Identification of Financial Sector Optimal Depth and Structure from the Perspective of Economic Growth, Macroeconomic and Financial Stability

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This paper attempts to estimate financial sector development targets which, other things being equal, provide for the best possible GDP performance while ensuring its growth sustainability along with price and financial stability. To address this task, the hypothesis of nonlinear relationship between GDP dynamics, its volatility, inflation, the frequency of financial crises, on the one hand, and the development of key financial sector segments was tested. The study used a standard technique of panel data regression analysis, on the other hand, employed in studies examining similar issues and a sample of 63 emerging and advanced economies covering 1980–2014.

Keywords: optimal level, financial sector development, economic growth, economic growth rate, volatility, price stability, financial stability, objective function

JEL Codes: C53, C82, E17

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1. Introduction

Is there an optimum depth of financial sector development which would simultaneously address the four macroeconomic policy objectives: achieve the highest possible economic growth rate, minimize its volatility, maximize price and financial stability? On the one hand, a more extensively developed financial intermediation sector can transform savings into investments more efficiently (Goldsmith, 1969), screen off nonviable business projects (King and Levine, 1993b), relieve credit constraints and facilitate risk sharing among economic agents (Levine, 2005), ensure exchange of economic information, thereby promoting economic growth (King and Levine, 1993a; Levine and Zervos, 1998; Rajan and Zingales, 1998; Beck et al., 2000; Levine et al., 2000; Rioja and Valev, 2004; Arcand et al., 2015). On the other hand, as the experience of the global 2007–2009 crisis (Great Recession) and earlier, thoroughly studied crises (above all, of the 1930s, Great Depression) suggests, an excessive, i.e., significantly outpacing real economy development, increase in financial sector depth, may involve certain dangers, such as the emergence of bubbles, systematic underestimation of risks, rising fragility of the financial system and its vulnerability to shocks (Bernanke, 1983; Kaminsky and Reinhart, 1999; Schularick and Taylor, 2012; Dell’Ariccia, 2001; Rajan, 2005). The resulting financial and price instability may have a substantial adverse effect on economic activity.

Recent years have provided vast empirical evidence of the nonlinear impact of financial development on economic growth (see Arcand et al., 2015; Rioja and Valev, 2004; Law and Singh, 2014; Cecchetti and Kharroubi, 2012; Sahay et al., 2015; and other). For instance, various studies suggest that the threshold of the private-sector-credit to GDP ratio, above which adverse macroeconomic effects are realized, lies within the 80–100% range. These effects studied in the literature include a decline in long-term GDP growth rates (Arcand et al., 2015) and a rise in growth volatility (Easterly et al., 2000).

To continue exploring the nonlinear impact of financial development on macroeconomic performance, we simultaneously applied the methodology which was successfully employed in a number of recent studies to several (instead of one) financial system segments and to four macroeconomic policy objectives rather than two (as in Beck et al., 2014) or three (as in Sahay et al., 2015). This study did not seek to explore the effects of mutual enhancement or mutual weakening which may arise as various segments of the financial sector develop (for instance loan and stock markets, as in Demirgüç-Kunt and Maksimovic, 1996; Levine and Zervos, 1998). This task should undoubtedly be dealt with after the maximum achievable development effects of each separately studied financial sector segments have become clear. The estimation of financial sector depth and structure which optimize all of the four macroeconomic goals would only make sense if this task is addressed based on comparable cross-country data including the history of financial sector development in emerging as well as more advanced economies.
2. Literature review

2.1. Financial development, economic growth, and macroeconomic stability

The idea that financial sector development drives economic growth was first put forward and described in detail in Schumpeter (1911), where the author showed that banks in their capacity of financial intermediaries perform a number of functions important to economic development. This idea was later tested empirically in Goldsmith (1969) and McKinnon (1973), whose results confirmed a positive correlation between financial system size and long-term economic growth rates based on cross-country data.

The early 1990s saw a large number of empirical studies exploring the causality between financial institutions development and economic growth. A new line of research was formed in the empirical literature – finance-growth nexus. King and Levine (1993a) for the first time showed on a large, 119-country, sample covering the years 1960 to 1989, that the depth of financial markets was a robust predictor of economic growth in the following decade. In the complementary paper by King and Levine (1993b), the authors show that the robust correlation between the current depth of the financial sector and future economic growth found in their preceding study is explained by banks filtering the flow of loan applications so as to separate potentially viable projects from nonviable ones: banks finance the former and don’t finance the latter, thereby helping economic growth in future. Levine and Zervos (1998), Levine (1991) and Bencivenga et al. (1995) suggested that stock market liquidity positively affected economic growth, because more liquid stock markets provide more incentives for investors to engage in business projects, since it would be easier for them to sell their stakes in future. By contrast, these theoretical concepts and empirical findings of Levine and Zervos (1998) are at odds with those of Shleifer and Vishny (1986), which suggest that as stock market liquidity increases, making it easier to promptly sell equity stake in firms, incentives for potential investors to get involved into speculative trades in securities also increase. One should also mention Levine et al. (2000) and Beck et al. (2000), which, by comparing the results of various econometric methods using instrumental variables, found that it is the development of financial institutions that promotes the development of the economy rather than the other way around.

It should be mentioned that although there is vast empirical literature in which financial development was found to have an effect on economic growth, the authors of some papers came to the opposite conclusion: it is economic growth that is the source of financial development. Their main message is that financial development is a by-product of economic growth (Shleifer and Summers, 1988). In other words, they noted that finances had no stimulating effect on growth. A statistical relationship found between the dynamics of financial system
development and economic growth may be due to the influence of macroeconomic environment (Lucas, 1988), institutional factors (Rousseau and Wachtel, 2002; Arestis and Demetriades, 1997) or higher living standards achieved (Demetriades and Law, 2006).

One important drawback of all of the above studies is, however, that they all seek to reveal only a linear relationship between finances and economic growth. The findings of more recent studies suggest that an increase in financial sector depth does not always cause economic growth to accelerate. On the one hand, development of financial markets helps economic growth by creating greater opportunities for investment in the economy, alleviating the information asymmetry problem and helping economic agents diversify sources of funding (Levine, 2005; De Gregorio and Guidotti, 1995). On the other hand, after a certain threshold has been reached, the level of financial sector development becomes excessive, triggering rapid accumulation of various risks in the system. These in turn bring down stability and economic growth (Rioja and Valev, 2004; Law and Singh, 2014; Arcand et al., 2015; Sahay et al., 2015), while growth volatility increases (Easterly et al., 2000; Sahay et al., 2015). This problem is particularly relevant to countries with weak regulation and supervision of financial markets (Sahay et al., 2015). Hence one can say that the relationship between financial and economic development is not linear. In other words, this implies the existence of a certain saturation point of financial markets development from the perspective of their ability to stimulate a balanced economic growth the so-called “too-much-finance” effect. Overheated financial markets enhance slowdown of the economic growth due to the massive accumulation of risks along with the emergence of a high likelihood of financial crises and an increase in the economy’s volatility (Demirgüç-Kunt et al., 2013; Rajan, 2005).

Stolbov (2017) tested the direction of causality on a panel of 24 OECD countries and found that for most of the countries an increase in the loan market depth brought about economic growth, whereas the evidence of the reverse causality was weak. That said, no relationship whatever between finances and growth was found for 12 out of the 24 countries, which may provide evidence that there is a certain limit of financial system development beyond which it cannot stimulate economic growth.

Studies exploring the relationship between financial system development and the economy in general typically use economic growth as a dependent variable and analyze its factors. To get a better insight into the impact of financial development on economic growth, one should take into account both growth rates and their volatility (Kindleberger, 1978; Beck et al., 2014; Sahay et al., 2015). The main goal of economic policy is not only the achievement of high growth rates but also maintaining the stability of economic development. A well-developed financial sector can help GDP growth volatility decline, but only up to a certain limit. Although developed financial systems create conditions for economic growth
stabilization by smoothing over production and consumption processes, they can also result in excessive debt accumulation by firms. This may cause a massive accumulation of financial vulnerability by corporate and private borrowers (Easterly et al., 2000), thus affecting GDP performance.

According to a number of studies (De Gregorio and Guidotti, 1995; Demirgüç-Kunt and Levine 2001; Levine, 2005; Dabla-Norris and Srivisal, 2013), it is not only an increase in financial sector depth but also changes in its composition (ratios between its different segments) that can have an effect on economic growth, this effect being nonlinear. For instance, Levine (1997) added to cross-country growth regressions the ratio of stock market capitalization to private sector credit and found its robust statistical significance. Demirgüç-Kunt and Levine (2001) showed that it is not only the scale of financial services that was essential to economic development but their allocation among various financial sector segments. It follows from De Gregorio and Guidotti (1995), Levine (2005), Dabla-Norris and Srivisal (2013) that as a country advances to a higher level of economic development, entrepreneurs begin to need a wider array of financial instruments – above all securities, including equity securities – suitable for the flexible management of risks and capital mobilization. Under these circumstances, prevalence in the national financial sector of bank lending may become an obstacle to further economic growth.

As for studies exploring the relationship between financial development and economic growth based on Russian experience, Ono (2012) is worth mentioning. Using Russian empirical data, the author tests the hypothesis of unidirectional causality between financial sector development and economic growth. Two measures of financial development were used: the ratio of money supply to GDP and that of private sector credit to GDP. The findings of this study suggest that money supply expansion drives economic growth in the short-term perspective, which in turn creates conditions for a rise in bank lending. The author explains these findings by peculiarities of the Russian economy: the oil price positive shock usually causes ruble appreciation, which, given the shortage of money supply sterilization instruments, spurs money supply expansion, thus increasing per capita GDP. Russia’s banking system, however, has a limited ability to generate economic growth, so it only responds to money supply expansion by increasing lending.

In Stolbov (2008), the correlation analysis of GDP growth rate and various measures of financial depth suggests there is a rather weak positive effect of financial development on economic growth for the case of Russia. The weakness of this correlation is explained mainly by the low level of Russian financial market development. The author, however, notes that in future the financial market can be regarded as the potential factor of the Russian economy’s growth which will enhance the effectiveness of savings transformation into investment.

Krinichansky and Fatkin (2017) analyzes the relationship between finances and growth using Russian regional data. The study makes an attempt to identify nonlinear effects through the extensive employment of econometric methods for
estimating relationships, ranging from regions’ averages to relationships within groups of regions, formed based on various criteria. Regions with both low and high GDP per capita were found to show lower economic growth rates, which the authors attribute to their possible low diversification in terms of the industrial composition of the economy.

2.2. Finance, price stability, and systemic banking crises

The accumulation of systemic risks as the global financial sector develops, has provided motivation for conducting a number of studies to examine the effect of finance on price stability and the likelihood of the emergence of systemic banking crises. Although these studies differ in their focus, ranging from foreign exchange crises (Kaminsky and Reinhart, 1999; Domac and Martinez-Peria, 2003) and bank deposit insurance (Demirgüç-Kunt and Detragiache, 2002) to the level and dynamics of the loan market itself (Schularick and Taylor, 2012), they arrive at similar findings: it is not so much the exchange rate regime, the deposit insurance system, high variance of inflation rates, etc., that act as key predictors of systemic banking crises in future as the current changes in lending to the private sector. Even the lending level, i.e., the ratio of private sector credit to GDP does not affect the likelihood of systemic banking crises nearly as much as its changes do. This is consistent with the so called “credit view” (see Bernanke (1983) and other) on financial instability drivers, which can be summed up as what Schumpeter called “reckless lending”.

As regards empirical studies dealing with the effect of financial development, in particular loan or stock market depth, on price stability, the literature so far provides little evidence to that effect. In Lee (2011), the US postwar data was used to construct vector autoregression (VAR) for exploring the effect of yields on securities (equity) on business activity in the economy and price level. The author showed that in the VAR model incorporating an interest rate indicator, returns on securities explain just a small proportion of overall inflation variation. This is, however, not a cross-country study, and, as such, it does not give an insight into what is the degree of heterogeneity of relationship between inflation and stock market performance on the samples of emerging economies and developed countries. In De Schryder (2017), a sample of 15 OECD countries is used to analyze the response of inflation to the emergence of crisis processes in the economy and to financial system deleveraging. The study based on the hybrid new Keynesian Phillips curve showed an asymmetric response of inflation to output gaps (more pronounced in the periods when the economy was heating up and extremely weak when it was cooling down) and no impact of bank loans on the relationship between inflation and output gaps. From the theoretical perspective, the effect of loan market depth on inflation can be both positive and negative. In the former case, it works via the lending channel: lending growth
acceleration helps economic growth accelerate, thereby amplifying inflation processes. In the latter case, it works via the prices of alternative funding sources for firms: if the bank loan supply declines firms may have to look for other sources of financing investment which may be more expensive, thus affecting costs and hence prices for end consumers.

Some empirical studies, in addition to the effect of financial market depth on price and financial stability, look at the structure of financial sector characteristics. One example of these is the level of bank liabilities dollarization. The high level of dollarization enhances inflation acceleration, but in economies with high inflation the opposite relationship is also seen: inflation lowers confidence in the national currency and boosts foreign currency settlements and savings (Levy-Yeyati, 2006). On top of that, the high level of banking liabilities dollarization adversely affects banking system stability, heightening the likelihood of a banking crisis. Liabilities dollarization gives rise to a problem of potentially unbalanced assets/liabilities structure, when a bank obtains foreign currency funding and invests into local currency assets. But even if the economy is financed with foreign currency loans and foreign exchange risk is shifted onto customers, a sharp national currency depreciation would prevent a bank from meeting its liabilities timely, which may result in a stability loss for not just an individual bank but for the entire banking sector (De Nicolo et al., 2005; Honohan and Shi, 2003; Laeven and Valencia, 2012).

The share of foreign banks in the banking system’s total assets can be regarded as another characteristic of financial sector structure. Although the arrival of foreign banks in a national banking system can improve its efficiency and financial services quality, the excessive presence of foreign banks may have adverse implications for the banking system’s stability. Toughening of competition between domestic and foreign banks brings down banking sector profits, reducing banks’ net worth and making their financial position more fragile (Claessens et al., 2001).

3. Objectives of the empirical study

Questions which the empirical analysis should answer can be formulated as follows:

1. How does financial sector depth affect (1) economic growth, (2) macroeconomic instability (economy growth rate volatility), (3) price instability (inflation), and (4) financial instability (the likelihood of a systemic banking crisis)?
2. If the effect of financial sector depth is nonlinear, then what is its form and how do points in which (1) economic growth, (2) macroeconomic, (3) price, and (4) financial instability optima are reached relate to each other?
3. What is the optimal financial sector depth at which (1) maximum economic growth and minimums of (2) macroeconomic, (3) price, and (4) financial instability are reached?
4. What is Russia’s distance to the optimum point of financial sector depth?
To answer these questions, this study employed a standard method of regression analysis of panel data which is used in research examining nonlinear relationships between financial development and economic growth (finance-growth nexus; Rioja and Valev (2004), Arcand et al. (2015), Sahay et al. (2015), and other) and between financial development and macroeconomic instability (finance-volatility nexus, Easterly et al., 2000; Beck et al., 2014; Sahay et al., 2015).

The general form of regression equations for each of the four macroeconomic policy objectives \((Y_1, \ldots, Y_4)\) is written as (see (1)):

\[
Y_n = GDP_{it} = \alpha_i + \beta_1 \cdot FD_{j, it} + \beta_2 \cdot FD_{j, it}^2 + \sum_{m=1}^{M_1} \gamma_m \cdot Controls_{m, it} + \epsilon_{it}, \quad (1)
\]

where for country \(i (i = 63, \) countries with an-at-least-average income, including Russia), for a 5-year period \(t (t = 1980-1984, \ldots 2010-2014):\)

\(n = 1 \ldots 4\) is the index of macroeconomic policy goal;

\(Y_1 = GDP_{it}\) is a 5-year average of GDP growth rate;

\(Y_2 = \sigma(GDP_{it})\) is a standard deviation of annual GDP growth rate over a five-year period;

\(Y_3 = CPI_{it}\) is the average inflation rate over a five-year period (CPI);

\(Y_4 = CRISIS_{it}\) is the fraction of years witnessed banking crises (Laeven and Valencia, 2012) over a five-year period;

\(FD_{j, it}\) (Financial Development) is \(j\)-th measure of financial development \((j = 1 \ldots 6):\)

1. Loans to the private sector, % of GDP \((j = 1);\)
2. Domestic corporate bonds, % of GDP \((j = 2);\)
3. External corporate debt, % of GDP \((j = 3);\)
4. Stock market capitalization, % of GDP \((j = 4);\)
5. The private pension savings market, % of GDP \((j = 5);\)
6. Insurance sector assets, % of GDP \((j = 6).\)

\(CONTROLS_{m, it}\) is groups of control factors reflecting macroeconomic, financial, institutional, and demographic development.

Regression equations for dependent variables \(Y_1 = GDP_{it}\) and \(Y_2 = \sigma(GDP_{it})\) relied on King and Levine (1993a); King and Levine (1993b), Ramey and Ramey (1995), Levine and Zervos (1998), Easterly et al. (2000), Durlauf et al. (2005), Aghion et al. (2005), Beck et al. (2014), Sahay et al. (2015) and Arcand et al. (2015) as reference in selecting control factors. In equations for variable \(Y_3 = CPI_{it}\) see Lee (1992), Cottarelli et al. (1998), Blot et al. (2015) which were used for this purpose.

Equations for variable \(Y_4 = CRISIS_{it}\) see Kaminsky and Reinhart (1999), Domac

\[2\] This study focuses on the price stability indicator in the form of the CPI. This approach may draw rightful critique because the effectiveness of price stability achievement, as a rule, implies the degree of proximity to a certain target as part of inflation targeting policy rather than the minimization of the CPI measure as such (Gosselin, 2007; Hove et al., 2017). However, if CPI deviation from the inflation target is regarded as a macroeconomic policy objective, this substantially restricts the sample of countries to be used in a study and may have a negative effect on the coherence of its findings. In this context, the impact of financial development on the achievement price stability as part of inflation targeting policy may become a promising line of further, more in-depth research.
and Martinez-Peria (2003), Boyd et al. (2004), Beck et al. (2006), Schularick and Taylor (2012), Anginer et al. (2014), Sahay et al. (2015).

\( \alpha_{k,i} \) is fixed effects reflecting time-constant cross-country differences in growth trends \((k = 1)\), growth volatility \((k = 2)\), inflation \((k = 3)\), and the frequency of systemic banking crises \((k = 4)\).

\( \varepsilon_{k,it} \) is a regression error.

Key coefficients to be estimated are \( \beta_{j,1} \) and \( \beta_{j,2} \) \((j = 1...4)\), describing the impact of the linear and quadratic components of financial development measures for each of the four macroeconomic policy goals. In the equation for GDP growth, theory and existing empirical studies predict an inverse U-shaped relationship, whereas in the equations for GDP growth volatility, inflation, and financial instability, they predict a positive U-shaped relationship.

To estimate the parameters of regression equations, the two-step Generalized Methods of Moments (2-step GMM) was used, allowing the endogeneity problem to be dealt with. For instrumental variables we used the first lags of explanatory variables and the current values of institutional, in particular, variables of legal origin/type of legal system, which, as shown in Anginer et al. (2014), are significant from the perspective of explaining cross-country differences in the depth of financial market development.

After the estimation of regression equations, optimum points were computed in the case if the coefficients at the linear and quadratic components of another financial development measure were significant and had signs agreeing with the expectations described above. The formula for computing the optimum points is standard and is written as: 

\[
-0.5 \frac{\beta_{j,2}}{\beta_{j,1}} (j = 1...4)
\]

If a nonlinear relationship is found for at least one of the four objectives and the estimated optimum point lies within the acceptable region, this will allow an optimum to be sought for all of the four macroeconomic policy objectives. Formally, the optimization procedure can be written as follows (see (2)):

\[
L(FD_{j,it}) = \frac{\hat{Y}_{1,it}}{\sigma_1} + \mu_2 \frac{\hat{Y}_{2,it}}{\sigma_2} + \mu_3 \frac{\hat{Y}_{3,it}}{\sigma_3} + \mu_4 \frac{\hat{Y}_{4,it}}{\sigma_4} \rightarrow \max_{FD_{j,it}} \Rightarrow FD_{j,it}^*, \quad (2)
\]

where

\( L() \) is the objective functional defining the regulator’s objective function from promoting the development of the financial sector’s \( j \)-th segment \((j = 1...6)\) and written as a function of \( FD_{j,it} \);

\( \mu_1, .., \mu_4 \) are weights determining the regulator’s preferences regarding goals \((1) – (4)\). In further computations, the first best was assumed to be defined as \( \mu_1 = .. = \mu_4 = 1/4 \), the second best \(- \mu_1 = \mu_3 = \mu_4 = 1/3 \) и \( \mu_2 = 0 \);

\( \sigma_1, .., \sigma_4 \) are standard deviations of variables \( Y_1, .., Y_4 \) over the entire observation period (1980–2014). The normalization of the variables by their standard deviation ensures the comparability of measurement and enables standard arithmetic operations (in particular, addition) to be applied to them;
\( \hat{Y}_{1,it}, \ldots, \hat{Y}_{s,lt} \) are fitted values of macroeconomic policy goals as nonlinear functions from financial development measures \( FD_{j,lt} \).

\( FD_{j,lt}^* \) is the value of \( j \)-th financial development measure optimizing all of the four macroeconomic policy objectives \((j = 1 \ldots 6)\).

**4. Dataset**

To model the effect of various financial markets’ development indicators on economic growth rate, its volatility, price and financial stability, all the variables involved were split into groups: macroeconomic, financial, demographic, and institutional ones. The World Bank database was used as a source of macroeconomic and demographic variables. Most of the data on financial markets and measures of financial development were also obtained from the World Bank’s Global Financial Development Database (GFDD); the IMF’s International Financial Statistics (IFS) and Financial Soundness Indicators (FSI). The Bankscope – Bureau van Dijk database was used as a source of additional information on banking indicators. The institutional variables were collected from the databases of the World Bank and analytical institutions (Fraiser Institute and Heritage Foundation), specializing in international and national policy research.

This study uses a sample of 63 advanced and emerging economies (with an at least medium development level), including commodity-exporting countries. The sample included only countries for which the share of missing values for all the indicators was no larger than 5%. The observation period for the sample concerned averaged 35 years, from 1980 to 2014 (2015), allowing the financial sector development to be examined in the long term. The last observation date varies across countries and variables, as it depends on data availability. Data for each indicator was averaged over 5-year periods: 1980–1984, 1985–1989, 1990–1994, 1995–1999, 2000–2004, 2005–2009, 2010–2014, enabling short-term fluctuations to be smoothed and a relationship between financial development and economic growth to be studied on a long-term basis.\(^3\)

**5. Nonlinear effect of financial development on economic growth, macroeconomic and financial stability: estimation results**

Based on the obtained sample of 63 countries, including Russia, we estimated a regression equation set (1) describing the nonlinear effect of each of the selected six financial development indicators on each of the four macroeconomic policy

\(^{3}\) Averaging of series on non-intersecting five-year horizons also allows mitigating the impact of inertia inevitably arising in an analysis of nonstationary data series for indicators which we selected. Hence there is no need to add directly to the regression models the lags of dependent variables as explanatory factors (Arellano and Bond, 1991; Arellano and Bover, 1995; Blundell and Bond, 1998).

objectives: economic growth, minimization of its volatility, price and financial stability. Estimation results will be presented in a standard form as a summary table containing the estimates of equation parameters and their corresponding optimum points for each of the six financial development indicators, and as figures reflecting nonlinear relationships between finances and macroeconomic policy objectives.

5.1. Domestic loan market

The results of identifying nonlinear effects of domestic loan market depth on economic growth, macroeconomic instability (growth volatility), price and financial instability are provided in Table 1. Column I presents the final multivariable model for annual growth rates averaged within five-year intervals ($GDP$), column II does so for growth volatility ($\sigma(GDP)$), column III – for inflation ($CPI$), columns IV and V – for financial (in)stability indicators ($CRISIS$ and $Z$-score). The explanatory variables are divided into four blocks: the first, the key one, contains financial development indicators, including loans to the private sector and their value squared (in levels or logarithms, depending on approximation quality), the second block contains macroeconomic control variables, the third – demographic ones, the fourth – institutional ones. The estimates of optimum points are provided in the last line.

Regression results suggest a nonlinear relationship between each of the four macroeconomic policy objectives and the depth of private sector loan market development.

All of the four optimum points obtained satisfy the notion that, after a certain threshold, financial development depth can become excessive (the “too-much-finance” effect, Arcand et al., 2015; Law and Singh, 2014). All of the four optimum points are robust to variation in complementary explanatory variables of the models.

Thus, the optimum point for the measure of systemic banking crises ($Y_4$) is reached first, followed by that for inflation ($Y_3$), then – for GDP growth rates ($Y_1$) and finally – for GDP growth volatility ($Y_2$). The result obtained may suggest that initially, as the first threshold value is passed (57%, column IV), the negative effect of the adverse selection of borrowers starts to surpass the standard positive effects of financial intermediation ($ex$ $ante$ assessment of the viability of business projects to be financed, $ex$ $post$ monitoring of investment effectiveness and corporate governance efficiency, etc., see the review in Levine, 2005). In a situation where it is easier for banks to hike interest rates on loans than to bear increased costs of verifying borrowers’ creditworthiness (the “costly state verification” problem, Townsend, 1979; Bernanke and Gertler, 1989), the banking system should face the conditions of systemic banking crises more often, while firms would shift the costs of more expensive lending onto consumers. The latter would give a boost to inflation – as loan market depth passes its second threshold (64%). The increased probability of systemic banking crises and heightening of inflationary pressure
would negatively affect economic growth – as loan market depth passes its third threshold (86%). This negative effect on growth should build up after loan market depth passes its fourth threshold (104%), above which a further increase in loan market depth would push growth volatility up (Ramey and Ramey, 1995).

**Table 1. The effect of loan market depth on the achievement of macroeconomic policy objectives**

|                          | GDP (I) | σ(GDP) (II) | CPI (III) | CRISIS (IV) |
|--------------------------|---------|-------------|-----------|-------------|
| **1. Financial variables** |         |             |           |             |
| Bank loans to private sector / GDP, in log, % | 17.355* (9.612) | -5.394** (2.374) | -1.374* (0.776) |
| Bank loans to private sector / GDP, in log, % (squared) | -1.945* (1.088) | 0.648** (0.294) | 0.170* (0.092) |
| Bank loans to private sector / GDP, % | -0.126** (0.060) |          |           |             |
| Bank loans to private sector / GDP (squared), % | 0.001* (0.0003) |          |           |             |
| Fraction of banking system’s crisis years in five-year period (lag = 1), dimensionless | -0.903** (0.378) |          |           |             |
| Growth rate in bank loans to private sector (lag = 1), in log, % | 0.259*** (0.065) |          |           |             |
| **2. Macroeconomic variables** |         |             |           |             |
| Inflation (CPI, in log.), % | -0.560* (0.324) |          |           |             |
| GDP per capita (lag = 1) in log, USD | -2.748*** (0.575) |          |           |             |
| GDP per capita, USD | -0.00003 (0.00005) |          |           |             |
| GDP growth rate volatility (lag =1), % | -0.014 (0.015) |          |           |             |
| Natural resource rent / GDP (lag = 1) in log, % | -0.162 (0.223) | -0.483* (0.291) |          |             |
| Natural resource rent / GDP in log, % |          |           |           |             |
| Exchange rate volatility, national currency units to 1 USD | 0.006* (0.004) |          |           |             |
| Dummy variable for strictly fixed exchange rate | -0.142 (0.182) |          |           |             |
| Oil and gas exports / GDP (lag = 1), % | 0.058** (0.026) |          |           |             |
| Trade openness (total exports and imports / GDP, in log., % | -2.228*** (0.608) |          |           |             |
| **3. Demographic variables** |         |             |           |             |
| Population growth rate, % | 0.390 (0.351) |          |           |             |
| Age dependency ratio (children), in log. | -3.788*** (1.423) |          |           |             |
In addition to loan market depth, other variables, representing macroeconomic, financial, institutional and demographic development, were included in the model. The results confirm the findings of the previous studies and suggest that inflation and wealth are negatively related to growth (Mankiw et al., 1992; Barro and Sala-i-Martin, 2004). Population dynamics and the economy’s natural resource rent were found to be nonsignificant in the estimated regression models of growth (I). However, a significant and negative effect of the young-age dependency ratio was documented (children’s dependency on the working age population). As Bernanke and Rogoff (2002) point out, in countries with a higher age dependency ratio, economic agents show lower risk tolerance than in other countries. This can to a certain extent slow investment and growth. This result should however be treated with caution because the latest research in this area suggests that there may be no relationship between population age and economic growth (Acemoglu and Restrepo, 2017).

The regression models of growth volatility (II) also provided more evidence that countries with increased volatility of their national currencies and greater specialization in oil and gas exports are subject to higher economic instability than other countries.

The regression models of inflation (III) also showed a negative effect of a rise in the economy’s openness (exports and imports): access to global markets makes domestic producers cut prices under the pressure of growing global competition. No inflation transfer effects were found. Inflation was also found to tend to decline in the aftermath of systemic banking crises. On the one hand, banking crises have a depressing effect on economic activity and hence on price dynamics, on the other hand, during crises, banks incorporate higher risk-premia in their interest
rates on loans, leading to cost-push inflation, while as the crisis slows down the situation turns around.

The regression models of systemic banking crises (IV) confirmed the main finding of Kaminsky and Reinhart (1999), and Schularick and Taylor (2012) that excessive lending dynamics is a key driver of financial instability. This conclusion holds for equation V, where Z-score of banking system stability is used as a dependent variable. And, finally, an effect of improvement in institutional environment quality (captured by the indicator of the level of economic freedoms) was found to promote financial stability.

From the technical perspective, sets of instruments used in all the equations are valid under the standard Hansen test for over-identifying moment conditions (P-values of the test never fall below 10%). This suggests the credibility of GMM-estimates and allows proceeding to an analysis of the U-shaped forms of relationships between loan market depth and all of the four macroeconomic policy goals (as shown in Figure 1 of Appendix). Constants were computed for each of these forms by averaging fixed effects over the entire period and for all of the countries in the sample. Optimum values were specified in each of the forms and Russia’s position in the relevant form during the last two five-year periods along with loan market depth forecasted by 2035 under the best-case macroeconomic scenario and positive dynamics of institutional development. The latter was evaluated as part of Mamonov et al. (2017).^4

The use of logarithms instead of loan market depth levels in equations I, III, and IV allows identifying non-symmetric relationships between these levels and the relevant dependent variables (as shown in Figure 1a), c), d) of Appendix) which are actually observed in the data.

The average value of loan market depth for Russia in the 2010–2014 five-year period stood at 49%, while in the next five-year period of 2015–2019 it is expected to grow to 60%, with loan market depth forecasted to continue growing to reach 73% by 2035. This value is found to be below the growth rate and growth volatility thresholds but above those for inflation and systemic banking crises, implying that Russia has potential to gain from further loan market deepening through stable economic development, which will, however, be accompanied by some increase in price and financial instability.

5.2. Corporate bond market

Results of identifying nonlinear effects of domestic corporate debt market on economic growth, macroeconomic instability (growth volatility), and price and financial instability are presented in Table 2.

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^4 Further on, we use the long-term forecast obtained by Mamonov et al. (2017) as part of a best-case scenario, to analyze the effects of other financial sector segments’ development.
Table 2. Effect of domestic corporate debt market depth on the achievement of macroeconomic policy objectives

|                          | GDP                      | σ(GDP)                  | CPI                      | CRISIS                  |
|--------------------------|--------------------------|-------------------------|--------------------------|-------------------------|
|                          | I                        | II                      | III                      | IV                      |
| 1. Financial variables   |                          |                         |                          |                         |
| Domestic corporate bonds / GDP, in log., % | -3.083*** (1.141) |                         |                          |                         |
| Domestic corporate bonds / GDP, in log., % (squared) | 0.502*** (0.194) |                         |                          |                         |
| Domestic corporate bonds / GDP, % | 0.116** (0.058) | -0.285*** (0.099) | -0.22** (0.010) |                         |
| Domestic corporate bonds / GDP (squared), % | -0.001*** (0.0004) | 0.003*** (0.001) | 0.0004* (0.0002) |                         |
| Bank loans to private sector / GDP, % |                         |                         | 0.009*** (0.001) |                         |
| 2. Macroeconomic variables |                          |                         |                          |                         |
| GDP per capita (log.), USD |                         | -1.648** (0.766) |                         |                         |
| Inflation (CPI), % |                         | -0.230** (0.113) |                         | 0.001 (0.006) |
| Average exchange rate, current and preceding, national currency units to 1 USD |                         |                         | 0.0002*** (0.0001) |                         |
| Volatility of real effective exchange rate index, % |                         | 0.320** (0.127) |                         |                         |
| Trade openness (total exports and imports / GDP), % |                         | -0.058** (0.024) |                         |                         |
| Current account / GDP, % |                         |                         | 0.024*** (0.006) |                         |
| 3. Demographic variables |                          |                         |                          |                         |
| Age dependency ratio (elderly) |                         | 0.343** (0.173) |                         |                         |
| 4. Institutional variables |                          |                         |                          |                         |
| Financial freedom index, nondimensional |                         | -0.132** (0.063) |                         |                         |
| Economic freedom index, nondimensional | 1.438** (0.620) |                         | -0.270*** (0.053) |                         |
| Index of judicial system independence, nondimensional | 1.046*** (0.345) | -0.686** (0.314) |                         |                         |
| Political stability index, nondimensional |                         | -2.319** (0.956) |                         |                         |
| Number of observations | 149                      | 128                     | 111                      | 36                      |
| P-value (Hansen test) | 0.138                    | 0.634                   | 0.521                    | 0.563                   |
| Inflexion point -0.5β_{j,2}/β_{j,1} | 45.661*** (8.253) | 21.603** (9.112) | 51.041*** (7.625) | 25.078*** (2.296) |
| Confidence interval of inflexion point (90%) | [37.408; 53.914] | [12.491; 30.715] | [43.416; 58.666] | [22.782; 27.374] |

Notes:
1) GDP is a 5-year average of annual GDP growth rates; σ(GDP) is a standard deviation of annual GDP growth rate over a five-year period; CPI is an average inflation over a five-year period, (CPI), log., CRISIS is the fraction of years witnessed banking crises (Laeven and Valencia, 2012) over a five-year period.
2) All the models are estimated using a two-step generalized method of moments (2-step GMM with fixed effects (FE) over the 1980–2014 period (with averaging within five-year period).
3) ***, **, * - 2-step GMM-estimation of the coefficient is respectively 1%, 5%, and 10% significant. In the parentheses under the coefficients their robust standard errors are shown.
The regression results suggest a nonlinear relationship between each of the four macroeconomic policy objectives and domestic corporate debt market depth.

The optimum point of GDP growth rate volatility ($Y_2$) is reached first, followed by that for the indicator of systemic banking crises inflation ($Y_4$), then – for GDP growth rates ($Y_1$) and finally for inflation ($Y_3$). Initially, the deepening of the domestic corporate debt market brings down the volatility of economic growth rates (to 22%), then – via this – stabilizes the financial sector (to 23%), in particular, the banking system. The deepening of the domestic corporate depth market within a certain range (from 25% to 46% of GDP) tends to positively affect economic growth. When occurring simultaneously, all three processes can have a depressing effect on inflation before reaching a threshold of 51% of GDP. Further deepening of the domestic corporate debt market beyond a threshold of 51% of GDP amplifies inflation processes.

The composition of control variables in all the models estimated did not change substantially compared with that used in the similar models with loan market depth described above (see subsection 5.1). Maintaining the stability of the political sphere reduces economic growth volatility in the medium term (model III), which agrees with the findings of the previous studies (Sahay et al., 2015). Also, the models were found to confirm that national currency depreciation contributes to shattering financial and price stability by influencing investor and population's expectations (Cottarelli et al., 1998; Demirgüç-Kunt and Detragiache, 2002; Beck et al., 2006).

The results of constructing U-shaped forms of relationships between the depth of the domestic corporate debt market and all of the four macroeconomic policy objectives are presented in Figure 2 of Appendix. The average value of domestic corporate debt market depth over a five-year period of 2010–2014 stood at 6%, is expected to increase to 10% in the next five-year period of 2015–2019 and to continue rising to reach 35% by 2035. This value is below those thresholds found for economic growth and inflation but above the threshold values for growth volatility and systemic banking crises, suggesting in turn that Russia has a beneficial potential of further domestic corporate debt market deepening through stable economic development, which will, however, be accompanied by some increase in financial instability and GDP growth volatility.

5.3. The market of external long-term corporate debt

The results of identifying nonlinear effects of external corporate debt market depth on economic growth, macroeconomic instability (growth rate volatility), and price and financial instability are presented in Table 3.

The estimation results confirm a nonlinear relationship between each of the four macroeconomic policy objectives and the size of external corporate debt. Computation results suggest that the optimum point of the measure of systemic
banking crises (20%) is reached first, followed, closely to each other, by optimum values, in this order: GDP growth rate volatility (29%), GDP growth rate (30%) and, finally, inflation (32%). It can be assumed that excessive debt burden expansion first undermines financial, including banking, stability, then causes heightened macroeconomic uncertainty and GDP growth volatility, which in turn depresses the long-term growth rate (Ramey and Ramey, 1995). As the potential of economic growth, which would normally facilitate the repayment of external corporate debt, declines under these conditions, the government may benefit from depreciating the accumulated external corporate debt by letting inflation accelerate.

**Table 3. Impact of external corporate debt market depth on the achievement of macroeconomic policy objectives**

|                      | GDP | σ(GDP) | CPI | CRISIS |
|----------------------|-----|--------|-----|--------|
|                      | I   | II     | III | IV     |
| 1. Financial variables |     |        |     |        |
| Private sector’s external debt / GDP, % | 0.368*** | -0.275** | -0.394** | -0.085*** |
|                      | (0.140) | (0.116) | (0.165) | (0.032) |
| Private sector’s external debt / GDP (squared), % | -0.006** | 0.005** | 0.006** | 0.0022** |
|                      | (0.002) | (0.002) | (0.003) | (0.0010) |
| Fraction of banking system’s crisis years in a five-year period (lag = 1), nondimensional | -1.713* |  |  |  |
|                      | (1.013) |        |     |        |
| Growth rate in bank loans to private sector (lag =1), in log., % | -0.636** | 0.286*** |  |  |
|                      | (0.296) | (0.107) |     |        |
| 2. Macroeconomic variables |     |        |     |        |
| GDP per capita (lag = 1), in log., USD | -2.386** |  |  |  |
|                      | (1.201) |        |     |        |
| GDP per capita (lag = 1), USD |  | -0.0002* |  |  |
|                      |  | (0.001) |     |        |
| Dummy variable for exchange rate stability (threshold = 5% of growth rate) |  |  | -0.057 |  |
|                      |  |  | (0.113) |    |
| Dummy variable for exchange rate stability (threshold = 1% of growth rate) |  |  | -0.180 |  |
|                      |  |  | (0.354) |    |
| Natural resource rent / GDP, % |  |  |  | 0.018 |
|                      |  |  |  | (0.021) |
| Trade openness (total exports and imports / GDP), in log., % | 0.234 |  |  |  |
|                      | (2.306) |        |     |        |
| Trade openness (total exports and imports / GDP), % |  |  | 0.030 |  |
|                      |  |  | (0.032) |    |
| Current account / GDP, % |  |  |  | -0.029 |
|                      |  |  |  | (0.122) |
| Share of government consumption in GDP (log.), % | 0.319 |  |  |  |
|                      | (4.661) |        |     |        |
| Share of government consumption in GDP (lag = 1), in log., % |  |  |  | 0.874 |
|                      |  |  |  | (1.131) |

*Table 3 continues on p. 106*
3. Demographic variables

Share of population with higher education in of 25–64 years age group (log.), %  
1.471 \[ (1.280) \]

Share of population with higher education in of 25–64 years age group, %  
–0.192* \[ (0.114) \]

Age dependency ratio (elderly)  
0.121 \[ (0.255) \]

4. Institutional variables

Index of property rights protection, nondimensional  
–0.528* \[ (0.285) \]

Number of observations  
114 116 98 73

P-value (Hansen test)  
0.125 0.441 0.725 0.646

Inflexion point \(-0.5\hat{\beta}_{j,2}/\hat{\beta}_{j,1}\)  
30.037*** \[ (5.621) \] 29.123*** \[ (4.982) \] 31.530*** \[ (3.453) \] 19.588*** \[ (3.918) \]

Confidence interval of inflexion point (90%)  
[24.416; 35.658] [24.141; 34.105] [28.077; 34.983] [15.670; 23.506]

Notes:
1) GDP is a 5-year average of annual GDP growth rates; \(\sigma(GDP)\) is a standard deviation of annual GDP growth rate over a five-year period; CPI is an average inflation over a five-year period, (CPI), log., CRISIS is the fraction of years witnessed banking crises (Laeven and Valencia, 2012) in a five-year period.
2) All the models are estimated using a two-step generalized method of moments (2-step GMM with fixed effects (FE) over the 1980–2014 period (with averaging within five-year period).
3) ***, **, * – 2-step GMM-estimation of the coefficient is respectively 1%, 5%, and 10% significant. In the parentheses under the coefficients are their robust standard errors.

Along with the size of external corporate debt, control macroeconomic variables, included with the expected signs, were used in the model. GDP per capita, for instance, reflects the initial period of economic development and appears in the model of economic growth rates with the negative sign, confirming the hypothesis of the convergence of these rates (Mankiw et al., 1992; Barro and Sala-i-Martin, 2004). More advanced economies (based on GDP per capita) on average feature lower inflation. In countries with a more vibrant loan market, the likelihood of systemic banking crises is found to be higher (in line with the findings of Schularick and Taylor, 2012).

Demographic and institutional variables were also included in the models as additional regressors. To take account of demography’s impact on economic growth, the elderly dependency ratio was used. Population ageing does not have a statistically significant effect on growth volatility, which is generally in line with recent research in this area (Acemoglu and Restrepo, 2017). Institutional development is found to be related to general economic performance, creating favorable conditions for economic growth and reducing its volatility (Acemoglu et al., 2004).

The results of constructing U-shaped forms of relationships between the depth of external corporate debt market and all of the four macroeconomic policy objectives are presented in Figure 3 of Appendix). The average depth of external corporate debt
market stood at 13% for Russia in the five-year period of 2010–2014, is expected to increase to 15% in the next five-year interval of 2015–2019 and to continue increasing to reach 22% by 2035. Russia’s position in the U-shaped form of external corporate debt relationship is on average forecasted to improve in the next five-year period and in the period until 2035. Russia may only deviate to the right of the optimum point with respect to the targeted frequency of banking crises.

5.4. Stock market (equity market)

The estimates of nonlinear impact of stock market depth on economic growth, macroeconomic instability (growth volatility), and price and financial instability are presented in Table 4.

Table 4. The effect of stock market depth on the achievement of macroeconomic policy objectives

|                      | GDP       | σ(GDP)    | CPI       | CRISIS    |
|----------------------|-----------|-----------|-----------|-----------|
|                      | I         | II        | III       | IV        |
| **1. Financial variables** |           |           |           |           |
| Stock market capitalization / GDP, in log., % | 4.271**   | –1.317**  |           |           |
|                      | (1.960)   | (0.560)   |           |           |
| Stock market capitalization / GDP, in log., % (squared) | –0.579*   | 0.225**   |           |           |
|                      | (0.319)   | (0.098)   |           |           |
| Stock market capitalization / GDP, % | –0.035*** | –0.012**  |           |           |
|                      | (0.011)   | (0.006)   |           |           |
| Stock market capitalization / GDP (squared), % | 0.0001*** | 0.00005*** |           |           |
|                      | (0.00004) | (0.005)   |           |           |
| Fraction of banking system’s crisis years in five-year period (lag = 1), nondimensional | 1.315**   | –0.551*   |           |           |
|                      | (0.629)   | (0.296)   |           |           |
| Growth in bank loans to private sector (lag = 1), in log., % | 0.193*** |           |           |           |
|                      |           |           | (0.052)   |           |
| **2. Macroeconomic variables** |           |           |           |           |
| National savings / Gross national income, % | 0.067     |           |           |           |
|                      | (0.058)   |           |           |           |
| GDP per capita (lag = 1) in log., USD | –1.896*** | –0.335*   | 0.147     |           |
|                      | (0.403)   | (0.403)   | (0.157)   |           |
| Natural resource rent / GDP (lag = 1) in log., % | –0.268   | 0.171     |           |           |
|                      | (0.217)   | (0.115)   |           |           |
| Dummy variable for exchange rate stability (threshold = 5% of growth rate) | –0.561*** |           |           |           |
|                      | (0.214)   |           |           |           |
| Dummy variable for exchange rate stability (threshold = 1% of growth rate) | 0.110**  |           |           |           |
|                      | (0.053)   |           |           |           |
| Real interest rate (lag = 1), % | –0.012**  |           |           |           |
|                      | (0.005)   |           |           |           |
| Trade openness (total exports and imports / GDP, in log.), % | –1.697   | 1.639***  | –1.017    | –0.053    |
|                      | (1.362)   | (0.445)   | (0.857)   | (0.364)   |

Table 4 continues on p. 108
The regression results suggest nonlinear relationships between each of the four macroeconomic policy objectives and the depth of stock market development.

The optimum point of GDP growth volatility ($Y_2$) is reached first, followed by that of GDP growth rate ($Y_1$), then – by that of the measure of systemic banking crises ($Y_4$) and finally – that of inflation ($Y_3$). Initially, stock market deepening boosts growth rate volatility, then this causes growth rate itself to decline. Economic slowdown within a certain interval of stock market depth (from 40% to 140% of GDP) tends to suppress inflation. When concurrent, all the three processes can have a simultaneous negative effect on demand from end borrowers and bank loan supply as well as the loan collateral costs, heightening the likelihood of a systemic banking crisis (above the 140%-of-GDP threshold). Further unfoldng of crisis processes – after a stock market depth threshold of 160% is reached – amplifies inflationary processes (via the channel of risk-premia hiking by banks during the crisis and firms shifting the rising costs onto end consumers). However, as further estimation shows, the last effect is so far very limited at the country level.
The composition of control variables in all the models estimated did not change considerably compared with that used in models with loan market depth described above.

The results of constructing the U-shaped forms of relationships between stock market depth and all of the four macroeconomic policy objectives are presented in Figure 4 of Appendix. The average ratio of stock market capitalization to GDP equaled 43% in the five-year period of 2010–2014, is expected to fall to 37% in the next five-year period of 2015–2019, with the stock market expected to continue deepening to reach 84% of GDP by 2035. This means that Russia’s position in the U-shaped form of the relationship between finance and growth is on average forecasted to deviate to the right of the optimum points of growth and growth volatility (40% and 20% respectively) on the above horizon, but will stay clearly to the left of the optimum points for inflation (160%) and systemic banking crises (130%).

5.5. Private pensions savings market

The results of identifying nonlinear effects of the depth of the private pension savings market on economic growth, macroeconomic instability (growth volatility), and price and financial instability are presented in Table 5.

**Table 5. Impact of the depth of the private pension savings market on the achievement of macroeconomic policy objectives**

|                      | GDP    | σ(GDP) | CPI    | CRISIS |
|----------------------|--------|--------|--------|--------|
|                      | I      | II     | III    | IV     |
| 1. Financial variables |        |        |        |        |
| Pension fund assets / GDP, % | 0.350** (0.163) | -0.295*** (0.113) | -0.044** (0.019) | -0.048** (0.020) |
| Pension fund assets / GDP (squared), % | -0.0047** (0.0020) | 0.0032** (0.0015) | 0.0003* (0.0002) | 0.00034** (0.00016) |
| Fraction of banking system’s crisis years in five-year period (lag = 1), nondimensional | 0.206 (0.257) | | | |
| Growth rate in bank loans to private sector (log.), % | 0.481*** (0.163) | | | |
| Growth rate in bank loans to private sector (lag = 1), % | | | 0.214** (0.085) | |
| 2. Macroeconomic variables |        |        |        |        |
| GDP per capita (lag = 1), in log., USD | -2.796*** (0.994) | | | |
| GDP per capita (lag = 1), USD | | -0.00016*** (0.00005) | -0.00002 (0.00002) | |
| Natural resource rent / GDP, % | -0.050 (0.038) | 0.020 (0.013) | | |

*Table 5 continues on p. 110*
The estimation results suggest that the relationships between each of the four macroeconomic policy objectives and the depth of the private pension savings market are nonlinear.

As the private pension savings market develops, the optimum point of GDP growth rate (37%) is reached first, followed by that of GDP growth volatility (47%), with inflation (71%) and systemic banking crises (70%) following closely to each other. It can be assumed that excessive growth in private pension fund assets initially worsens macroeconomic dynamics (through a drop in disposable income and consumer expenditure), which in turn weakens financial and banking stability, boosting inflation.

In addition to the size of the private pension funds market, the models took account of macroeconomic control variables, which appear to have expected signs. GDP per capita, for instance, reflects the initial level of economic development and is included in the model of the economic growth rates with the negative
sign, confirming the hypothesis of their convergence (Mankiw et al., 1992; Barro and Sala-i-Martin, 2004). More advanced economies (based on GDP per capita) on average show lower GDP growth volatility. Countries with a more dynamic loan market see a higher probability of systemic banking crises, in line with the findings of Schularick and Taylor (2012). Also, a greater openness of the economy to trade heightens the frequency of financial crises.

Demographic and institutional variables were included in the models as additional factors. A rise in life expectancy was found to be related to GDP growth acceleration.

The results of constructing the U-shaped forms of relationships between the depth of the private pension savings market and the four macroeconomic policy objectives are presented in Figure 5 of Appendix. The average ratio of pension fund assets to GDP in the 2010–2014 five-year period equaled 2.5% for Russia. It is expected to rise to 4% in the next five-year period of 2015–2019 and to continue increasing for the depth of private pension savings market to reach 10% of GDP by 2035. Russia’s position in the U-shaped form of relationships between the depth of the private pension savings market and the targets is on average forecasted to improve, shifting slightly to the right for all the targets.

5.6. Insurance market

The results of estimating the non-linear effect of insurance market size on economic growth, macroeconomic instability (growth volatility), and price and financial instability are presented in Table 6 below.

The regression analysis results suggest non-linear relationships between the level of insurance market development and three out of the four macroeconomic policy objectives (excluding inflation).

As the insurance market develops, the optimum point of economic growth ($Y_1$) is reached first, followed by that of GDP growth volatility ($Y_2$), and finally – by that of systemic banking crises ($Y_4$). It is worth noting that optimum points of GDP growth and GDP growth volatility lying close to the 50th percentile of country distribution over the entire observation period (and corresponding to insurance sector assets of 10% of GDP) are in accordance with each other. Insurance market development in excess of a certain threshold increases GDP growth volatility, slowing economic growth (Kindleberger, 1978; Easterly et al., 2000; Rajan, 2005). Besides the growth rate slowdown, inflationary pressure builds up, and, taken together, this leads to risk accumulation in various financial market segments (including the banking system and the insurance sector) due to a decline of economic agents’ creditworthiness. If insurance companies’ total assets reach a threshold level of 22.1% of GDP (in equation IV for systemic banking crises), further insurance market development may undermine financial stability (an emergence of a banking crisis). In addition,
this result agrees with the findings of Das et al. (2003) that parallel development of the banking sector and the insurance segment (a close tie) is the potential source of financial instability.

Table 6. The effect of insurance sector size on the achievement of macroeconomic policy objectives

|                          | GDP          | σ(GDP)       | CPI          | CRISIS       |
|--------------------------|--------------|--------------|--------------|--------------|
|                          | I            | II           | III          | IV           |
| 1. Financial variables   |              |              |              |              |
| Insurance sector assets / GDP, % | 3.863**     | -5.217*      | -0.907**     |              |
|                          | (1.701)      | (2.797)      | (0.391)      |              |
| Insurance sector assets / GDP, in log., % | -0.846**    | 1.130**      | 0.147***     |              |
|                          | (0.370)      | (0.575)      | (0.053)      |              |
| Insurance sector assets / GDP, in log., % (squared) | -0.846**    | 1.130**      | 0.147***     |              |
|                          | (0.370)      | (0.575)      | (0.053)      |              |
| Growth rate in bank loans to private sector (lag = 1), % | -1.111***   | 1.540        | 0.113***     |              |
|                          | (0.375)      | (1.026)      | (0.039)      |              |
| 2. Macroeconomic variables |              |              |              |              |
| GDP per capita (lag = 1), in log. USD | -1.139**    | -2.363       | -3.074***    |              |
|                          | (0.563)      | (1.547)      | (1.041)      |              |
| Real effective exchange rate of national currency, national currency unit to 1USD | 0.094      |              | 0.028        |              |
|                          | (0.098)      |              | (0.017)      |              |
| Trade openness (total exports and imports / GDP, in log.), % |              |              | -13.125*     | (7.766)      |
|                          |              |              | (0.039)      |              |
| Natural resource rent / GDP (lag = 1), % |              | -0.146       |              |              |
|                          |              | (0.132)      |              |              |
| Real interest rate, %    | 0.074        |              |              |              |
|                          | (0.193)      |              |              |              |
| 3. Institutional variables |              |              |              |              |
| Index of Economic Freedom, nondimensional | 1.571**     |              |              |              |
|                          | (0.688)      |              |              |              |
| Number of observations   | 93           | 127          | 153          | 63           |
| P-value (Hansen test)    | 0.120        | 0.115        | 0.780        | 0.140        |
| Inflection point -0.5β_{1,1}/β_{1,2} | 9.816*      | 10.050*      | 22.074*      |              |
|                          | (5.758)      | (5.155)      | (12.708)     |              |
| Confidence interval of inflexion point (90%) | [4.058; 15.574] | [4.895; 15.205] | [9.366; 34.782] |

Notes:
1) GDP is a 5-year average of annual GDP growth rates; σ(GDP) is a standard deviation of annual GDP growth rate over a five-year period; CPI is an average inflation over a five-year period, (CPI), log., CRISIS is the fraction of years witnessed banking crises (Laeven and Valencia, 2012) over a five-year period.
2) All the models are estimated using a two-step generalized method of moments (2-step GMM with fixed effects (FE) over the 1980–2014 period (with averaging within five-year period).
3) ***, **, * – 2-step GMM-estimation of the coefficient is respectively 1%, 5%, and 10% significant. In the parentheses under the coefficients are their robust standard errors.

In addition to insurance market size, control variables accounting for macroeconomic, financial and institutional development were included in the model. The composition of control variables in these models largely coincides with that of similar models estimated for loan market depth and described for other
financial market sectors described above. The optimum points obtained are robust to variation in a number of complementary explanatory factors in the models.

Russian insurance sector’s average assets in the five-year period of 2010–2014 stood at 1.8% of GDP, are expected to rise to 2.2% in the next five-year period of 2015–2019, and to 8% of GDP by 2035. This will bring Russia very close to the estimated threshold levels for all the macroeconomic policy objectives (excluding inflation, for which no threshold values were determined). Consequently, Russia has a considerable potential to benefit from further development of the insurance market. The threshold levels of the economic growth rate and GDP growth volatility are found to be the closest to the current value of insurance market depth in Russia, although in reality the insurance market has quite a long way to go to reach these threshold levels; while the current insurance market size is even farther away from the optimum value for the measure of systemic banking crises (the fourth target).

6. Optimization of the regulator’s utility function and estimation of long-term economic effects for Russia

6.1. Results of the optimization of the regulator’s utility function using key variables of the financial sector

The results of econometric modeling suggest that the nonlinear effects under which financial development may become excessive after reaching a certain threshold (the “too-much-finance” effect, Arcand et al., 2015), are found for all the financial development indicators examined. Under the methodology described above, the existence of nonlinear effects allows specifying the regulator’s utility function from stimulating the development of the financial sector’s particular segments from the perspective of achieving the four above objectives. The regulator’s utility functions were determined for each of the six financial development indicators along with the values of indicators maximizing this utility (see Figures 7.1–7.6 of Appendix).

First, the estimation suggests that the regulator’s utility function from promoting the private sector loan market development is reached at a point where the ratio of loans to GDP is 84% (See Figure 7.1 of Appendix). Russia is steadily moving towards this point: the average loan market depth stood at 49% in 2010–2014, is expected to increase to 60% for 2015–2019 and to 73% by end-2035. The distance from the current to the optimal point is thus estimated at 24 percentage points (84% – 60%), or less than half of the level already reached. This points to an appreciable market expansion potential. It has to be admitted though that this potential may fail to be all realized in full in the long-term.

5 For the description of scenario provisions and the results of long-term financial development forecasts, see Mamonov et al. (2017).
Second, estimation for the domestic corporate bond segment has suggested that the optimum of its deepening is 32% of GDP (See Figure 7.2 of Appendix). Russia is moving towards this point: the average depth of the market under analysis stood at just 6.5% of GDP in 2010–2014. It is expected to reach 10% in 2015–2019 and to 35% by end-2035. The distance to the optimum point is, thus, estimated at 22 percentage points (32% – 10%), three times the level already reached. The potential of development from the current level to the optimum is quite substantial. Moreover, if favorable conditions are provided, this potential can all be realized in the long term.

Third, the estimated optimal value of external long-term corporate debt equaled 23% of GDP (see Figure 7.3 of Appendix). Russia is making its progress towards this mark: in 2010–2014, the average depth of Russian firms’ bond issues in foreign market came to 13% of GDP, it is expected to increase to 15% in 2010–2019 and to 22% by end-2035. The distance to the optimum point is therefore estimated at 8 percentage points (23% – 15%), ¾ of the level achieved. The development potential is small, much smaller than that for the loan and domestic corporate bond markets. There is a chance for it to be largely realized (subject to a decline in geopolitical tensions) in the long term.

Fourth, the stock market sees a situation opposite to the cases described above: Russia is moving away from an optimum point of 10% of GDP (see Figure 7.4 of Appendix). The average stock market depth stood at 41% of GDP in 2010–2014 and is expected to decline to 37% in 2015–2019. Under the most favorable conditions possible, stock market capitalization is forecasted to rise to 84% by end 2035. The distance to the optimum point is therefore estimated at 69 percentage points (106% – 37%), around 3 times the level achieved. The potential of development to the optimum level is quite substantial, but, unlike the corporate bond market, it will hardly be realized within the next 15-20 years.

Fifth, the estimation has shown that the regulator’s utility function from promoting the development of the independent pension savings market is reached at a point where the ratio of the relevant fund assets to GDP equals 52% (see Figure 7.5 of Appendix). Russia is moving towards this point, albeit slowly: the average depth of the market under analysis equaled 2.5% of GDP in 2010–2014. It is expected to reach 4% in 2015–2019 and to increase to 10% by end-2035. Hence the distance to the optimum point is estimated at 48 percentage points (52% – 4%), 12 times the level reached. The potential of development from the current to optimum level is the largest among the financial market segments studied. However, only a small part of this potential can be realized in the long term even under the most favorable macroeconomic, institutional, and demographic conditions.

Sixth, the estimation has produced an optimum point of 13% of GDP for the insurance market (see Figure 7.6 of Appendix). In recent periods, the domestic insurance market has been stagnating far away from this point: the average depth of the market under analysis was 1.8% in 2010–2014, while in 2015–2019 its weak
growth to 2.2% is expected. The current distance to the optimum point is therefore estimated at 11 percentage points (13% – 2%), around 6 times the level reached. This segment’s development potential is one of the largest (second only to that of the pension funds). Under a best-case long-term scenario, an insurance market depth may increase to 8% by end-2035. A considerable part of the potential can be realized in the long run under favorable conditions.

6.2. Estimation of long-term economic effects for Russia from approaching the optimum values of financial sector development

1. The study identified the financial sector’s segments whose development to the optimum level is capable of securing the strongest cumulative macroeconomic effect for Russia (the change in the regulator’s objective function, see Table 7).

### Table 7. Optimum and current parameters of Russia’s financial sector development

| Financial sector parameter, % of GDP | Bank loans to private sector | Domestic corporate bonds | External corporate debt | Stock market capitalization | Independent pension fund assets | Insurance sector assets |
|-------------------------------------|-----------------------------|--------------------------|-------------------------|-----------------------------|-------------------------------|-------------------------|
| Value of financial sector parameter | Average over 2015–2019       | 59.8                     | 9.9                     | 15.3                        | 36.9                          | 4.1                     | 2.2                     |
|                                      | Optimum (model)              | 84                       | 32                      | 23                          | 106                           | 52                      | 13                      |
| Transition into optimum              | \( \Delta X \)               | 24.2                     | 22.1                    | 7.7                         | 69.1                          | 47.9                    | 10.8                    |
| Effect from financial development    | \( GDP \)                    | 0.3                      | 1.4                     | 1.0                         | –0.5                          | 4.1                     | 1.9                     |
| (optimum less average over 2015–2019)| \( \sigma(GDP) \)            | –1.0                     | –0.2                    | –0.7                        | 1.2                           | –5.6                    | –2.7                    |
|                                      | \( CPI \)                    | 0.2                      | –3.7                    | –1.1                        | –3.4                          | –6.7                    | 1.7                     |
|                                      | \( CRISIS \)                 | 2.5                      | –8                      | 0.6                         | –38                           | –86                     | –76                     |
| Change of the regulator’s objective  | \( \Delta L \)               | 0.11                     | 0.46                    | 0.24                        | 0.47                          | 2.57                    | 1.45                    |
| function                             | Elasticity of the regulator's |                          |                          |                             |                               |                         |                         |
|                                      | objective function for the   |                          |                          |                             |                               |                         |                         |
|                                      | financial sector parameter   |                          |                          |                             |                               |                         |                         |
|                                      | \( \Delta L/\Delta X \)      | 0.4%                     | 2.1%                    | 3.1%                        | 0.7%                          | 5.4%                    | 13.4%                   |

Reference: for 2015–2019

| \( GDP \) | \( \sigma(GDP) \) | \( CPI \) | \( CRISIS \) |
|-----------|-------------------|-----------|--------------|
| 0.25      | 1.7               | 6.6       | 60-80        |

Notes:
1) These estimates do not take account of possible substitution/complementation effects between various segments of the financial market.
2) GDP – 5-year average of annual GDP growth. \( \sigma(GDP) \) – standard deviation of annual GDP growth over a five-year period. CPI – annual inflation over a five-year period (CPI), log., CRISIS – the fraction of years witnessed banking crises (Laeven and Valencia, 2012), over a five-year period.
The strongest cumulative macroeconomic effect is achieved through the development of institutional investors. Growth in independent pension fund assets from the current (average expected for years 2015–2019) to an optimum point of 52% of GDP or a rise in insurance companies’ assets to an optimum of 13% of GDP should result in the change of the regulator’s objective function by 2.6 and 1.5 respectively.

The average cumulative macroeconomic effect is secured through accelerated development of the domestic securities market. The change of the regulator’s objective function due to the size of domestic corporate bond market and equity market capitalization achieving optimum levels should equal 0.46 and 0.47 respectively.

Expansion in private external long-term corporate debt produces a slightly lesser cumulative effect. For the objective function of macroeconomic policy, a cumulative effect from this debt reaching an optimum level of 23% of GDP is 0.24.

The weakest cumulative effect is produced by expansion in bank loans to the private sector. The cumulative effect of private sector loans reaching an optimum level of 84% of GDP for the objective function of macroeconomic policy is 0.11.

2. Domestic financial market segments can be split into three groups depending on how desirable, in the regulator’s view, is their development to the optimum level.

A positive effect for all of the four policy objectives is secured through the development of independent pension funds and domestic corporate bond market.

A positive effect for most of the objectives is achieved through an external long-term corporate debt increase to the optimum level, and through insurance sector development. External long-term corporate debt expansion to the optimum level promotes economic growth, brings down its volatility, heightens price stability but depresses financial stability somewhat. While by attaining the optimum level, the insurance sector helps economic growth acceleration, reduces growth volatility and financial instability, it, nevertheless, leads to price rises (possibly because of excessive increase in insurance expenses included in the costs).

A positive effect for just half of policy objectives is produced through bank loan and stock market development to the optimum level. Bank loan market development to the optimum level may cause negative “side effects” for financial and price stability but at the same time may also have a positive effect on economic growth and its stability. Stock market development shows a mirror image of the above: negative effects for economic growth and its stability, and positive effects for price and financial stability.

3. The domestic financial sector segments which can be identified as having high priority for development are those for which transition to the optimum state,
on the one hand, ensures the strongest cumulative macroeconomic effect, and, on the other hand, requires the least effort, as measured by the size of the gap with the current state.

From this perspective, the following priority hierarchy can be suggested (see Figure 8 of Appendix):

— the highest priority – insurance sector, independent pension funds;
— medium priority – domestic corporate bonds, bank loans, external long-term corporate debt;
— limited priority – equity market

### Table 8. Forecasted and current parameters of Russia’s financial sector development

| Financial sector parameter / GDP, % | Bank loans to private sector | Domestic corporate bonds | External corporate debt | Stock market capitalization | Independent pension fund assets | Insurance sector assets |
|------------------------------------|-----------------------------|--------------------------|------------------------|-----------------------------|--------------------------------|------------------------|
| Value of financial sector parameter | 2015–2019 average | 59.8 | 9.9 | 15.3 | 36.9 | 4.1 | 2.2 |
|                                   | RUSSIA-2035 | 72.9 | 34.6 | 22.0 | 84.4 | 9.8 | 8.2 |
| Change over forecast period | ΔX | 13.1 | 24.7 | 6.7 | 47.5 | 5.7 | 6.0 |
| Effect from financial development (forecast less 2015–2019 average), p.p. | | | | | | | |
| GDP | 0.2 | 1.5 | 0.9 | -0.3 | 1.4 | 2.0 |
| σ(GDP) | -0.7 | -0.2 | -0.7 | 0.8 | -1.3 | -2.8 |
| CPI | 0.0 | -4.0 | -1.0 | -3.0 | -1.7 | 1.1 |
| CRISIS | 1.0 | -6.0 | -0.6 | -31.0 | 0.0 | -67.0 |
| Change of the regulator’s objective function | ΔL | 0.09 | 0.45 | 0.23 | 0.43 | 0.38 | 1.38 |
| Elasticity of the regulator’s objective function for the financial sector parameter | ΔL/ΔX | 0.7% | 1.8% | 3.5% | 0.9% | 6.6% | 23.0% |
| Reference: for 2015–2019 | GDP | σ(GDP) | CPI | CRISIS | | | |
| | 0.25 | 1.7 | 6.6 | 60-80 | | | |

Notes:
1) These estimates do not take account of possible substitution/complementation effects between various segments of the financial market.
2) GDP – 5-year average of annual GDP growth. σ(GDP) – standard deviation of annual GDP growth over a five-year period. CPI – an annual inflation over a five-year period (CPI), log., CRISIS – the fraction of years witnessed banking crises (Laeven and Valencia, 2012), over a five-year period.

4. The growth limits for various financial market segments impose constraints on the size of a cumulative macroeconomic effect that can materialize on the long-term forecast horizon (see Table 8). It is hardly feasible to go beyond these limits without extraordinary steps taken and circumstances emerging, which in turn implies extraordinary efforts and costs. Development priority assessment for domestic financial sector segments, which is linked to a specific historic period,
should take into account the nonlinearity of this development and non-uniform realization of macroeconomic effects which this development produces.

Based on these considerations, the following development priority hierarchy for the period until 2035 is suggested (see Figure 9 of Appendix):
— the highest priority – insurance sector;
— medium priority – independent pension funds, domestic corporate bonds, bank loans, external long-term corporate debt;
— limited priority – equity market.

The priority of independent pension funds was lowered because macroeconomic effects of their development are realized gradually and constraints on its development are greater than in other financial segments on the forecast horizon.

5. Given the objective growth limits of various financial market segments in the long run, the cumulative macroeconomic effect of their development can be realized only partially. Under the best-case scenario, the change of regulator’s objective function until 2035 will be just 50–60% of the financial sector’s development to its optimum.

The potential of macroeconomic change will be realized in full or almost in full thanks to the development of domestic corporate bond market, insurance sector, and external long-term corporate debt. For bank loans and the equity market, 80–90% of potential will be realized, for independent pension funds – just 15%.

Since development will not reach the “too-much-finance” levels (Arcand et al., 2015) until 2035, no negative macro “side effects” will be seen as a rule, i.e., for most of the financial sector segments, their development will simultaneously accelerate long-term economic growth, reduce growth volatility and enhance price and financial stability. The only exception is the development of the equity market (the macro “side effect” is some slowdown in GDP growth and its volatility increase) and the insurance sector (some price stability reduction).

6. Change in the structural proportions of financial sector development to the optimal level will point to qualitative changes.

First, this means change in the ratio between bank lending and corporate bond issues. Whereas in 2010–2014, this ratio averaged 8:1, the optimum condition implies a ratio of 2.5:1. This ratio is closest to the median for countries forming Cluster 3 (“Balanced leaders”, see Stolbov et al., 2018; Table 9). These countries’ median ratio is close to 2.5:1.

Second, this means a substantial rise in the role of institutional investors (independent pension funds and insurance companies) compared with banks. Whereas in 2010–2014, total assets of domestic independent pension funds and insurance companies averaged 4% of GDP (according to the World Bank data), in the optimum state they should reach around 65% of GDP. This is also close to the
median of the countries making up the “Balanced leaders” cluster (see Table 9) – 51% on average in 2010–2014.

Meanwhile, there is a relationship between growth in the domestic corporate bond market and equity market capitalization on the one hand, and expansion in institutional investors’ assets on the other hand. Also, growth in loans to firms for financing fixed investment raises firms’ market value. It should be noted that this study did not aim to examine relationships between various financial market segments. It estimated “net” effects of achieving optimum levels for each of financial sector depth indicators without looking into their relationships with one another.

**Table 9.** Financial development parameters by country cluster based on 2010–2014 data

| Value of financial sector parameter | Optimum (model) | Median | 10th percentile | 90th percentile | Median | 10th percentile | 90th percentile | Median | 10th percentile | 90th percentile | Median | 10th percentile | 90th percentile |
|------------------------------------|-----------------|--------|-----------------|-----------------|--------|-----------------|-----------------|--------|-----------------|-----------------|--------|-----------------|-----------------|
| Financial sector parameter, % of GDP | Bank loans to private sector | Domestic corporate bonds | External corporate debt | Stock market capitalization | Independent pension fund assets | Insurance sector assets | Bank loans to private sector | Domestic corporate bonds | External corporate debt | Stock market capitalization | Independent pension fund assets | Insurance sector assets |
|------------------------------------|-----------------|--------|-----------------|-----------------|--------|-----------------|-----------------|--------|-----------------|-----------------|--------|-----------------|-----------------|
| Cluster 1 (“Autonomus”)            | 84              | 32     | 23              | 106             | 52     | 13              | 17.7            | 0.6    | 2.8             | 2.1             | 0.1    | 1.0             | 56.9            | 16.4            | 40.1            | 59.1            | 19.1            | 6.5             |
| Cluster 2 (“Overheated leaders”)   | 147.4           | 64.6   | n/a             | 78.1            | 67.3   | 51.5            | 103.5           | 14.3   | n/a             | 31.6            | 9.0    | 24.9            | 185.6           | 116.3           | n/a             | 119.4           | 109.3           | 96.6            |
| Cluster 3 (“Balanced leaders”)     | 107.8           | 44.5   | 10.8            | 69.2            | 15.5   | 35.3            | 131.2           | 57.7   | 14.0            | 230.2           | 92.1   | 87.9            | 131.2           | 57.7   | 14.0            | 230.2           | 92.1   | 87.9            |
| Cluster 4 (“Junior partners”)      | 65.5            | 7.1    | 10.1            | 21.8            | 7.4    | 9.8             | 47.3            | 1.2    | 3.6             | 5.1             | 1.9    | 2.8             | 73.7            | 37.0   | 55.4            | 68.7            | 16.0             | 18.2            |

The estimation of optimum development levels for various financial sector segments, with the effects of their mutual influence taken into account, will be addressed in further studies. This may result in an appreciable adjustment of our findings. The findings of this study are therefore preliminary.

*Appendix is available at www.cbr.ru/eng/money-and-finance; dx.doi.org/10.31477/rjmf.201803.89*
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