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Toughening Financial Regulation After Crisis 2008-2009 in OECD countries: implications for the credit cycle

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Motivation. The tightening of financial regulation after the crisis of 2008-2009 is one of the leading topics of scientific discussion in the fields of finance and macroeconomics. Many scholars recognize that the gradual loosening of financial regulation contributed to the 2008-2009 crisis and its unusual depth. The analysis of the causes of the financial crisis showed the need to tighten financial regulation and strengthen control over financial institutions, which was implemented by the financial supervision and economic policy bodies.

Measures to tighten financial regulation, introduced in response to the crisis of 2008-2009, were designed to increase the stability of the national financial systems, to reduce the likelihood of similar financial shocks in the future. In 2009-2019, the financial regulation of the OECD countries underwent systemic changes both at the national and supranational levels.

The transition from the Basel II standards to the Basel III standards continues at the supranational level in the BCBS countries on a mandatory basis and in many other countries voluntarily. The Basel Standards are based on the principles repeatedly formulated by various organizations after the financial crisis – capital adequacy, liquidity, the presence of "safety buffers" (countercyclical buffer and conservation buffer), quality risk management, disclosure of information by financial institutions. However, the introduction of such measures can lead to a slowdown in economic growth – not only in the OECD countries, but also in developing countries.

The chosen topic has become particularly relevant against the background of the continued phase of credit crunch in some countries under low interest rates for an unusually long time – from 2009 to 2018. In the post-war period, the world economy for the first time is experiencing such low and even negative interest rates in such a long period of recovery. Thus, it is very important to analyze the behavior of the credit cycle under the new conditions.

Brief literature review. The crisis of 2008-2009 provoked a broad scientific discussion focused on the causes of the crisis, its consequences and the necessary measures. One of the central topics of this discussion was the tightening of financial regulation.

Many researchers, as well as government officials, recognized gaps in financial regulation as one of the reasons for the crisis [Bernanke, 2010], [Carmassi et al., 2009], as well as the need to reform the financial system and improve financial institutions [Bernanke, 2009], [Claessens et al., 2010].

However, we cannot say that the positive impact of any tightening measures on the stability of the financial system is clearly established – this issue is still the subject of scientific discussion [Barth et al., 2012]. Modernization of financial institutions requires a strategic macroprudential approach [Hanson et al., 2010].

The discussion on the necessary measures aimed at improving the stability of the financial system gathered a lot of opinions. First of all, various researchers have formulated capital adequacy requirements, recommendations on the countercyclical nature of regulating such requirements, recommendations on liquidity management [Brunnermeier et al., 2009], [The Turner Review, 2009]. The IMF called for increasing the capacity of central banks to manage systemic shocks, as well as strengthening financial supervision [Lessons of Financial..., 2009], [Governance Practices..., 2009]. Measures to strengthen the control of rating agencies, which also played a role in the development of the financial crisis, were considered necessary [Brunnermeier et al., 2009], [Crotty, 2009].

The agreement of the Basel Committee on Banking Supervision – Basel III [Basel Committee et al., 2010] was the result of scientific discussion, as well as discussion at the interstate level. Even before the major crashes of 2008, it became clear that the principles of Basel II, which contains recommendations concerning banking regulation, need to be fundamentally strengthened. In Basel III, provisions were formulated to complement, rather than replace, Basel II and are primarily aimed at improving the sustainability of individual banks and the banking sector as a whole. Much attention was paid to capital adequacy requirements, new liquidity management standards were introduced, requirements for disclosure and transparency of activities were tightened, and risk management requirements were increased.

The described tightening of financial regulation took place during a period of low interest rates and "credit crunch" [Brunnermeier, 2008], [Mizen, 2008], which should be taken into account when analyzing the consequences of the introduction of more stringent requirements for the financial system.

The theoretical analysis of the credit cycle behavior was done by Hyman Minsky in a series of papers [Minsky, 1975], [Minsky, 1983], [Minsky, 1986]. Minsky's Neo-keynesian hypothesis of financial instability was later used by many economists to describe the behavior of the credit cycle [Magnus, 2007], [Whalen,

2007], [Cassidy, 2008], including when analyzing the role of financial standards in the credit cycle [Crotty, 1994].

The empirical analysis of the consequences of the tightening of financial regulation has been carried out by many researchers using various econometric methods. The impact of the introduction of the Basel III requirements was assessed by the Macro Environment Analysis Group established within the framework of the Basel Committee [Basel Committee et al., 2010], [Basel III..., 2011], the International Monetary Fund [Cosimano et al., 2011], [Elliott et al., 2012] by OECD experts [Slovik et al., 2011].

For analysis of consequences of financial regulation toughening dynamic stochastic general equilibrium models (DSGE models) [Roger et al., 2011], [Cristiano et al., 2010], vector autoregressive models (VAR models) [Lown, Morgan, 2006], [Ciccarelli, Maddaloni, Peydró, 2010], [Hristov, Hülsewig, Wollmershäuser, 2011], vector error correction models (VECM models) [Calza, Gartner, Sousa, 2001], [Gambacorta, 2011], and even models with neural networks [Krug et al., 2015] could be used. Probabilistic models (logit and probit models) are used to estimate the probability of a banking crisis [Barrell et al., 2010], [Kato et al., 2010].

Objectives of the research. The purpose of the present study is to analyze the transformation of the credit cycle model after the 2008-2009 crisis and to assess the impact of financial regulation tightening on the credit cycle and, consequently, the economic growth of the OECD countries in the context of a long-term credit crunch.

The aim of the thesis determines the need for a consistent solution of the following tasks:

- To analyze the changing nature of the business and credit cycle in the OECD countries in 2003-2019, including the period of the global financial crisis;
- Based on a review of the literature and analysis of statistical data, to formulate the key differences between the model of the credit cycle in 2009-2019 from the model before the global financial crisis;
- Describe the key mechanisms and measures to tighten financial regulation of the banking system and non-banking institutions;
- Based on the review of the empirical literature, to identify effective methods for analyzing the relationship between financial regulation and the behavior of credit in the cycle;

- To assess the impact of the tightening of financial regulation on the credit cycle behavior, and, thus, on the economic growth of several groups of OECD countries in 2003-2019.

Methodology. The analysis of the credit cycle behavior under the tighter financial regulation is based on the hypothesis of financial instability by Hyman Minsky, supplemented by the assumption of the endogeneity of financial standards by James Crotty.

There are many differences between the OECD countries in the degree of financial development and the institutional environment: differences between the Anglo-Saxon and Continental systems of law, differences in corporate governance standards, differences in the system of financial regulation. Thus building a single model for all OECD countries is impractical, the dissertation analyzes the EU and the United States separately.

For the analysis of the European credit cycle, the theoretical model of the credit cycle for economies with a single monetary policy by John Driscoll, modified by ECB experts, is used. Countries are divided into two groups: Austria, Germany, Luxembourg, the Netherlands, France, Finland and Greece, Italy, Ireland, Spain, Portugal. The first group of countries hold highly developed financial system, included in the first cluster in terms of GDP per capita. The second group of countries is the countries that survived the debt crisis and are included in the second cluster in terms of GDP per capita. The model is constructed using quarterly data from the 1st quarter of 2003 to the 4th quarter of 2019.

The study was conducted using a set of basic general scientific methods (generalization, induction, classification, modeling). The least squares method, panel data analysis methods, and vector autoregression model were used to construct the econometric model.

The vector autoregressive model for the European case includes 5 equations, in each of which one of the studied variables acts as a dependent (the volume of loans, credit standards, the growth rate of real GDP, the loan rate, the interest rate on the debt market (the variables are given in accordance with the order of inclusion in the model)). For example, for the volume of loans, the equation will look like this:

$$l_{it} = \alpha_i^{(0)} + \sum_{i=1}^{4} \alpha_i^{(1)} l_{it} + \sum_{i=1}^{4} \alpha_i^{(2)} cs_{it} + \sum_{i=1}^{4} \alpha_i^{(3)} y_{it} + \sum_{i=1}^{4} \alpha_i^{(4)} \rho_{it} + \sum_{i=1}^{4} \alpha_i^{(5)} r_t + \varepsilon_t$$

where l_t is the volume of loans issued, cs_t is the credit standards, y_t is the real GDP growth rate, r_t is the loan rate, and ρ_{it} is the interest rate on the debt market, a four-lag model is used.

In the case of the US, the interest rate on the debt market is not used due to the small number of observations.

Data from the SLO (Senior Loan Officer Opinion Survey) and BLS (Bank Lending Survey) surveys conducted by the Federal Reserve System and the European Central Bank, respectively, are used as proxy variables for credit standards in the model presented in the dissertation study. In the surveys conducted, credit managers answered the following question:

Over the past three months, how have your bank's credit standards as applied to the approval of loans or credit lines to enterprises changed? Please note that we are asking about the change in credit standards, rather than about their level.

1. *Tightened considerably;*
2. *Tightened somewhat;*
3. *Remain basically unchanged;*
4. *Eased somewhat;*
5. *Eased considerably.*

The answers to these questions allow us to assess changes in credit standards. The dissertation study uses the net percentage of respondents who noted an increase in a particular indicator.

For the presented analysis, regulatory documents and analytical reports of the Bank for International Settlements, the Group of Twenty, the OECD, the World Bank, and the European Central Bank were used. The statistical databases of the European Central Bank, the OECD, the World Bank, the US Federal Reserve System, the Federal Reserve Bank of St. Louis, the Basel Committee on Banking Supervision, and the Financial Stability Board were used as the information base of the study.

Hypotheses. The following hypotheses were tested as part of the econometric analysis:

- Hypothesis 1 (on credit rationing). In the study period, the dependence of the issued loan volume on the interest rate is positive, which indicates a greater role of supply factors in the formation of credit activity. The equilibrium of supply and demand for loans is also ensured by non-price rationing by credit standards. The tightening of credit standards causes a slowdown in credit activity, which in turn will cause a reduction in GDP growth.
- Hypothesis 2 (on the formation of credit standards). Credit standards are formed depending on other macroeconomic and credit cycle variables: positively depend on the volume of previously issued loans (which reflects the dependence on the phase of the credit cycle), negatively depend on the growth rate of real GDP, positively depend on the loan rate and the rate on the debt market.

Main findings.

1. The credit cycle in the OECD countries behaved abnormally in the period 2009-2019.

Usually during the period of economic recovery, GDP growth occurs, which leads to the confidence of creditors in the future and a decrease in credit standards, which leads to credit expansion and credit innovation. Gradually, the debt of borrowers increases and the transition from secured to speculative financing begins, after which the "Minsky moment" comes, after which the debt assets are devalued, and creditors try to repay the debts. New loans are issued only with high requirements for the amount of collateral, terms, etc. The volume of credit falls, the economy begins to decline, gradually the " bad " debt is forced out of the market, and a new phase of recovery begins.

After the Great Recession in 2008-2009 there was an abnormal behavior of the credit cycle of a number of OECD countries– a prolonged phase of credit compression, the lack of transition to the phase of credit expansion, which is especially strange in the context of low interest rates. The credit cycle after the global financial crisis (2009-2019) is not similar to the previously observed pre-crisis model due to a number of features of the development of the financial sector and the regulation of this sector.

The stylized model of the EU and US credit cycle of 2009-2019 is based on the results of the analysis of the credit cycle of the EU and US countries using econometric methods described below. The constructed model explains the

abnormal behavior of credit in the United States and other OECD countries after the 2008-2009 recession (Figure 1).

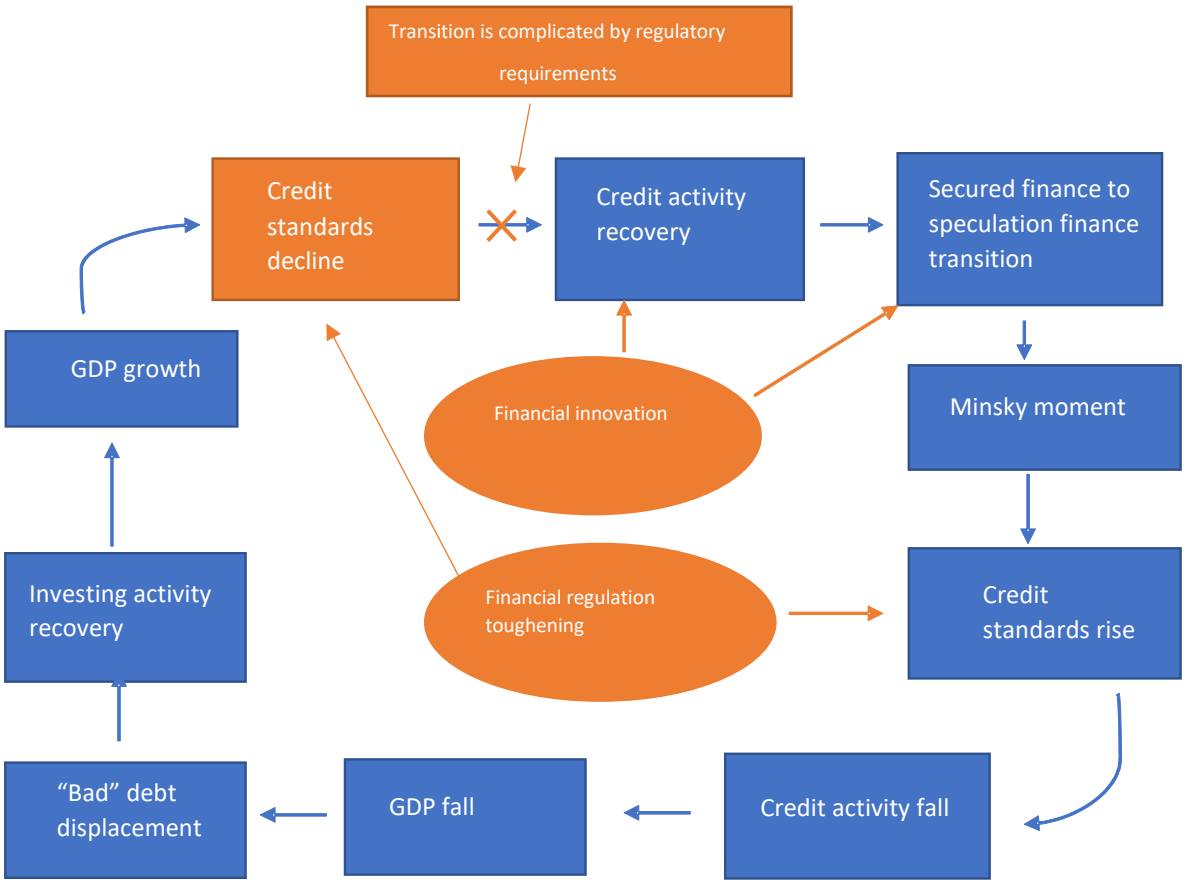


Figure 1.Stylized credit cycle model.

The credit activity increase during the credit growth phase was higher than in previous cycles, due to the introduction of many financial innovations. The phase of raising credit standards was accelerated by the introduction of Basel III requirements, which disrupted the credit cycle and led to a delay in the phase of recovery of investment activity. In countries with more developed financial systems, the cycle intervention was less significant than in countries with less

developed financial systems, which may explain the abnormal behavior of the credit cycle in PIIGS countries.

2. There is heterogeneity across countries in the credit crunch.

In some countries, the fall in the volume of credit is more significant. In others, the phase of credit crunch can be considered almost normal. The credit cycle of the so called PIIGS countries (Portugal, Ireland, Italy, Greece, Spain) - countries that survived the debt crisis – has suffered the most significantly.

The duration of the credit cycle phases varies between countries, but on average, the credit growth phase lasts for several years, followed by a credit boom phase (credit growth with rising interest rates) for several years. The subsequent phase of credit crunch is usually short (several quarters), characterized by stagnation or reduction in the volume of loans under declining interest rates. In case of normal credit cycle behavior, after the credit crunch phase the credit growth and credit innovation phase begin.

For the OECD countries after the crisis of 2008-2009, three types of credit activity can be distinguished: normal, stagnant, and falling. In countries with normal credit activity – France, Canada, the Netherlands, Finland – the credit crunch phase took 4-8 quarters, after which the credit expansion phase and the subsequent growth of credit activity began. In other countries – Austria, Belgium, the United Kingdom, and Germany – the credit compression phase has been prolonged. Despite low interest rates, credit expansion is not happening, and the economic recovery after the crisis is being held back. In the third group of countries – the United States, Japan, and the PIGS countries (Greece, Spain, Italy, and Portugal) – the credit crunch phase is expressed not in the stagnation of credit activity, but in the continued decline in the volume of loans to the non-financial private sector in 2009-2017. The continuing decline in interest rates did not stimulate the growth of credit activity, the volume of loans issued by 2017 fell almost to the level corresponding to 2007.

The differences in credit activity by country group are clearly visible in the graphs of credit cycles in the coordinates "loan rate – outstanding loans to the non-financial sector". In graphs 2-4, point A marks January 1, 2003, and point B marks April 1, 2017. Each of the graphs shows the trajectory of the credit cycle, depending on the interest rate. In the first phase, all charts show a phase of credit growth under lower interest rates. In the next phase, there is a boom in all groups, the volume of loans is growing despite the increase in interest rates. The third

phase is the credit crunch phase – a period of stagnation or decline in the volume of loans issued against the background of declining interest rates. The credit crunch phase and subsequent movements of the credit cycle differ for the three groups of countries.

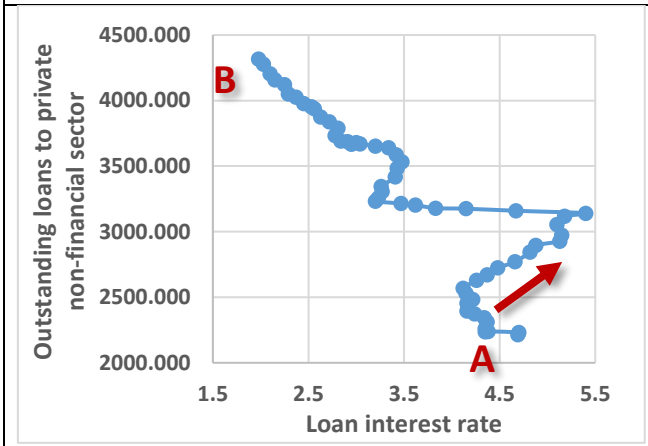
<table>
<tr><th colspan="2">Change in the volume of loans depending on the loan interest rate in increments of 1 quarter from January 1, 2003 to April 1, 2017</th></tr>
<tr><td> 

Figure 2. Credit trajectory, France. Source: BIS, ECB.

France, Canada, Netherlands, Finland</td><td>Normal credit activity

In the group of countries with normal credit activity, the credit crunch phase is short-lived, and after its end, a new phase of credit growth is observed. The credit cycle has a classic look. The US credit cycle of 1975-1993 and 1993-2003 is similar.</td></tr>
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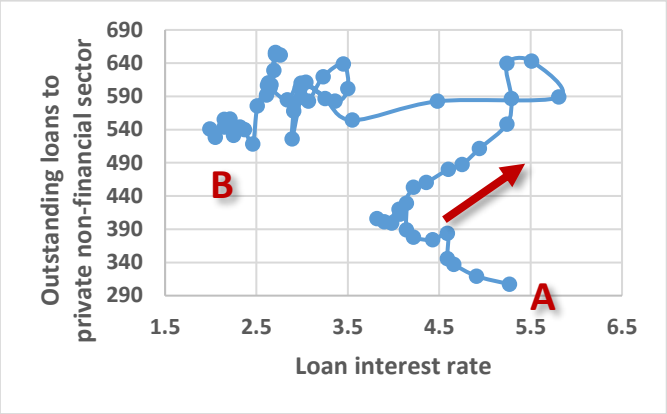
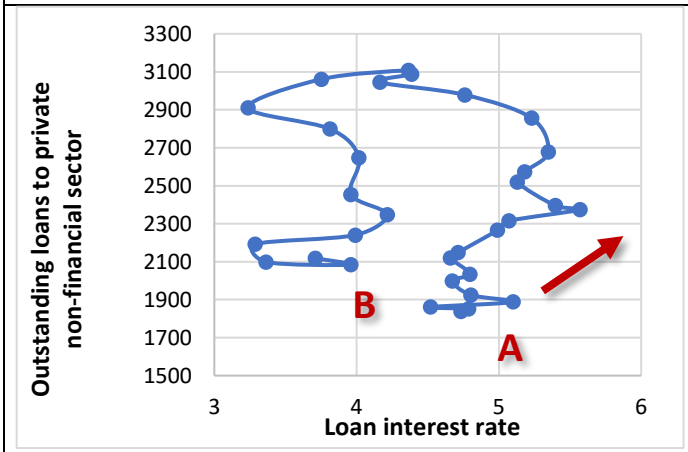
 *Figure 3. Credit trajectory, Austria. Source: BIS, ECB* **Austria,** Belgium, Great Britain, Germany	**Stagnant credit activity** In the group of countries with stagnant credit activity, the credit crunch phase continues up to 2017, the volume of loans does not change under declining rates. The credit cycle is "stuck" in the credit crunch phase.
 *Figure 4. Credit trajectory, USA. Source: BIS, ECB* **USA,** Greece, Spain, Italy, Portugal, Japan	**Falling credit activity** In the group of countries with declining credit activity, after the end of the credit crunch phase, the volume of loans issued fell for a long time, despite low interest rates. The behavior of the credit cycle is abnormal, and there was no recovery for 2017

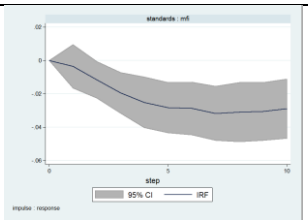
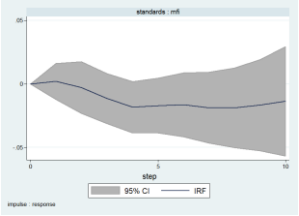
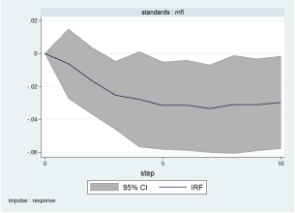
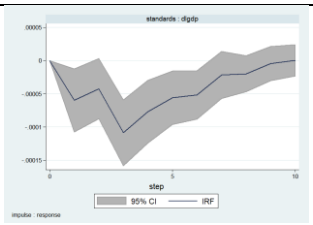
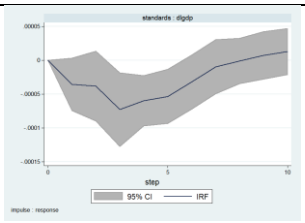
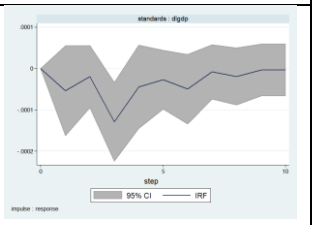
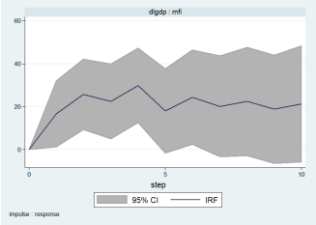
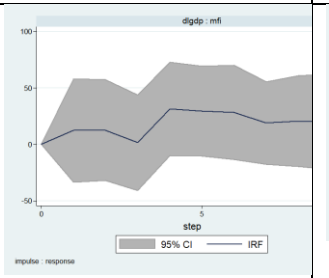
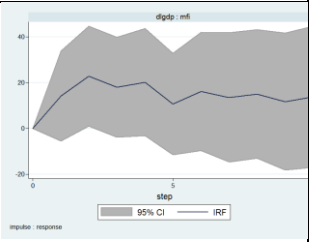
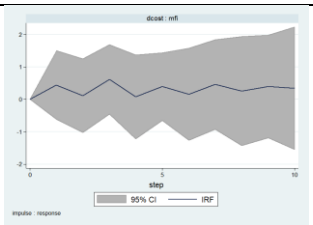
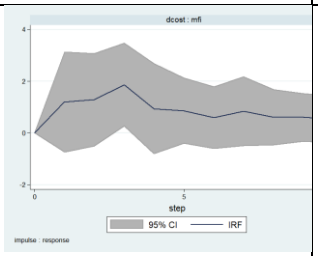
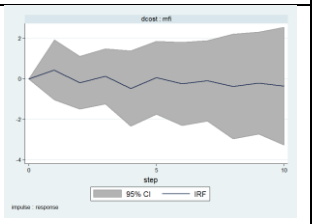
Despite the general background of the prolonged phase of credit crunch in many countries, fluctuations in the credit cycle depending on macroeconomic variables persist. In the econometric analysis, other criteria were also used to divide countries into subsamples: the division into clusters carried out in [Grigoriev, Pavlyushina, 2018], the occurred debt crisis, the fact that international organizations provided technical assistance.

3. The tightening of financial regulation in relation to the banking sector has significantly affected the behavior of the credit cycle.

The volume of issued loans positively depends on the loan rate, and banks have begun to rationalize the loan with the additional requirements for borrowers.

The results of the analysis of the vector autoregression model based on European data for two samples are presented in the response functions (Table 1). The impulse response function shows the simulated change of one variable to a one-time shock of another variable. The abscissa axis shows the number of quarters that have passed since the shock, and the ordinate axis shows the change in the variable for each quarter. The graphs show a forecast of the response function and a 95% confidence interval.

Table 1. Impulse response functions in the EU credit cycle model.

	All countries	Group 1	Group 2
Impulse: credit standards Response: loan volume			
Impulse: credit standards Response: GDP growth			
Impulse: GDP growth Response: loan volume			
Impulse: loan interest rate Response: loan volume			

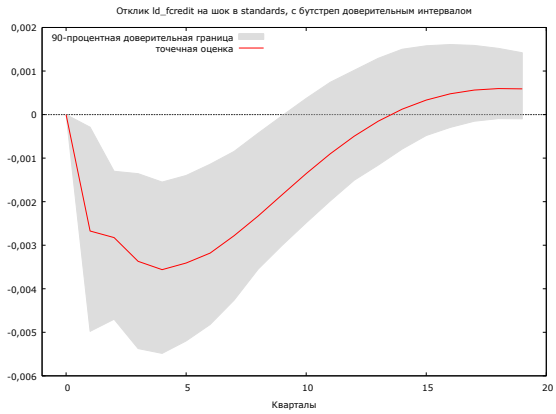
- For all specifications, the volume of loans and GDP growth rate react negatively to the change in credit standards, although for the first group of countries, the reaction of credit activity to the growth of credit standards is insignificant.
- The increase in GDP growth has a slight upward pressure on the volume of loans in the general specification and for the second group of countries (in the first group, the impact is insignificant).
- The interest rate has a statistically significant, although small, impact only in the first group of countries, while in the second group of countries the impact is insignificant. This is probably due to a two-way relationship: on the one hand, an increase in the interest rate has a downward effect on the demand for loans, on the other hand, an upward pressure on the supply of loans.

The decomposition of the variance allows us to draw the following conclusions:

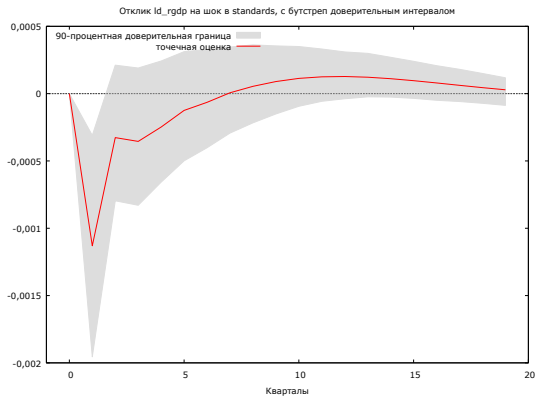
- The change in credit standards (an exogenous impulse of one standard deviation) explains about 10% of the variance in the volume of loans issued over the next three years in the overall model specification.

The analysis of the vector autoregressive model of the US credit cycle confirms the conclusions made on the European data. The volume of issued loans and the GDP growth rate decrease statistically significantly with the growth of credit standards. Table 2 shows the point forecast of the response function and the 95% confidence interval.

Table 2. Impulse response functions in the USA credit cycle model.



Impulse – credit standards, response – loan volume



Impulse – credit standards, response – GDP

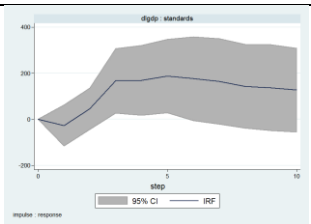
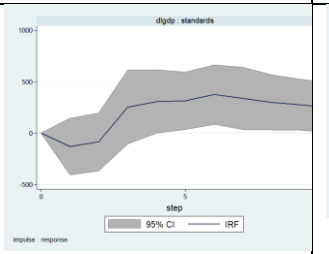
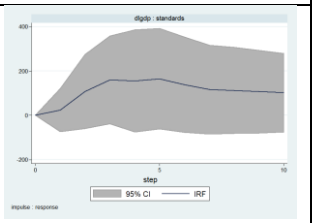
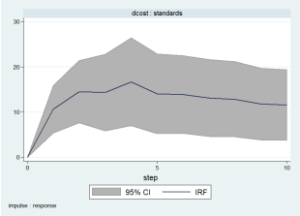
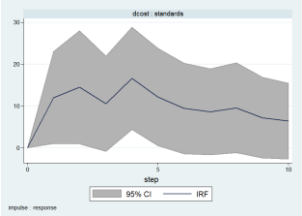
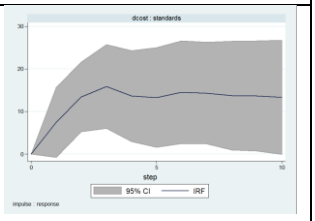
Hypothesis 1 (about credit rationing) was confirmed. In the VAR model, the interest rate variable has no statistical significance for the volume of loans issued. However, in all models and specifications, it turns out that credit standards have a negative impact on credit activity: the tightening of credit standards causes a statistically significant slowdown in credit activity for all specifications, as well as a reduction in GDP growth.

4. Credit standards are defined both by the requirements of the Basel Committee on Banking Supervision exogenous to the credit cycle by the banks themselves.

Bankers shape credit standards in response to change in macroeconomic variables. The introduction of the Basel requirements in turn becomes an exogenous shock – or rather a set of exogenous shocks – for the credit standards variable, i.e. the tightening of credit standards does not occur in response to changes in macroeconomic variables. The increase in credit standards negatively affects the loan volume and the rate of GDP growth, so it is necessary to include them in the credit cycle model.

The results of the analysis of the vector autoregression model are presented in Table 3.

Table 3. Impulse response functions in the EU credit cycle model.

	All countries	Group 1	Group 2
Impulse: GDP growth Response: credit standards			
Impulse: loan interest rate Response: credit standards			

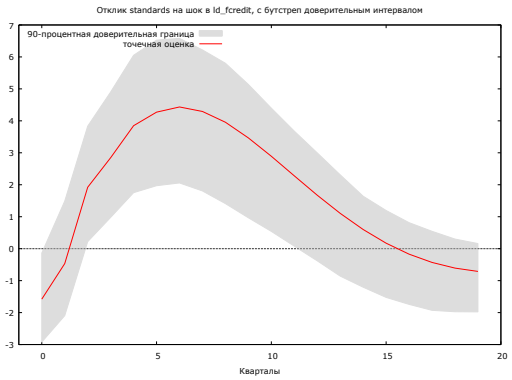
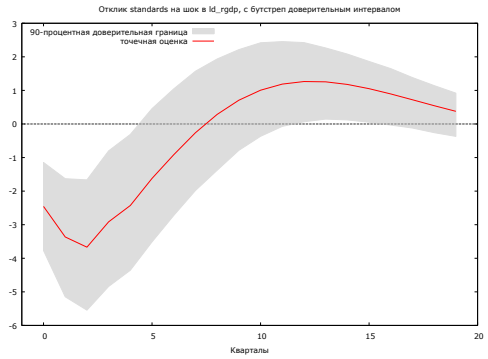
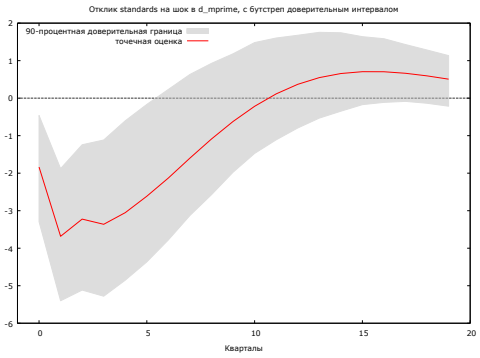
- The increase in GDP growth has a statistically significant positive impact on credit standards in the general specification and for the first group of countries (for the second group, the impact is insignificant).
- The loan rate has a statistically significant and positive effect on credit standards for all specifications.

The decomposition of the variance allows us to draw the following conclusions:

- The change in the cost of borrowing explains about 14% of the variance in the level of credit standards over the next three years.

The formation of credit standards in the United States also depends on macroeconomic variables, but the direction of influence does not always coincide with EU case. The level of credit standards is significantly positively affected by the volume of loans issued, negatively affected by GDP growth, but negatively affected by the loan rate. Graphs 5-9 show a forecast of the response function and a 95% confidence interval.

Table 4. Impulse response functions in the USA credit cycle model.

 *Impulse – loan volume, response – credit standards*	 *Impulse – GDP, response – credit standards*
 *Impulse – loan interest rate, response – credit standards*	

Hypothesis 2 (on the formation of credit standards) was partially confirmed. The most important factor determining credit standards is the loan interest rate: as the loan interest rate rises, credit standards rise in the EU and fall in the US. In addition, credit standards respond positively and significantly to the rate increase in the EU debt market. Both in the EU and in the US, credit standards increase with the growth of the volume of loans issued, but the impact of GDP growth on their formation in the EU is not observed, only in the US. For the EU countries, it turns out that the elasticity of credit standards for interest rates (both on loans and on the debt market) is significantly higher in the second group of countries.

5. The uneven tightening of financial regulation in the period 2009-2019 creates regulatory arbitrage.

Difficulties in obtaining financing in the banking sector encourage the gradual transition of large non-financial companies looking for significant funding to the

debt market. Small and medium-sized businesses, as well as businesses in countries with less developed debt markets, receive funding in the shadow banking sector. Thus, capital flows to less regulated sectors of the financial market.

In the new post-pandemic environment, this problem may worsen. "For highly rated companies, there will remain the possibility of cheap funding with the help of state programs or obtaining financing on the market, taking into account the possibility of subsequent repurchase of securities by the central bank. In the case of small and medium-sized businesses, after the exit from the recession of those who can survive it, there will be a long recovery in investment activity: the banking sector is "squeezed" by regulatory requirements, there are no own profits, the debt market is difficult to access, the possibility of obtaining financing remains only in the shadow banking sector and the stock market. If in previous decades the risk premium in medium-quality bonds was distributed fairly evenly across risk groups on the verge of investment and speculative (BBB-and above and BB+ and below), now there will be a hard divide between issuers and issues that are subject to refinancing by the Central Bank and do not fall under access to the "liquidity window". The above problem will be of greater importance for Anglo-Saxon market-centric economies. In economies with a continental model (continental Europe), the problem of funding in the debt market for companies will be felt to a somewhat lesser extent due to the bank-centric nature of the economies" [Drugina, Tabakh, 2020].

Contribution. This study contributes to the empirical literature analyzing the behavior of the credit cycle after the Great Recession and the impact of tighter financial regulation on credit activity. Despite the increased attention of the economic discussion to the topic of the crisis and the tightening of financial regulation, there are no empirical studies in the literature investigating the impact on credit activity of the credit standards variable endogenous to the credit cycle.

1. The study provides empirical evidence for the Minsky financial instability hypothesis and the premise of endogenous Crotty financial standards: econometric modeling of the credit cycle for the EU and US countries confirms the negative impact of the introduction of increased credit standards on the credit expansion phase, taking into account the endogenous formation of the credit standards variable. The model allowed us to empirically identify differences in the behavior of countries that have experienced a debt crisis (PIIGS countries) and countries without a debt crisis. The countries of the first group are characterized by a higher rate of transmission of shocks and remission.

2. The analysis of the dynamics of credit activity is carried out in the coordinates "interest rate - loan volume", which are new for such studies. This allowed countries to be divided into groups according to the behavior of the credit cycle: countries with normal credit activity (for example, France and the Netherlands), countries with stagnant credit activity (for example, Germany and Belgium), and countries with falling credit activity (for example, the United States and Portugal).

3. Based on the constructed econometric models of the credit cycle of the OECD countries, the study constructed a stylized model of the credit cycle after the 2008-2009 recession, explaining the abnormal behavior of credit. Important factors in shaping the behavior of the credit cycle in the period 2009-2019 were monetary policy and the tightening of financial regulation carried out after the 2009 crisis. The criterion of the behavior of credit activity depending on the level of rates was used when dividing countries into groups for econometric analysis.

Approbation of the research results. The main findings of the dissertation were presented at 5 scientific conferences: "Studies of economic cycles and crises in Russia" (RANEPA, Moscow, 2016), II Bunatyanov Readings "Relevance of Economic Crises: theory and Practice" (RANEPA, Moscow, 2016), XI International conference "Russian Regions in the focus of change" (URFU, Yekaterinburg, 2016), international forum "Euro-Asia Forum in Politics, Economics and Business" (EAFPEB, Istanbul, 2017), XIX April International Scientific Conference on Economic Development and Society (HSE, Moscow, 2018).

The key provisions of the dissertation were used in the educational process at the National Research University "Higher School of Economics" when teaching the disciplines "Introduction to the World Economy", "International Finance", "World Economy: changes after the crisis of 2008-2009".

List of author's original articles

Articles published in journals indexed in the Scopus bibliographic database:

Podrugina A.V., Transformation of the credit cycle of the EU countries after the Great Recession// Economic policy. 2021. T. 16. no. 4. pp. 8-41.

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Other articles published on the topic of the dissertation:

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