$$

$$z\_usd_t^{gap} = \eta\ z\_usd_{t-1}^{gap} + \varepsilon_t^{z\_usd_t^{gap}}. \qquad \text{(A4.13)}$$

(d) Equations of the real equilibrium interest rate and gap therein:

$$rr_t = rr_t^{eq} + rr_t^{gap}, \qquad \text{(A4.14)}$$

$$rr_t^{gap} = \varphi\ rr_{t-1}^{gap} + \varepsilon_t^{rr_t^{gap}}, \qquad \text{(A4.15)}$$

$$rr_t^{eq} = \chi\ rr_{t-1}^{eq} + (1-\chi)\cdot 5 + \varepsilon_t^{rr_t^{eq}}. \qquad \text{(A4.16)}$$

(e) Block of equations for determining the risk–premium:

$$ru\_prem_t = ru\_prem_t^{eq} + \varepsilon_t^{ru\_prem}, \qquad \text{(A4.17)}$$

$$ru\_prem_t^{eq} = \Delta z\_rub_t^{eq} + rr_t^{eq} - ru\_rr_t^{eq}, \qquad \text{(A4.18)}$$

$$us\_prem_t = us\_prem_t^{eq} + \varepsilon_t^{us\_prem}, \qquad \text{(A4.19)}$$

$$us\_prem_t^{eq} = \Delta z\_usd_t^{eq} + rr_t^{eq} - us\_rr_t^{eq}. \quad \text{(A4.20)}$$

(f) Equations of the equilibrium level of credits and gap in this variable:

$$l_t = l_t^{eq} + l_t^{gap}, \quad \text{(A4.21)}$$

$$\Delta l_t^{eq} = \psi_0 \Delta gdp_t^{eq} - \psi_1 \Delta rr_t^{eq} + \varepsilon_t^{rm^{eq}}, \quad \text{(A4.22)}$$

$$l_t^{gap} = \upsilon\, l_{t-1}^{gap} + \varepsilon_t^{rm^{gap}}. \quad \text{(A4.23)}$$

(g) External sector equations:

$$x_t = x_t^{eq} + x_t^{gap}, \quad \text{(A4.24)}$$

$$\Delta x_t^{eq} = \iota\, \Delta x_{t-1}^{eq} + (1-\iota)^{5,5}\!/_4 + \varepsilon_t^{x^{eq}}, \quad \text{(A4.25)}$$

$$x_t^{gap} = \kappa_0\, ru\_gdp_t^{gap} - \kappa_1 z_t^{gap} + \varepsilon_t^{x^{gap}}, \quad \text{(A4.26)}$$

$$n_t = n_t^{eq} + n_t^{gap}, \quad \text{(A4.27)}$$

$$\Delta n_t^{eq} = \omega\, \Delta n_{t-1}^{eq} + (1-\omega)^{6,9}\!/_4 + \varepsilon_t^{n^{eq}}, \quad \text{(A4.28)}$$

$$n_t^{gap} = ad_t^{gap} + \vartheta z_t^{gap} + \varepsilon_t^{n^{gap}}. \quad \text{(A4.29)}$$

(h) Equations of the aggregate and domestic demand:

$$ad_t = ad_t^{eq} + ad_t^{gap}, \quad \text{(A4.30)}$$

$$\Delta ad_t^{eq} = \theta\, \Delta ad_{t-1}^{eq} + (1-\theta)^{7,5}\!/_4 + \varepsilon_t^{ad^{eq}}, \quad \text{(A4.31)}$$

$$ad_t^{gap} = \varsigma\, n_t^{gap} + (1-\varsigma) gdp_t^{gap} + \varepsilon_t^{ad^{gap_1}}, \quad \text{(A4.32)}$$

$$d_t = d_t^{eq} + d_t^{gap}, \quad \text{(A4.33)}$$

$$\Delta d_t^{eq} = \zeta\, \Delta d_{t-1}^{eq} + (1-\zeta)^{7}\!/_4 + \varepsilon_t^{d^{eq}}, \quad \text{(A4.34)}$$

$$ad_t^{gap} = \tau\, x_t^{gap} + (1-\tau) d_t^{gap} + \varepsilon_t^{ad^{gap_2}}, \quad \text{(A4.35)}$$

where π_t — increase in the consumer price index (quarterly growth of CPI) in the Republic of Belarus in annual terms;

π_t^e — quarterly inflationary expectations in the Republic of Belarus in annual terms;

π_t^{imp} — quarterly imported inflation in the Republic of Belarus (net of the energy prices inflation) in annual terms;

π_t^{eng4} — quarterly energy prices inflation in annual terms;

gdp_t — real GDP in the Republic of Belarus;

gdp_t^{eq} — real equilibrium GDP in the Republic of Belarus;

gdp_t^{gap} — deviation of real GDP from its equilibrium level or a gap in real GDP in the Republic of Belarus (output gap);

s_rub_t — the Russian ruble nominal exchange rate against the Belarusian ruble;

z_rub_t — the Russian ruble real exchange rate against the Belarusian ruble;

$z\_rub_t^{eq}$ — the Russian ruble real equilibrium exchange rate against the Belarusian ruble;

$z\_rub_t^{gap}$ — deviation of the Belarusian ruble real exchange rate against the Russian ruble from its equilibrium level, or a gap in the Belarusian ruble real exchange rate against the Russian ruble;

s_usd_t — the US dollar nominal exchange rate against the Belarusian ruble;

z_usd_t — the US dollar real exchange rate against the Belarusian ruble;

$z\_usd_t^{eq}$ — the US dollar equilibrium real (real equilibrium) exchange rate against the Belarusian ruble;

$z\_usd_t^{gap}$ — deviation of the Belarusian ruble real exchange rate against the US dollar from its equilibrium level, or a gap in the Belarusian ruble real exchange rate against the US dollar;

rr_t — real interest rate in the Republic of Belarus;

rr_t^{eq} — real equilibrium interest rate in the Republic of Belarus;

rr_t^{gap} — deviation of the real interest rate from its equilibrium level, or a gap in the real interest rate in the Republic of Belarus;

ru_prem_t — foreign investors' risk premium for operations involving the Belarusian ruble against the Russian ruble;

$ru\_prem_t^{eq}$ — foreign investors' equilibrium risk premium for operations involving the Belarusian ruble against the Russian ruble;

$prem_t$ — foreign investors' risk premium for operations involving the Belarusian ruble against the US dollar;

$us\_prem_t^{eq}$ — foreign investors' equilibrium risk premium for operations involving the Belarusian ruble against the US dollar;

π_oil_t — quarterly oil prices inflation in US dollars in annual terms;

π_gas_t — quarterly gas prices inflation in US dollars in annual terms;

ru_π_t — quarterly growth of CPI in Russia in annual terms;

$ru\_gdp_t^{gap}$ — real GDP gap in Russia (output gap in Russia);

us_π_t — quarterly growth of CPI in the USA in annual terms;

$ru\_rr_t^{eq}$ — real equilibrium interest rate on fresh credits issued to legal persons in Russia;

$us\_rr_t^{eq}$ — real equilibrium interest rate on fresh credits issued to legal persons in the USA;

l_t — real level of credits in the Republic of Belarus;

l_t^{eq} — real equilibrium level of credits in the Republic of Belarus;

l_t^{gap} — deviation of the real level of credits from its equilibrium level, or a gap in

the real credit in the Republic of Belarus;

x_t — physical volumes of Belarusian exports;

x_t^{eq} — equilibrium physical volumes of Belarusian exports;

x_t^{gap} — deviation of the physical volumes of exports from the equilibrium level or an export gap;

x_t — physical volumes of Belarusian imports;

x_t^{eq} — equilibrium physical volumes of Belarusian imports;

x_t^{gap} — deviation of the physical volumes of Belarusian imports from the equilibrium level or an import gap;

d_t — real domestic demand in the Republic of Belarus;

d_t^{eq} — real equilibrium domestic demand in the Republic of Belarus;

d_t^{gap} — deviation of the real domestic demand from its equilibrium level or a gap in the real domestic demand in the Republic of Belarus;

ad_t — real aggregate demand in the Republic of Belarus;

ad_t^{eq} — real equilibrium aggregate demand in the Republic of Belarus;

ad_t^{gap} — deviation of the real aggregate demand from its equilibrium level, or a gap in the real aggregate demand in the Republic of Belarus.

Attachment 5

Figure A5.1 Output gap (the Kalman filter) and inflation in the Republic of Belarus

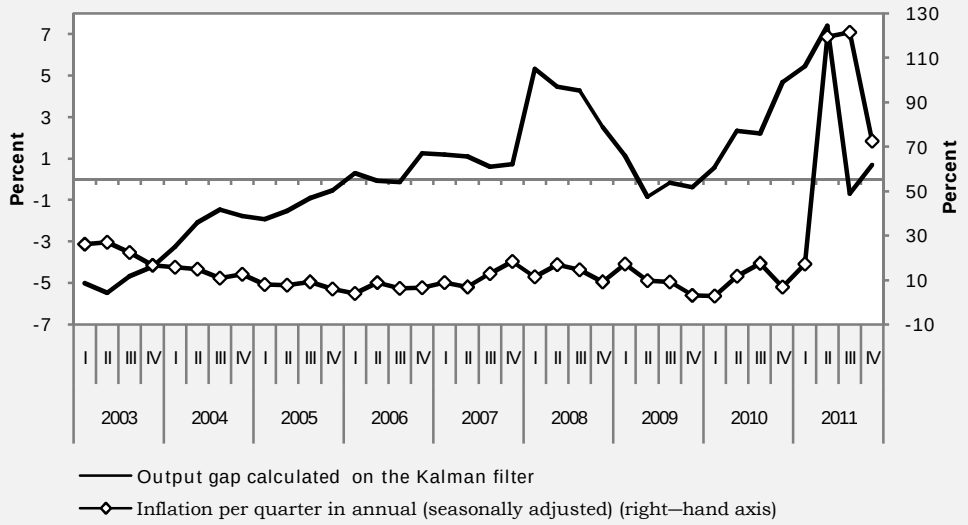
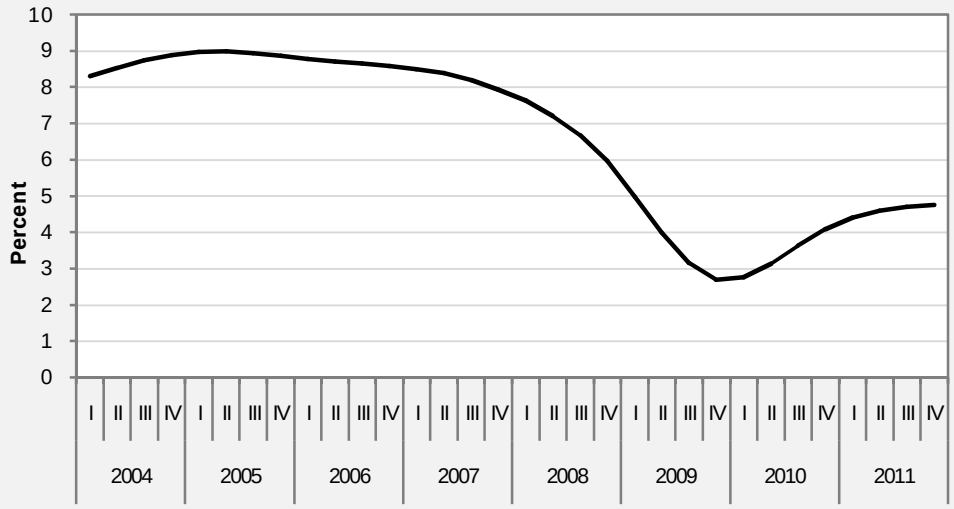


Figure A5.2 Change in the equilibrium output in the Republic of Belarus calculated based on the Kalman filtering approach



Attachment 6

Ratio of the volume of the banking system's credits to the economy in the countries standing at different development levels

Country	Note	Credits–to–GDP ratio for 2001—2008, %	GDP per capita for 2001—2008, USD thousand (at the current exchange rate)
Kirghizia	1	7,6	0,51915
Vietnam		63,8	0,63661
India		38,3	0,72332
Mongolia		28,4	0,98998
Philippines		33,3	1,22861
Egypt		50,8	1,35973
Indonesia		24,2	1,38752
Georgia		16,2	1,49097
China: Mainland		113,4	1,81455
Ukraine		36,1	1,89691
Thailand		97,8	2,75367
Belarus		23,7	3,10562
Colombia		24,8	3,32680
Bulgaria		39,7	3,59467
Kazakhstan		34,7	4,05487
Romania		20,8	4,69310
Brazil		33,8	4,79361
Argentina		13,4	5,29904
Malaysia		113,3	5,51158
Russian Federation		26,8	5,60233
Venezuela		14,3	6,00613
Turkey		21,5	6,15820
Chile		70,4	6,91626
Latvia		62,2	7,68770
Lithuania		37,6	7,70193
Poland		34,7	8,04761
Mexico		15,4	8,05200
Croatia		52,1	9,72532
Hungary		51,8	10,19292
Estonia		68,4	10,28585
Slovakia		38,2	11,12459
Czech Republic		40,2	12,08530
Korea		92,0	16,15684
Portugal		155,4	16,94192
Slovenia		56,6	17,60957
Israel		87,3	20,45903
Greece		77,2	21,18645
New Zealand		121,7	23,79409
Spain		148,0	24,78721
China: Hong Kong		145,5	26,45776
Italy		92,9	29,10642
Australia		102,3	30,70923
France		103,4	32,88584
Germany		120,5	33,02576
Canada		125,6	33,42933
Japan		102,7	34,32906
Belgium		97,2	34,40204
Austria		123,5	35,70951
Great Britain		161,9	35,94363
Finland		72,4	36,58397
Netherlands		170,3	37,95206
Sweden		112,5	39,12401
USA		56,2	40,81947
Denmark		177,6	45,49135
Ireland		188,0	45,51447
Iceland	1	189,8	46,16128
Switzerland		161,8	48,70896

Source. *Authors' calculations based on the statistical data provided by the IMF (International Financial Statistics) and the World Bank.*

Note. 1 — 2002—2007 *calculation period*.

Attachment 7

Average annual growth of GDP and credit in real terms across various countries for 2002—2009 based on GDP per capita for 2001.

Group	Country	Note	GDP per capita for 2001, US dollars	Average annual credit growth for 2002—2009, %	Average annual GDP growth for 2002—2009, %
I	Kirghizia	b	307,8	23,9	4,5
	Vietnam	b	415,4	23,0	7,4
	India	a	462,8	14,9	7,8
	Mongolia	a, 1	483,1	37,8	8,2
	Georgia	a	687,1	29,5	6,5
	Indonesia	a	771,1	8,4	5,3
	Ukraine	a	780,7	30,6	4,0
	Philippines	a, 1	898,7	2,9	7,1
	China: Mainland	b	1041,6	12,7	10,8
	Belarus	b	1239,2	26,5	7,8
	Egypt	a	1365,1	–0,1	5,1
	Kazakhstan	a	1490,9	27,0	7,8
II	Bulgaria	b	1719,2	29,1	4,5
	Romania	a	1815,5	27,5	4,7
	Thailand	a	1834,2	4,2	4,2
	Russian Federation	a, 1	2100,7	21,9	6,8
	Colombia	a	2297,1	8,8	4,2
	Turkey	a	2906,6	17,1	4,6
	Brazil	a	3133,6	10,8	3,5
	Lithuania	b	3492,7	29,4	4,8
	Latvia	b	3524,0	24,7	4,1
	Malaysia	a	3903,2	3,6	4,8
	Chile	a	4394,9	6,3	3,6
	Estonia	b	4574,5	18,0	3,8
	Venezuela	a, 1	4963,0	18,2	5,1
	Poland	b	4978,6	12,7	4,3
	Croatia	a	5153,1	11,4	3,2
	Hungary	b	5221,1	12,8	1,8
	Slovakia	b	5632,3	9,2	5,2
	Czech Republic	b	6048,7	8,3	3,4
	Mexico	a	6284,1	5,6	1,7
	Argentina	a	7200,2	1,4	5,1
III	Slovenia	b	10235,8	13,7	3,0
	Korea	a	10654,9	7,7	3,9
	Portugal	b	11241,9	6,0	0,4
	Greece	b	11966,4	10,0	3,2
	New Zealand	a	13444,2	6,6	2,5
	Spain	b	14958,3	12,2	2,2
	Australia	a	19054,0	9,3	3,7
	Israel	a	19111,5	3,4	3,4
	Italy	b	19609,4	4,7	0,0
	France	b	21991,0	5,1	1,1
	Belgium	b	22519,9	5,7	1,4
	Germany	b	22967,4	0,7	0,5
	Canada	a, 1	23017,4	2,9	2,4
	Austria	b	23642,3	4,8	1,6
	Finland	b	24111,6	8,7	1,7
	China: Hong Kong	a	24811,7	4,7	4,2
	Great Britain	a	24884,5	7,4	1,3
	Netherlands	b	24969,0	7,7	1,2
	Sweden	b	25321,1	5,9	1,7
	Ireland	b	27076,1	12,5	2,7
	Iceland	a	27799,9	11,9	2,8
	Denmark	b	29967,1	6,7	0,7
	Japan	a	32210,1	–0,4	0,4
	Switzerland	a	35269,2	3,3	1,6
	USA	a	35343,9	4,4	1,6

Source. *Authors' calculations based on the statistical data provided by the IMF (International Financial Statistics) and the World Bank.*

Note. *a — credits to private sector, b — credits to other sectors, 1 — 2002—2008 calculation period*

Attachment 8

Average annual growth of GDP and credits in real terms across various countries for 2002—2009 based on the Credits–to–GDP ratio for 2001.

Group	Country	Note	Credits–to–GDP ratio for 2001, %	Average annual credit growth for 2002—2009, %	Average annual GDP growth for 2002—2009, %
I	Kirghizia	b	3,8	23,9	4,5
	Georgia	a	7,5	29,5	6,5
	Romania	a	8,6	27,5	4,7
	Mongolia	a, 1	9,5	37,8	8,2
	Venezuela	a, 1	11,6	18,2	5,1
	Ukraine	a	13,0	30,6	4,0
	Lithuania	b	14,1	29,4	4,8
	Mexico	a	14,1	5,6	1,7
	Bulgaria	b	14,8	29,1	4,5
	Belarus	b	14,9	26,5	7,8
	Turkey	a	15,4	17,1	4,6
	Russian Federation	a, 1	16,4	21,9	6,8
	Kazakhstan	a	16,4	27,0	7,8
	Argentina	a	20,2	1,4	5,1
	Indonesia	a	20,3	8,4	5,3
	Colombia	a	21,9	8,8	4,2
	Latvia	b	27,3	24,7	4,1
	India	a	29,1	14,9	7,8
	Poland	b	29,2	12,7	4,3
	Brazil	a	29,3	10,8	3,5
	Hungary	b	33,3	12,8	1,8
	Croatia	a	36,6	11,4	3,2
	Slovakia	b	37,3	9,2	5,2
	Slovenia	b	38,1	13,7	3,0
	Vietnam	b	39,3	23,0	7,4
	Estonia	b	40,0	18,0	3,8
	Philippines	a, 1	40,2	2,9	7,1
	Czech Republic	b	40,7	8,3	3,4
	USA	a	51,6	4,4	1,6
	Egypt	a	54,9	–0,1	5,1
	Finland	b	56,5	8,7	1,7
	Greece	b	58,0	10,0	3,2
II	Chile	a	67,6	6,3	3,6
	Italy	b	80,4	4,7	0,0
	Korea	a	81,8	7,7	3,9
	Israel	a	84,9	3,4	3,4
	Australia	a	85,3	9,3	3,7
	Belgium	b	89,0	5,7	1,4
	France	b	92,2	5,1	1,1
	Thailand	a	96,9	4,2	4,2
	Iceland	a	100,1	11,9	2,8
	Sweden	b	101,9	5,9	1,7
	Spain	b	104,6	12,2	2,2
	New Zealand	a	108,7	6,6	2,5
	China: Mainland	b	111,9	12,7	10,8
	Japan	a	113,5	–0,4	0,4
	Austria	b	114,3	4,8	1,6
	Germany	b	123,3	0,7	0,5
	Canada	a, 1	125,4	2,9	2,4
	Malaysia	a	129,1	3,6	4,8
	Great Britain	a	134,4	7,4	1,3
	Ireland	b	137,6	12,5	2,7
	Portugal	b	137,7	6,0	0,4
	Netherlands	b	140,3	7,7	1,2
	Denmark	b	147,1	6,7	0,7
	China: Hong Kong	a	151,5	4,7	4,2
	Switzerland	a	153,6	3,3	1,6

Source. *Расчеты Authors' calculations based on the IMF's statistical data (International Financial Statistics).*
Note. *a — credits to private sector, b — credits to other sectors, 1 — 2002—2008 calculation period*

Attachment 9

Average annual growth of GDP and credit in real terms across countries in the long–term period

Group	Country	Period	Note	Average annual credit growth, %	Average annual GDP growth, %
I	Poland	1982—2009	b	1,46	3,39
	Czech Republic	1994—2001, 2002—2009	a, b	2,31	3,27
	Denmark	1967—2009	b	2,51	1,97
	Italy	1971—2009	b, * 1999	2,90	2,04
	Switzerland	1949—2009	a	3,59	2,58
	Hungary	1983—2009	b	3,74	1,39
	China: Hong Kong	1992—2009	a	3,80	3,77
	Argentina	1979—2009	a	4,90	2,48
	Portugal	1978—1998, 2000—2009	a, * 1999, b	5,03	2,45
	Germany	1961—2009	b, * 1999	5,04	2,64
	Finland	1961—2009	b, * 1999	5,18	3,12
	Sweden	1951—2000, 2001—2009	a, b	5,43	2,71
	Colombia	1969—2009	a	5,53	4,03
	Brazil	1989—2009	a	5,64	2,81
	USA	1949—2009	a	5,75	3,26
	Austria	1965—1997, 2000—2009	a, * 1998—1999, b	6,09	3,01
	Mexico	1949—2009	a	6,31	4,61
	Venezuela	1963—2008	a	6,47	3,48
	Slovakia	1995—2002, 2003—2009	a, b	6,90	4,62
	Egypt	1983—2009	a	6,92	5,04
	Japan	1956—2009	a	6,93	4,48
	Philippines	1959—2008	a	7,26	4,33
	Iceland	1961—2009	a	7,49	4,03
	France	1951—1997, 2000—2009	a, * 1998—1999, b	7,62	3,35
	Great Britain	1952—2009	a	7,71	2,37
	Canada	1949—2008	a	7,79	3,77
	Turkey	1988—2009	a	7,85	3,69
	Ireland	1949—2009	b, * 1999	7,93	4,12
	New Zealand	1955—2009	a	8,07	3,05
	Australia	1960—2009	a	8,24	4,37
	Spain	1955—1998, 2000—2009	a, * 1999, b	8,33	4,29
	Netherlands	1957—2009	b, * 1998—1999	8,34	3,07
	Belgium	1954—1997, 2000—2009	a, * 1998–1999, b	8,35	3,20
	Chile	1961—2009	a	8,36	4,01
	Croatia	1994—2009	a	8,80	3,88
	Slovenia	1992—2009	b, * 2007	8,82	3,08
	India	1951—2009	a	9,14	4,83
	Greece	1954—2009	b, * 2001	9,22	3,97
	Israel	1970—2009	a	9,42	6,01
	Indonesia	1981—2009	a	10,56	4,89
	Kirghizia	1996—2009	b	10,60	4,98
	Malaysia	1971—2009	a	11,99	6,53
	Thailand	1951—2009	a	12,65	6,19
	Korea	1954—2009	a	14,22	6,62
	China: Mainland	1979—2009	b	13,35	9,93
II	Bulgaria	1994—2009	b	13,48	2,61
	Mongolia	1992—2008	a	13,65	4,46
	Kazakhstan	1994—2009	a	14,20	4,25
	Romania	1997—2009	a	15,79	2,37
	Lithuania	1995—2009	b	15,84	4,71
	Russian Federation	1996—2008	a	18,34	4,68
	Estonia	1994—2003, 2004—2009	a, b	20,01	4,57
	Latvia	1995—2000, 2001—2009	a, b	22,33	4,56
	Vietnam	1996—2009	b	22,57	7,19
	Belarus	1996—2009	b	24,09	7,05
	Georgia	1997—2009	a	27,79	5,79
	Ukraine	1999—2009	a	29,06	4,27

Source. *Authors' calculations based on the IMF's statistical data (International Financial Statistics).*

Note. *a — credits to the private sector, b — credits to other sectors, * 'years' — the data on some countries is absent in relation to the euro adoption.*

Attachment 10

The model of long–term GDP growth depending on the banking system's long–term growth of credit to the economy based on cross–country comparisons

Dependent variable: y			
Number of selected countries: 57			
Variable	**Coefficient**	**t– statistics**	**Probability**
$cr_i D$	–0,164	–4,71	0,0000
cr_i	0,327	6,91	0,0000
c	1,459	4,11	0,0001
D_CN	4,102	4,31	0,0000
R–squared	0,669		
Durbin–Watson stat	1,676		

Notations:

i — index of a country within the studied selection;

y — average growth of real GDP;

cr — growth of the banking system's credit to the economy in real terms;

D — dummy variable indicating the groups of countries: D=0 indicates countries with low average credit growth as compared to the average GDP growth; D=1 indicates countries with high average credit growth as compared to the average GDP growth [Attachment 9];

D_CN — dummy variable for China;

c — intercept.

Attachment 11

The average annual balance of goods and services as a percentage of GDP and real credit growth in the long–term period

Country	Period	Note	Average annual credit growth, %	Average annual balance of goods and services, % of GDP
Georgia	1997—2009	a	27,79	–19,93
Latvia	1995—2000, 2001—2009	a, b	22,33	–10,92
Romania	1997—2009	a	15,79	–8,46
Lithuania	1995—2009	b	15,84	–8,38
Bulgaria	1994—2009	b	13,48	–7,63
Vietnam	1996—2009	b	22,57	–7,52
Mongolia	1992—2008	a	13,65	–7,13
Estonia	1994—2003, 2004—2009	a, b	20,01	–6,75
Belarus	1996—2009	b	24,09	–4,83
Korea	1954—2009	a	14,22	–3,25
Kazakhstan	1994—2009	a	14,20	0,61
Ukraine	2004—2009	a	24,97	–9,62
Poland	1982—2009		1,46	–0,50
Czech Republic	1994—2001, 2002—2009		2,31	–0,53
Denmark	1967—2009		2,51	1,81
Italy	1971—2009		2,90	0,47
Switzerland	1949—2009		3,59	2,21
Hungary	1983—2009		3,74	–0,53
China: Hong Kong	1992—2009		3,80	5,42
Argentina	1979—2009		4,90	2,48
Germany	1961—2009		5,04	1,89
Finland	1961—2009		5,18	1,87
Sweden	1951—2000, 2001—2009		5,43	2,24
Colombia	1969—2009		5,53	–0,83
Brazil	1989—2009		5,64	0,63
USA	1949—2009		5,75	–1,58
Austria	1965—1997, 2000—2009		6,09	0,75
Mexico	1949—2009		6,31	–0,25
Venezuela	1963—2008		6,47	5,27
Slovakia	1995—2002, 2003—2009		6,90	–4,55
Egypt	1983—2009		6,92	–7,27
Japan	1956—2009		6,93	1,09
Philippines	1959—2008		7,26	–3,35
Iceland	1961—2009		7,49	–1,37
France	1951—1997, 2000—2009		7,62	0,17
Great Britain	1952—2009		7,71	–0,74
Canada	1949—2008		7,79	1,14
Turkey	1988—2009		7,85	–2,29
Ireland	1949—2009		7,93	–0,75
New Zealand	1955—2009		8,07	–0,43
Australia	1960—2009		8,24	–1,01
Spain	1955—1998, 2000—2009		8,33	–2,10
Netherlands	1957—2009		8,34	2,90
Belgium	1954—1997, 2000—2009		8,35	1,37
Chile	1961—2009		8,36	1,97
Croatia	1994—2009		8,80	–6,80
Slovenia	1992—2009		8,82	–0,45
India	1951—2009		9,14	–1,60
Greece	1954—2009		9,22	–7,85
Indonesia	1981—2009		10,56	3,17
Thailand	1951—2009		12,65	–0,77
China: Mainland	1979—2009		13,35	1,52
Malaysia	1971—2009		11,99	8,02
Kyrghizia	1996—2009		10,60	–17,51
Israel	1970—2009		9,42	–12,72
Portugal	1978—1998, 2000—2009		5,03	–9,25
Russian Federation	1996—2008	a	18,34	10,88

Source. *Authors' calculations based on the IMF's statistical data (International Financial Statistics).*
Note. *a — credits to the private sector, b — credits to other sectors.*