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# The Outcome of Directed Lending in Belarus: Mitigating Recession or Dampening Long-Run Growth?

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## Abstract

This study analyzes the effects of directed lending upon total factor productivity and GDP growth in Belarus over the period of 2000–2012. In theory, directed lending can enhance physical capital accumulation and make the access to credit easier, but empirical studies often show that it leads to unproductive hoarding of capital and financing of lower-yielding projects. This study seeks to explore which of these effects has dominated in the Belarusian economy during a last decade. We find that expansion of directed lending has negatively affected TFP dynamics and thus negatively contributed to the rates of economic growth. . However, the detected negative impact of directed lending on total factor productivity was enfeebled by the expansion of market loans. In the future, this link between directed and market loans could cease to exit due to liquidity constrained commercial banks face. If continued, directed lending may

cause a more severe negative impact on TFP, and consequently undermine long-run economic growth.

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**KEY WORDS:** financial repression, directed lending, economic growth, transition economies, cointegration, vector error-correction model

**Non-technical summary**

Over the last decade, selective credit programs have been widely used to stimulate investment and growth in the Belarusian economy. Empirically, rising volumes of directed loans have been coupled with decent rates of GDP growth. However, the positive association between directed lending and total factor productivity growth is not so obvious. There is voluminous theoretical and empirical claiming that directed lending encourages unproductive hoarding of capital and politically-motivated financing of lower-yielding projects. At the same time, some in-country studies, including on China, India, and South Korea, recognize a positive link between financial repression and growth, stemming from enhanced accumulation of physical capital and easier access to credit for firms. For Belarus, the relationship between directed lending and total factor productivity is of major concern, as directed lending is expected to affect the incentives of firms and banks. This study seeks to empirically address this question over a period of 2000–2012 by employing two approaches: structural model with cointegration relationships and vector error-correction model. We trace the effects of two major types of directed loans – loans to agriculture and to households for residential construction – on the total factor productivity of the whole economy. The key result is that taken together, directed loans adversely affect total factor productivity and, through that, negatively contribute to GDP growth rates over the period concerned. As for the impact of individual elements of selective credit programs, it varies. For housing construction loans, the effect on factor productivity is strictly negative. As for agricultural loans, the effect is more ambiguous: it varies from being slightly positive to zero.. We also find that the spread between interest rate on directed loans and market interest rate amplifies these negative relationships. Lower preferential rates imply larger losses in factor productivity. It is important to stress that over a period concerned the growth of outstanding

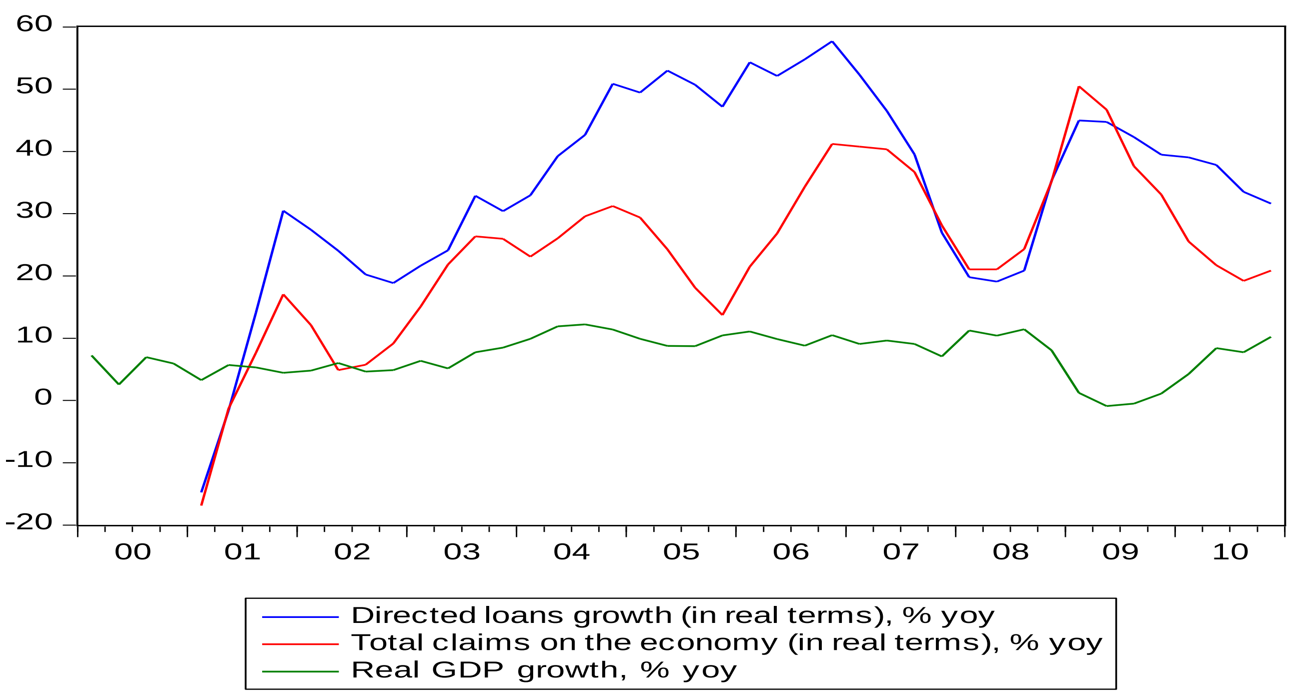
directed loans led to an increase of outstanding market loans. As the latter positively affect total factor productivity, the negative impact of directed loans has been weakened. This positive linkage between directed and marker loans is a product of expansionary monetary policy. This policy is aimed to maintain inflationary economic growth, but this phenomenon is out of scope of our analysis. Yet, if the government adheres to macroeconomic stability, then a trade-off between directed and market loans resurfaces and the negative impact of the former on TFP strengthens.

This implies that if the government seeks to maintain high growth rates in the economy, based on the efficient use of the factors of production, it should downscale directed lending.

## A. Introduction

### i. Policy context of the study

In Belarus, directed lending consists of two major elements: (i) the provision of designated volume of loans to selected sectors of the economy, mainly to agriculture, and to households – for the purpose of housing construction; and/or (ii) at interest rates lower than market rates. These selective credit programs have been implemented in order to avoid underinvestment and thus to stimulate output growth. According to the calculation by Fitch Ratings (2010), by the end of 2009, almost half of the outstanding loans in the economy were directed ones. The IMF provides a slightly smaller, but still substantial, figure of 46.2% (IMF, 2010). According to our own calculations, throughout 2011, the volume of directed loans amounted to about 40% of the total volume of outstanding loans. Yet, for the years to come the government has not planned any substantial cut of the volumes.




*Source*: authors' calculations on the basis of the data from the NBB and Belstat

Figure 1: The dynamics of directed loans, total loans, and GDP

The practices of directed lending have varied over the years. In the mid-1990s, selective credit policy was largely supply-centered, but later has been shifted to stimulate investment demand. While initially producers of agricultural machinery and equipment received preferential loans, later producers of agricultural goods were subsidized to acquire new capital goods.

Directed loans are provided by two state-owned banks, which collectively account for approximately 70% of assets and capital of the Belarusian banking system. The government remains the key shareholder of these banks (with ownership of nearly 100% of shares). It is thus legal for the government to intervene in the operation of these banks, as permitted by the relevant Edicts of the President, Government acts, and so on. Naturally, banks have to be persuaded or compensated to lend at low rates. For example, they may be provided with a full or partial compensation from the budget or receive rediscount priority loans from the National Bank (NBB) on concessional terms.

In Belarus, the government has not simply commanded banks it largely owns: in addition, there were guarantees on household deposits and relaxed reserve requirements. Other means of support have included direct refinancing by the National Bank, holding of government deposits in these banks, recapitalizations, and direct budgetary subsidies. Prior to 2003, refinancing of banks was connected to the provision of housing loans. In fact, the National Bank was the true lender in disguise, while commercial banks were used as mere intermediaries. Over 2004–2009, direct budgetary subsidies and government's deposits prevailed. From 2009 onwards, refinancing by the NBB resurged as the one the main sources of directed loans provision.

Over the last decade, bank recapitalizations were often applied to supply banks with the necessary liquidity. For instance, at the end of 2009, the NBB opened credit lines for two state-owned banks for a total volume of about 7% of total assets of these banks (or about 45% of their regulatory capital). These credit lines secured refinancing up to five consecutive years at the NBB's refinancing rate. In December 2010, statutory capitals of three major state-owned banks were increased at the expense of the budget's consolidated revenues. As a result, the volume of regulatory capital of these banks was enlarged by 22%, resulting in a 15%-increase for the banking system as a whole.

In fact, directed lending makes state-owned banks depending on the injections of liquidity from the government and the NBB, because alternative sources of capitalization remain scarce. This claim can be corroborated by short-term macroeconomic dynamics, which is affected by the use of a certain policy instrument from the menu described above. In particular, the use of direct refinancing corresponds with the expansion phase of the cycle and accelerated inflation. However, what instrument is employed does not matter for the rates of economic growth over the long run. This is because these instruments do not directly influence the functioning of channels through which the effects of financial lending upon growth are realized, such as total factor productivity in general and capital productivity in particular.

### ii. Statement of the research problem

How does directed lending in Belarus affect the dynamics of total factor productivity and the rates of GDP growth over the long run? Are there any signs of deteriorations of these macroeconomic indicators, associated with a substantial share of directed loans in the economy? Under selective credit programs, banks are partially deprived of their autonomy to make decisions over the provision of credit. Thus, banks' intermediation role is circumscribed by the authorities. On the one hand, directed loans may spur capital accumulation as firms have access to cheap loans and thus invest and – arguably – produce more. On the other hand, these loans may be allocated to lower-yielding projects and thus dampen growth rates of factor productivity and of GDP. In addition, non-favored companies – typically from the private sector – face higher interest rates. World Bank (2012) detects that soft budget constraints allow favored companies receive loans up to three times cheaper, if judged by the level of real effective interest rates. Although private companies tend to be more efficient than state-owned enterprises in terms of factor returns and profitability (World Bank, 2012), higher interest rates may reduce their demand for loans.

Therefore, there are two opposite forces at work: accelerated capital accumulation by the recipients of directed loans versus lower demand for capital by non-favored borrowers, or lower supply of credit by commercial banks, which are unable to infinitely expand their loan portfolios. At the macroeconomic level, the core question is the implications of the working of these two opposite forces for economic growth.

One of the best ways to address the research question is to analyze microeconomic data, but the series available cannot be used to make a meaningful inference. In particular, the dataset from Business Environment and Enterprise Performance Survey (BEEPS) conducted by EBRD in 1999, 2002, 2004, 2005, and 2009, include only several state-owned enterprises, which borrowed 50% and/or more of their loans from state-owned banks to finance capital expenditures. In particular, in 2009 there were only five of such enterprises (out of the sample of 347 companies), in 2005 – only two. In 2002 only two state-owned companies in the survey borrowed about 30% of their total volume of loans to pay for capital goods. The Ministry of Economy has a database of about 4,000 about enterprises, which receive state support in various forms, ranging from direct subsidies, tax rebates, and to directed loans, but this database is not open to the public (World Bank, 2011).

In this situation, we resort to macro-econometric analysis of available time-series. In particular, we seek to address the question whether directed loans contribute to increase in TFP and, through that, to GDP growth. A novelty of our paper is that traces the effects of lending provided to particular sectors, such as agriculture and housing. These sectors are the major recipients of directed loans. Agriculture remains to be the largest recipient of government aid in general, which is provided in various forms. While in 2010, the share of agricultural output in GDP was only 8%, the sector received up to 5% of GDP as subsidies in various forms (World Bank, 2011). At the same time, more than a half of agricultural companies were loss-makers, against 6.5 percent share in industry (according to Belstat data). Thus, there are strong reasons to suspect that at least a fraction of funds provided to agriculture is used unproductively.

As for housing construction, cheap residential loans are given to households, whose living conditions require ‘a drastic improvement’, as it is stipulated by the Belarusian legislation (which establishes the minimum amount of square meters per household member). Households in need are typically unable to pay for new housing in full and therefore liable for preferential housing loans. This policy exists only in Belarus among all other post-socialist countries, at least in terms of its scope. In fact, it can be considered as a part of peculiar ‘welfare state’ policy. However, investment in housing construction ‘do not contribute directly to building productive capacity’ of the economy (IMF, 2010, p. 24). Thus, expansion of this type of loans may reduce the returns on investment further.

## iii. Objectives of the study

We seek to estimate the effects of directed lending on total factor productivity and economic growth over a period of 2000–2012. At the first stage, we perform standard growth accounting procedures in order to estimate production function and calculate TFP for the economy as a whole. Next, we conduct co-integration analysis to detect whether there are long-term relationships between directed loans, fixed investment, and TFP dynamics and rates of GDP growth. We then formulate and test the structural model in order to determine the strength of the relationships among variables in question and trace the effects of policy shocks.

## B. Literature Review

### i Finance and growth: theoretical and empirical studies

There is a voluminous literature on the relationship between finance and economic growth. Cross-country empirical studies find that economies with more developed financial systems exhibit faster rates of growth of total factor productivity. In our study, we are concerned with the effect of directed lending, which is a government-created distortion in the bank-based financial intermediation[1], for productivity and growth of the whole economy.

The key function of financial intermediation is to link lender-savers and borrowers-spenders (Mishkin, 1992, p. 33). Functional system of financial intermediation processes information regarding investment opportunities and allocates capital to higher-yielding projects (King and Levine, 1993; Levine, 2002). Financial intermediaries act as agents that close information gaps between savers and investors. In doing so, they acquire ‘a comparative informational advantage over both savers and investors’ (Scholtens and van Wensveen, 2003, p. 18). They screen and monitor investors’ performance on the behalf of savers and charge

[1] The financial system of Belarus is centered on banks; financial markets are rudimentary.

transaction costs to parties on that basis (Greenwood and Jovanovic, 1990; Valdez and Wood, 2003).

Second, financial intermediaries can improve corporate governance of borrowers by economizing on monitoring costs. This activity reduces credit rationing and thereby boosts productivity and physical capital accumulation (Bencivenga and Smith, 1993). Third, financial intermediaries agglomerate capital for investment from different savers, who individually face the transaction costs and informational asymmetries, and thus help to overcome investment indivisibilities.

Levine (2002) stresses those positive relationships between finance and growth stem from the quality of financial intermediation. This quality improves, if financial intermediaries operate freely. If the governments intervene into the process of credit allocation, positive effects of financial intermediation are very likely to be mitigated. In a classical contribution by McKinnon (1973), government intervenes into the process of credit provision in order to help certain sectors of the economy to obtain cheap loans. This intervention, based on interest rate ceilings, results in 'financial repression', which leads to a misallocation of scarce funds. Financial repression is a set of measures, including high reserve requirements, discriminatory taxation of financial intermediaries and depositors, and selective credit programs (Roubini and Sala-i-Martin, 1992a, 1992b; Reinhart and Sbrancia, 2011).

Fry (1995, p. 433) distinguishes between six major types of selective credit techniques, such as 'subsidized loan rates for priority sectors, differential rediscount rates, direct budgetary subsidies, credit floors, credit ceilings, and proliferation of specialized financial institutions'. Of these six, the common technique is 'subsidized loan rates for priority sectors'. Directed lending was practiced in the Asian countries, including South Korea, Indonesia, Philippines, Taiwan, Pakistan, and India, as well as in many African states. Virtually everywhere it was employed to promote development of selected industries and to alleviate financial constraints faced by domestic firms. However, the 1989 World Bank report maintains selective credit policies were a major cause of fiscal distress in these developing countries despite some initial positive contribution to growth.

Such distress was also observed in the former socialist economies, where in the early years of transition governments bailed out commercial banks, which had provided loans to underperforming firms. Banks had given loans, being confident that governments saved workers and enterprises for political reasons and thus helped banks not to fail (Gorton and Winton, 1998; Berglöf and Roland, 1995). Apparently, this was a policy of centralized intervention into the process of credit allocation with notable fiscal implications.

Sherif et al. (2003) construct a stylized, but illustrative story, typical of the early years of transition. Initially, government is reluctant to restructure enterprise sector, being afraid of likely output decline. Commercial banks are used to channel funds to support enterprises. Thus, the role of banks as effective intermediaries is distorted: they become ‘ineffective shells’ to execute patronage over the economy. Supported enterprises are not always able to pay off their debts – fully or partially – and thus receive extension on loan repayment. Banks start facing insolvency and are often recapitalized by government, which is costly for the budget. If banks are not helped, then portfolio problems resurface, especially when the volume of non-performing loans grows. Bank insolvency can further increase vulnerability of banking system and ‘hollow out’ the banks’ capital. In order to break this vicious circle, banks in the first instance should be allowed to get rid of non-performing loans. More importantly, both banks and companies need to be signaled credibly that no bail-out is to be provided in the future. In the East-Central European economies, including Poland, Hungary, and Slovakia, bank privatization to foreigners was one of the tools to prevent bad debts from growing the after a series of costly recapitalizations (Mihalyí, 2004).

The case of Belarus appears to be an exception among other transition economies. While in the advanced reformers, fiscal distress forced governments to stop their interference into financial systems, no similar incentive was available in Belarus. A somewhat similar policy has been implemented in contemporary China. As in Belarus, in China, government-owned banks dominate the banking system. In an empirical study, Demetriades et al. (2008) find that the Chinese banking system has helped to support the growth of both firm value-added and TFP of Chinese firms. Even state-owned and collectively-owned firms with access to bank loans in China displayed good performance. The same result is recorded when loss-making firms are included in the sample. Rousseau and Xiao (2007) employ cointegrated vector autoregressive models to show that banking sector development was central to success of China's 'real' sector, while the stock market influence was insignificant. Despite government controls, banking sector provided firms with access to credit and lifted financial constraints. However, in both papers, the results are obtained by using the sample of manufacturing firms, whose performance is sensitive to many factors, including, for instance, access to technology, foreign markets, abundant labor supply, and so on.

In essence, the case of China has to be considered with caution. First, easier access to credit is provided for some favored firms, which typically operate in the urban areas. Huang (2008) stresses a divide between rural and urban enterprises in China. The latter group of firms often faces higher interest and tax rates than the former. Excessive investment in the urban areas has resulted in the accumulation of bad debts and caused asset and property bubbles. The

Chinese government coped with these problems by injecting liquidity in the banking system, but this solution is hardly to be sustainable in the long run (Das, 2012).

To summarize, both theoretical and empirical studies – cross-country and in-country ones – point to two crucial channels through which directed lending affects growth. In essence, directed lending is a policy measure whereby governments assume the functions of financial intermediaries regarding credit allocation. This intervention affects productivity of factor use and the supply and demand of funds.

#### ii Allocative inefficiency

In numerous studies, productivity is one of the key channels through financial development has positive and significant effects on economic growth (e.g. Beck, Levine, and Loyaza, 2000; Levine and Zervos, 1998). In a simple AK model framework (Pagano, 1993), financial development affects the volume of resources available for capital accumulation, and can encourage savings and then raise the productivity of capital. When assessing the effect of four different indicators of financial development on three growth indicators, one of which is total factor productivity, King and Levine (1993) find positive and significant effects of all four financial development indicators on TFP for 80 countries for the period 1960-1989. Benhabib and Spiegel (2000) explore whether financial development affects growth solely through its contribution to factor accumulations, or whether it also has a positive impact on total factor productivity. They find that indicators of financial development are correlated with both fixed capital and TFP growth, but the results are sensitive to the inclusion of country fixed effects. In addition, the indicators that are positively correlated with TFP growth differ from those that encourage investment.

As Demetriades and Luintel (1997, p. 381) maintain, the link between economic growth and financial development depends on the in-country institutional factors. There are wide institutional differences so financial development may drive growth in one country, but not in another. For instance, in India, financial repression has not hindered growth, and has not undermined the expansion of finance, for the period between 1970-1971 and 1998-1999 (Bhattacharya and Sivasubramanian, 2003). Thus, at least in several cases – South Korea, India, and China – a positive association between financial repression and growth was established for certain time periods.

A theoretical justification for this positive interrelationship can be provided by referring to 'social returns' on investment. Stiglitz et al. (1993) claim that in developing countries, banks without directed loans would 'not allocate funds to those projects for which the social returns are the highest'. Alternatively, there are possible positive spillovers (DeLong and Summers, 1991), stemming from the support of particular sectors for the whole economy. For example, in South Korea, subsidies to steel and electricity sectors helped to develop manufacturing (Wade, 2005).

However, there are both theoretical and empirical doubts. For instance, Galbis (1977) shows that in a dual economy, with the differences in factor returns between two sectors, financial repression dampens the average efficiency of investment. Empirically, Demetriades and Fattouh (2001) find that in South Korea in the 1970s, when financial repression had been practiced, TFP was indeed growing, but below a potential rate, as funds were diverted from higher-productivity projects to lower-productivity ones. Moreover, capital hoarding and overinvestment occurred.

To summarize, financial repression may divert savings from their use in higher-yielding projects. As a result, productivity channel is enfeebled by *allocative inefficiency*, as lower-returns projects are selected by the authorities. This leads to lower capital and total factor productivity. Alternatively, selective credit policies, aimed to cheapen the price of capital, may encourage the implementation of highly capital-intensive production techniques and this leads to unproductive hoarding of capital. Companies are induced 'to draw credit funds' instead of a more efficient use.

If an argument that projects should not be judged by private, but by social returns (Stiglitz et al., 1998) is considered, then those returns are supposed to contribute to factor productivity. For instance, companies can build and maintain infrastructure, invest in skills of their employees, etc. Although there is an ample empirical evidence on the positive link between financial development and productivity at the macro (e.g. Beck et al., 2000) and the micro levels (e.g. Demirguc-Kunt and Maksimovic, 2002), there is a room to explore the effects at the country level, given the existing specific country-cases, such as China, India, and South Korea.

### iii Liquidity channel

If loans are provided to less efficient borrowers, the returns can be smaller and, hence, banks can experience problems with liquidity. If these dynamics persist over time, the supply of credit may gradually decline. One can invoke the situation in transition economies, where less efficient borrowers sought extensions of their credit lines and governments bailed banks out, but soon faced fiscal strains (Sherif et al., 2003). Thus, governments have incentives to share their responsibility for financial repression with banks. In their turn, banks have incentive to hedge against these negative effects and to balance their portfolios by charging higher interest rates for non-favored borrowers. Moreover, banks may reduce the margin between deposit and credit interest rates. This reduced margin may also be indicative of worsening of the quality of financial intermediation as banks' profits are squeezed.

In case the difference between initial market interest rate and interest rate set by the government is sufficiently large, banks may hedge against the risks associated with this gap by introducing a minimum acceptable effective interest rate on total portfolio of loans. If this portfolio, that consists of both directed and market loans, provides the rate of return less than a certain minimum acceptable rate, bank has an incentive to further shrink the credit supply in order to secure the desired inflow of interest payments. In that case, the amount of loans granted would contract along with the increase of the interest rate. Another option for banks is credit rationing, i.e. as shown by Stiglitz and Weiss (1993), given the limitations of a size of an individual's bank portfolio and the risks associated with higher interest rates.

The effect of the increase in the market interest rate is irrelative to the characteristics of the system of directed loans provision, i.e. whether all banks provide both type of loans or several banks provide both market and directed loans and other banks grant market loans only. The latter is the case of Belarus. A crucial effect is that 'reservation' of a fraction of banks' portfolio for directed lending leads to the reduction of supply of market loans. This outcome can be a product of both higher interest rates, stemming from the reduced supply of loans as banks cannot limitlessly enlarge their portfolios. To summarize, irrespective of the design of the banking system (either with a representative bank or two dominant banks), the logic of effects of directed lending upon interest rates and demand for loans remains essentially the same.

The case of Belarus appears to be under-researched. This is particularly striking, given the warnings issued by the World Bank and the IMF in their recent reports on the situation in the Belarusian economy. In particular, the World Bank (2010, p. 12) argues that the grafting of subsidies and cheap loans upon largely unchanged industrial structure has indeed supported economic growth, but productivity improvements are 'largely exhausted' so 'the medium-term prospects for Belarusian industrial growth deteriorate'. In a similar fashion, the IMF (2010, p. 24) admits that 'the returns from high investment appears to have diminished'.

These claims were supported by micro-economic evidence. In particular, Kolesnikova (2010) maintains that financially-distressed enterprises who receive state aid, including directed loans, record decrease in TFP. In contrast, TFP increases if state aid is directed to newly restructured companies. To the best of our knowledge, macroeconomic effects of financial repression in Belarus have not been explored, especially up to 2011. Korosteleva and Lawson (2009) analyze the effects of financial repression on the development of financial system in Belarus over the period of 1996–2002. They find that financial repression generally revived growth, but attribute this effect to the specificities of the Belarusian case, where 'finance did not matter in the long run'. Pervasive government controls over finance were 'survival-oriented' and not 'growth-promoting', thereby 'producing a shallow finance system and passive financial intermediaries'. *In contrast, our contribution aims to show that finance matter in the long run, even in the specific case of Belarus, while the task is to determine whether the effect is positive or negative.*

## C. Econometric model: specification and estimation results

### i. Theoretical model formulation

Output of the entire economy is specified in the form of the Cobb-Douglas production function with a Hicks-neutral technical progress (equation (1)).[2] The relationships between finance and growth are realized through the impact of the total volume of outstanding loans on total factor productivity. The presence of directed loans distorts these relationships. First, allocative inefficiency arises as the volume of directed loans increases. Second, the spread

[2]The equations are presented in log form, i.e. lower-case character means the log of a correspondent variable.

between preferential interest rate and market interest rate may produce additional impact on the total supply of loans. If banks are obliged to provide cheap loans, they are inclined to balance their portfolios, including by the means of increasing interest rates for non-favored loans to offset possible negative effects related to directed loans. Most typically, these effects are related to lower returns. Also, large volumes of directed loans in banks' portfolios make them more vulnerable and essentially distort their function of financial intermediation. Thus, total factor productivity can be related to the volumes of outstanding market loans, outstanding directed loans, and the interest rate spread between the market rate and preferential rate (equation (2)).

As for the volume of outstanding market loans, in the literature it is often modeled by using functions of credit supply or credit demand. Credit demand functions include proxies for real income, interest rate, and context-specific explanatory variables. Credit supply functions capture the major aspects of banks' behavior by incorporating base money, income proxy, proxies for risks perception by banks, and some other specific variables. Both functions can also be used in combination (Backé and Zumer, 2006). We follow this approach in our model in order to capture income and risk perception of banks.

The proxy for income is capital investments, which is the only component of aggregated demand considered in the paper. Directed lending is another explanatory variable for outstanding market loans, that is expected to trace the adjustment of banks' credit portfolios to risks related to the exposure to the directed loans. Finally, interest rate spread – between market interest rates and preferential interest rates – reflects both demand-side interest rate incentives and supply-side, risk-management aspects (see equation (3)).

Capital investments can be treated as a function of both directed and market loans, and total factor productivity. Directed loans are used extensively to stimulate capital accumulation.

Market loans are also used for capital investments, but on a much lesser scale, and often used to finance operating needs of firms. In the equation (4), TFP may be considered a proxy for income that determines the returns on capital investments. The final equation of the model (equation (5)), is the law of motion of capital. Each of the stochastic equations below contains a constant term and a time-trend.

$$rgdp_t = \alpha * l_t + (1-\alpha) * k_t + tfp_t \quad (1)$$

$$tfp_t = \beta_1^{tfp} * rdl_t + \beta_2^{tfp} * rml_t + \beta_3^{tfp} * sp_t + \beta_4^{tfp} + \beta_5^{tfp} * T + \varepsilon_t^{tfp} \quad (2)$$

$$rml_t = \beta_1^{rml} * ri_t + \beta_2^{rml} * rdl_t + \beta_3^{rml} * sp_t + \beta_4^{rml} + \beta_5^{rml} * T + \varepsilon_t^{rml} \quad (3)$$

$$ri_t = \beta_1^{ri} * rdl_t + \beta_2^{ri} * rml_t + \beta_3^{ri} * tfp_t + +\beta_4^{ri} + \beta_5^{ri} * T + \varepsilon_t^{ri} \quad (4)$$

$$k_t = k_{t-1} * (1 - rdr_{t-1}) + ri_{t-1} \quad (5)$$

In these equations, α is the share of labor income in GDP, $\beta_i^j$ are the parameters. The notations for the variables are provided in Table 1. It should be emphasized that directed lending largely consists of two types of loans – agricultural and housing ones. It is then possible to estimate the impact of these individual elements of selective credit programs. For that matter, the equations (3)–( 5) should be modified to include RDLA and RDLH instead of RDL.

Table 1: Variables of the model[3]

| Variable notation | Variable name |
|---|---|
| K | Capital Stock |
| L | Labor Employment |
| TFP | Total Factor Productivity |
| RGDP | Potential GDP |
| RI | Gross Capital Formation (Capital Investments) |
| RDR | Real Depreciation Rate |
| RML | Market Lending |
| RDL | Directed Lending |
| RDLA | Directed Lending to Agricultural Firms |

[3]Capital letters mean raw data, lower-case characters mean correspondent data in logs.

| | |
|---|---|
| RDLH | Directed Lending for Housing Purposes |
| SP | Interest Rate Spread (Between Market and Directed Lending rates) |

The parameters for the equation (1) are informed by the results of theoretical worked reviewed in the respective section. Equation (5) is an identity. As for the equations (2)–(4), dynamic characteristics of the data determine the choice of a relevant econometric technique. If the hypothesis of cointegration regarding equations (2)–(4) is not rejected, then the correspondent relationships may be analyzed through the error-correction model (ECM) framework. Hence, the econometric model would consider theoretical relationships, specified by the equations (2)–(4), as long-term ones, while additional relationships for short-term dynamics could also be estimated. Furthermore, dynamic characteristics of the data may allow the application of a Vector Error-Correction Model (VECM) to analyze the relationships specified by the equations (2)–(4).

### ii. Data

A first empirical step in our analysis is to perform growth accounting. GDP growth is broken down into the components associated with changes in factor inputs and in technologies. The growth rate of technology is measured as a 'residual growth' (Barro and Sala-i-Martin, 1995, p. 452). Growth accounting is used not to explain the forces that drive the growth, but to obtain the data for analysis of effects of directed lending on growth.

We use a standard production function with constant returns to sale, written as $Y = F(T, K, L)$, where T is the level of technology, K is the fixed capital stock, and L is the quantity of labor.

We reasonably assume technological progress to be disembodied. Apart from the claim that 'for many issues in macroeconomics, the distinction between embodied and disembodied technological progress is not so important, and therefore the analyst is inclined to assume the simplest form, which is definitely the disembodied form' (Groth, 2012, p. 30), there are other context-specific reasons to make this assumption. In particular, it is very difficult to estimate the costs of new capital goods as both old and new equipment produce output.

We use standard procedures for growth accounting (described in Barro and Sala-i-Martin, 1995, Chapter 10). In the production function for the whole economy, we use 0.65 and 0.35 for α and β, respectively. These values are observed in other transition economies (cf. Campos and Coricelli, 2002; Dolinskaya, 2001). Second, same weights are used in the most recent and comprehensive study of growth dynamics, which also performs growth accounting (Demidenko and Kuznetsov, 2012).

Data on real GDP, (as well as on real investments, and other components of domestic demand) are provided by Belstat within its System of National Accounts (SNA) reports. We use these time series in 2009-year prices, on the quarterly basis, within a sample of 1995q1 to 2012q2. The data on labor employment are also provided by Belstat, although some adjustments are made by using Household Budget Surveys.

However, we should reveal some important details associated with the data available on capital stock. 'Out of the box' time-series data on capital are inappropriate. First, Belstat estimates growth rates of capital in constant prices on the annual basis. Second, these growth rates are calculated on the basis of a gross capital concept. However, for the purposes of growth accounting, it is more appropriate to apply a net capital concept.

According to gross capital concept, only fully depreciated, 'retired' assets are extracted from the total stock of capital, while depreciation is not properly estimated. Third – and this is crucial – if we apply the available data on capital, some striking contradictions are immediately observed. In particular, over a period of 1995–2012, capital-output ratio decreases from 6.8 to 2.8. This dynamics is hardly compatible with a considerable increase in real capital investments throughout these years. Though the data on capital investments are obtained through the System of National Accounts, there are serious concerns about their quality. Thus, we need to find a better measure for capital investment.

OECD (2001) suggests a perpetual inventories method, which seems well applicable in the context of Belarus. Moreover, this method is based on a net capital concept. According to this approach, the value of capital stock is taken at a given moment of time, and then the series are constructed introspectively or retrospectively by using the data on investment dynamics. In this paper, a starting point in time is January 1, 2009. This is because the period of 2008–2009 was characterized by low inflation, so the problem of overvaluation or undervaluation of net capital stock is diminished, if not avoided (cf. Demidenko and Kuznetsov, 2012).

Furthermore, standard book-keeping depreciation rates cannot be used. First, reported rates do not account for changes in the depreciation rules made by the government in 2009 in order to reduce output costs. In particular, many enterprises were granted relaxed depreciation rules, largely in the form of lower deduction rates. Second, under the evidence of increasing capital-output ratio over the period of 2000–2011, the use of a standard available depreciation rate of 5.5 percent implies that in the year 2000 this ratio was equal to zero. This is unrealistic, especially given that we use the most recent series on fixed capital.

Consequently, the standard rate appears to be too low. In fact, this observation is compatible with the evidence from other transition economies, characterized by higher depreciation rates (Demidenko and Kuznetsov, 2012). In order to obtain a reliable figure of depreciation, one can look at the equipment to structures ratio of fixed investment. In 2000, this ratio amounted to 0.378, peaked to 0.47 in 2006, and since that year decreased. Given the values of this ratio and controlling for reasonable value of capital-output ratio, depreciation rate appears to be around 8% over 2000–2004, and then declined to around 6.7% since 2005q1. Indeed, if the volume of investment in machinery and equipment grow, while investment in structures declines, depreciation ratio increases (Evans, 2000).

The data on directed loans are taken from the banking statistics at the macro level. Apparently, better quality data can be obtained from portfolios of individual banks, but they do not register directed loans in their portfolios. Moreover, banks apply different definitions to what can potentially be considered as a ‘directed loan’. Thus, we look at the beneficiaries of directed loans, mostly agricultural enterprises and households (who receive loans for residential construction). A small fraction of directed loans is provided to large industrial firms, but the volumes can hardly be deducted from available banking statistics.

Loan portfolios of agricultural enterprises and relevant households are burdened with directed loans: almost 100% and about 80%, respectively. Next, directed loans are typically issued in the national currency, while foreign currency loans are provided at a market rate. Moreover, there are data on short-term and long-term loans, and anecdotal evidence suggests that directed loans are usually long-term ones. Thus, in our study, the total volume of directed loans is the sum of long-term loans to agricultural firms and to households, issued in the national currency (this data is available since 2000q1). In order to obtain real time series, we apply GDP deflator.

The data obtained are very close to the estimates produced on certain dates (see Figure 1), produced, for instance, by the IMF (IMF, 2009). In order to trace the individual effects of different types of directed loans, we distinguish between loans to agriculture (RDLA), and housing loans for households (RDLH). Accordingly, the total amount of directed loans is the sum of RDLA and RDLH. However, a very high correlation coefficient between RDLA and RDLH (0.98) indicates a problem of multicollinearity in case these explanatory variables are jointly inserted into the regression. We therefore begin with a basic model with RDL as a basic explanatory variable, and then estimate the same model individually with RDLA and RDLH, instead of RDL. This procedure enables us to estimate the effects of individual components of selective credit programs.

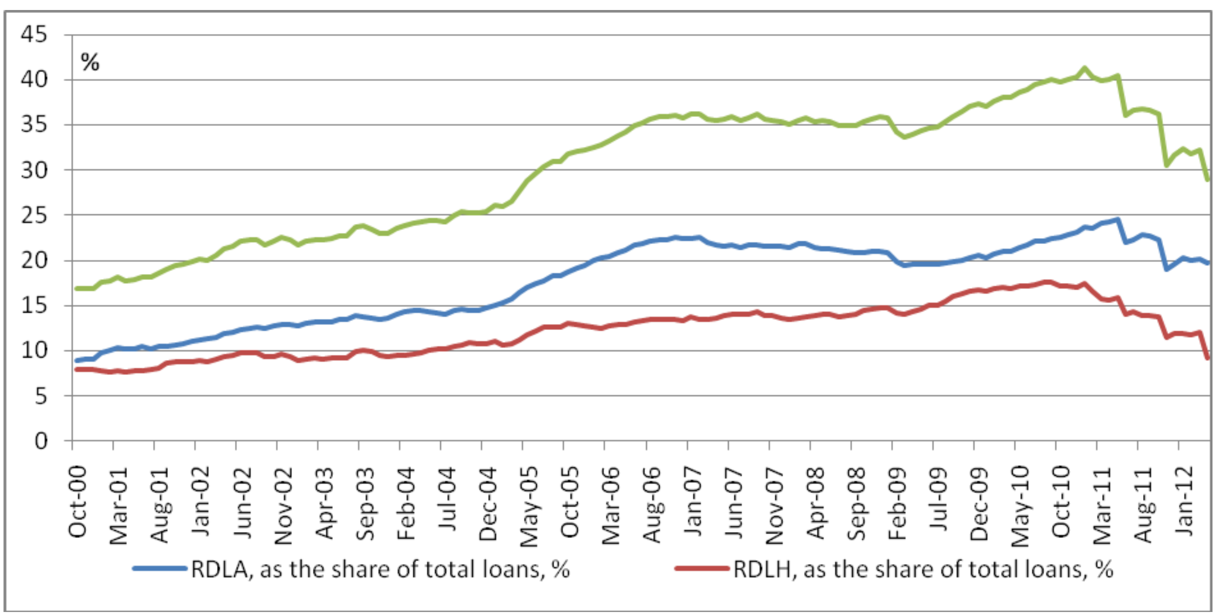



Figure 2. Directed loans as a share of total loans.

Series on interest rate spread is calculated on the basis on two real interest rates (deflated by GDP deflator). A proxy for preferential rate is the one charged on national-currency loans for agricultural firms, while a proxy for a market rate is the one for construction firms. Typically, construction firms do not receive directed loans, which are provided to households. This market rate is also less volatile than the interbank rate, which can also be considered as a proxy for a market rate. Time-series are shown in the Figure 3 below. Dynamic characteristics of the data – the results of unit root tests for data in logs – are provided in Table 2. As for TFP, the procedure of its calculation is described in the section on growth accounting.

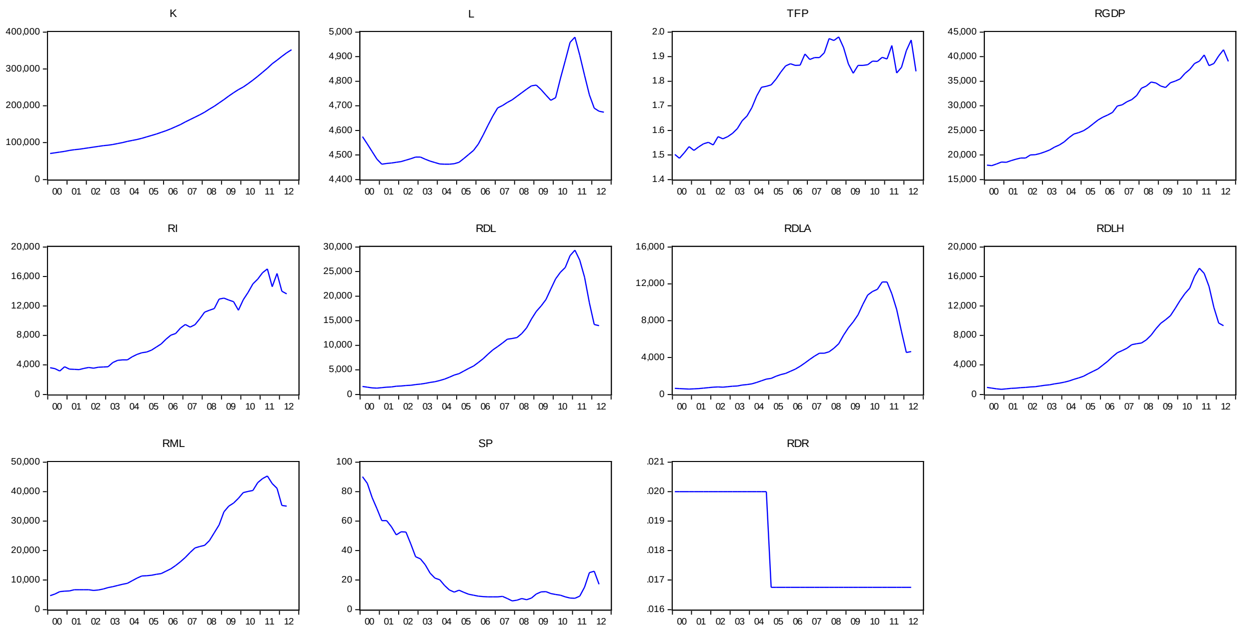



Figure 3. Data set

Table 2: Unit root tests

| Variable (in logs) | ADF-test specification | ADF-statistics (p-values) |
|---|---|---|
| TFP | const | -1.427 (0.561) |
| RI | const, trend | -1.801 (0.689) |
| RML | const, trend | -1.776 (0.701) |
| RDL | const, trend | -2.047 (0.561) |
| RDLA | const, trend | -2.391 (0.379) |
| RDLH | const | -1.621 (0.464) |
| SP | const | -2.094 (0.248) |

Note: The series were tested with a lag length basing on Schwarz info criterion. The sample is 2000q1-2012q2.

There are two structural breaks in the data: a period from 2008q4 until the end of the sample and over 2011q2–2012q2. The first period is associated with the influence of the global financial crisis, while the second one bears the stamp of the domestic currency crisis. One of the ways to alleviate the impact of the structural breaks is through the use of correspondent dummy variables. However, the impact of domestic currency crisis appears to be too significant and the direction of its impact on each individual variable was not homogenous throughout the period of 2011q2-2012q2. Hence, a set of dummy variables may be required to neutralize the impact of these structural breaks. Being aware of these difficulties, statistical inferences (direction of the impact, presence or absence of cointegrating relationships, and so on) are made on the basis of the full sample (2000q1-2012q2), by using impulse-indicator saturation approach (Hendry et al., 2008), while parameters are estimated on the basis of a reduced sample (until 2010q4).

### iii. Econometric model formulation

We consider that there are long-term relationships (cointegration) among the variables in the equations (2)–( 4). However, our sample includes 50 observations, so long-term estimates may not be robust. Being aware of that problem, we begin with a standard cointegration test following an Engle-Granger procedure, supplemented by two additional statistical methods. In particular, we use a dynamic specification of (2)–( 4) along with impulse dummy saturation, which allows to obtain much more robust results (Hendry and Mizon, 2011).

A basic framework contains two-step Engle-Granger method (Engle and Granger, 1987). This method is applicable to short samples. First, the following equation is estimated:

$$y_t = \mu + \delta T + \sum_{j=1}^{k} \beta_j x_t^j + u_t \qquad (6)$$

where $y_t$ – response variable, $x_t^j$ – a set of explanatory variables, $\mu, \delta, \beta$ are the regression coefficients, $T$ is time trend, and $u_t$ is an error term. Next, residuals from the equation (6) are tested by using a Dickey-Fuller procedure. If the null hypothesis is rejected, i.e. variables $y$ and $x^j$ are cointegrated, then short-run dynamics of the dependent variable should be analyzed by using error-correction model. The error-correction mechanism ($ECM_t$) is equal to the residuals of the equation (6):

$$ECM_t = u_t = y_t - (\mu + \delta T + \sum_{j=1}^{k} \beta_j x_t^j) \tag{7}$$

An error-correction model has the following form:

$$\Delta y_t = \varpi + \sum_{i=1}^{n} \varphi_i \Delta y_{t-i} + \sum_{i=0}^{n} \sum_{j=1}^{k} b_{ij} \Delta x_{t-i}^j + \gamma ECM_{t-1} + \varepsilon_t \tag{8}$$

where $\varpi, \varphi, b, \gamma$ are regression coefficients, $\varepsilon_t$ are regression residuals.

Dynamic modeling framework assumes that instead of equation (6) autoregressive model with distributed lags is estimated:

$$y_t = \mu + \delta T + \sum_{n=1}^{m} y_{t-n} + \sum_{n=1}^{m} \sum_{j=1}^{k} \beta_j x_{t-n}^j + u_t \tag{9}$$

In order mitigate the problem of structural breaks and outliers, equation (9) is 'saturated' by impulse indicator for every observation (significant variables are left in the equation). Under a relatively small significance level, the cost of testing of significance of such indicators for every observation period is extremely low (Johansen and Nielsen, 2009). Hendry and Mizon (2011) argue that 'Applying IIS in econometric modeling thus not only assesses the adequacy of a model, allows for external events that have significant effects on the phenomena being analyzed, and removes any adverse impacts from large data errors'.

Further, *PcGive* unit root test is applied to the equation (9), which is actually similar to the Dickey-Fuller test in respect to the equation (6). If the null hypothesis of no cointegration is rejected, from (9) we obtain a pseudo long-run solution in the form of equation (7), but with more robust parameters (with respect to original estimates of parameters in (7)) and may estimate short-term dynamics on the basis of equation (8).

In case of the hypothesis of no cointegration in the equations (2)–(4) is rejected, theoretical model (1)–(5) is transformed into the following set of equations:

$$rgdp_t = \alpha * l_t + (1-\alpha) * k_t + tfp_t \tag{10}$$

$$ecm_{tfp_t} = tfp_t - \left(\beta_1^{tfp} * rdl_t + \beta_2^{tfp} * rml_t + \beta_3^{tfp} * sp_t + \beta_4^{tfp} + \beta_5^{tfp} * T\right) \tag{11}$$

$$ecm_{rml_t} = rml_t - \left(\beta_1^{rml} * ri_t + \beta_2^{rml} * rdl_t + \beta_3^{rml} * sp_t + \beta_4^{rml} + \beta_5^{rml} * T\right) \tag{12}$$

$$ecm_{ri_t} = ri_t - \left(\beta_1^{ri} * rdl_t + \beta_2^{ri} * rml_t + \beta_3^{ri} * tfp_t + +\beta_4^{ri} + \beta_5^{ri} * T\right) \tag{13}$$

$$k_t = k_{t-1} * (1 - rdr_{t-1}) + ri_{t-1} \tag{14}$$

$$\Delta tfp_t = \sum_{i=1}^{n} \beta_{1i}^{\Delta tfp} * rdl_{t-i} + \sum_{i=1}^{n} \beta_{2i}^{\Delta tfp} * rml_{t-i} + \sum_{i=1}^{n} \beta_{3i}^{\Delta tfp} * sp_{t-i} + \beta_4^{\Delta tfp} + \beta_5^{\Delta tfp} * ecm_{tfp_{t-1}} + \varepsilon_t^{\Delta tfp} \tag{15}$$

$$\Delta rml_t = \sum_{i=1}^{n} \beta_{1i}^{\Delta rml} * ri_{t-i} + \sum_{i=1}^{n} \beta_{2i}^{\Delta rml} * rdl_{t-i} + \sum_{i=1}^{n} \beta_{3i}^{\Delta rml} * sp_{t-i} + \beta_4^{\Delta rml} + \beta_5^{\Delta rml} * ecm_{rml_{t-1}} + \varepsilon_t^{\Delta rml} \tag{16}$$

$$\Delta ri_t = \sum_{i=1}^{n} \beta_{1i}^{\Delta ri} * rdl_{t-i} + \sum_{i=1}^{n} \beta_{2i}^{\Delta ri} * rml_{t-i} + \sum_{i=1}^{n} \beta_{3i}^{\Delta ri} * tfp_{t-i} + \beta_4^{\Delta ri} + +\beta_5^{\Delta ri} * ecm_{ri_{t-1}} + \varepsilon_t^{\Delta ri} \tag{17}$$

For ECM models estimation, we apply ‘general-to-specific’ approach to the equations (11)–(13), (14)–(17), so the general specification (8) has been gradually shrunk to a more parsimonious version. The basic version of the model stipulates total directed loans outstanding (*rdl*) to be a policy variable. However, in order to distinguish between the impact of *rdla* and *rdlh*, we first substitute *rdl* for the *rdla* and then for *rdhl*.

In order to perform a robustness check, we consider *rdl (rdla, rdlh),sp* as endogenous variables and test for cointegration *tfp, rml, rdl (rdla, rdlh), sp* by using a Johansen test (Johansen, 1996). If the null hypothesis of no cointegration is rejected, then we may resort to a Vector Error-Correction Model framework:

$$\Delta \mathrm{Y}_t = \sum_{j=1}^{n} \Gamma_j \times \Delta Y_{t-j} + \Pi \times Y_{t-1} + \mu + \varepsilon \qquad (18)$$

Where $Y_t$ is the vector of endogenous variables (*tfp, rdl (rdla, rdlh), rml, sp*), $\Gamma_j$ is the matrix of coefficients of short-term impact of endogenous variables with lag *j*, $\Pi$ is a cointegration matrix for the vector of the variables; while $\mu$ is a constant term, and $\varepsilon$ is an error term. This framework might conflict with the exogenous character of *rdl (rdla, rdlh)* and *sp* (which is, in a sense, ‘predetermined’ policy variable). To some extent, this contradiction may be eliminated in case of weak exogeneity of correspondent variables in a system. If it is the case, a VECM framework might be expected to display the same direction of impact of *rdl* and *sp* on *tfp*.

## iv. Estimation results

A first step, which involves testing for cointegration (or, more accurately, the absence of cointegration) between TFP and other variables, gives us grounds to claim the existence of long-term relationships in each case (see Table 3).

Table 3: Long-Term Relationships for TFP

| Explanatory variables | Response variable | | |
|---|---|---|---|
| | *tfp (rdl-model)* | *tfp (rdla model)* | *tfp (rdlh model)* |
| *rdl* | **-0.082*** **(0.032)** | - | - |
| *rdla* | - | **0.061*** **(0.024)** | - |
| *rdlh* | - | - | **-0.168**** **(0.051)** |
| *rml* | 0.119* (0.051) | -0.073* (0.032) | 0.201** (0.058) |
| *sp* | -0.120** (0.016) | -0.090** (0.006) | -0.164** (0.019) |
| *const* | 0.479** (0.160) | 1.029** (0.126) | 0.438** (0.117) |
| *impulse dummy* | 2002q2*, 2006q4*, 2008q1*, 2008q4*, 2009q1*, 2009q2* | 2000q3**, 2000q4**, 2006q4*, 2008q1**, 2008q2**, 2008q3**. 2009q3* | 2001q1*, 2002q2**,2004q4**, 2005q1*, 2006q4**, 2008q1*, 2008q4**, 2009q1-q3** |
| Number of lags in the dynamic analysis | *1* | *1* | *1* |
| *PcGive unit root test,* $t_{ur}$ | -121.6** | -114.2** | -195.92** |

*Note: Standard errors are given in parenthesis. * - denotes significance at 5%-level, ** - at 1%-level.*

There are negative relationships between total volume of directed loans as well as housing loans the total factor productivity. Also, the interest rate spread negatively affects TFP.

Therefore, there is a presence of allocative inefficiency, which is augmented by the interest rate spread. Put simply, lower preferential rates inflict larger TFP losses. At this stage, we may claim there is a trade-off between market loans and directed loans: if an increase in the volume of directed loans negatively affects the volume of market loans, then larger TFP losses are observed, as the positive effects of market loans on capital accumulation are diminished.

In case of agricultural loans, the picture is more complicated. On the one hand, we observe a tiny positive effect for TFP, but this relationship may be enfeebled by the negative impact of the interest rate policy with respect to directed loans. Furthermore, the trade-off observed with housing loans disappears: there is a negative effect regarding market loans. The results of estimation of long-term relationships for market loans are provided in Table 4.

Table 4: Long-Term Relationships for RML

| Explanatory variables | Response variable | | |
|---|---|---|---|
| | *rml (rdl-model)* | *rml (rdla model)* | *rml (rdlh model)* |
| *rdl* | **-0.300*** **(0.140)** | - | - |
| *rdla* | - | **0.231*** **(0.047)** | - |
| *rdlh* | - | - | **0.244** **(0.165)** |
| *sp* | 0.208** (0.023) | - | |
| *ri* | 1.191** (0.119) | 0.892** (0.040) | 0.567** (0.163) |
| *const* | - | - | - |
| *T* | 0.043** (0.007) | - | 0.035** (0.05) |
| *impulse dummy* | 2006q2*, 2007q2*, | 2000q3*, 2005q2*, | 2002q1*, 2004q2, |

| | | | |
|---|---|---|---|
| | 2009q1*, | 2009q1* | 2006q2**, 2007q1-q2**, 2007q4**, 2008q1-q3**, 2009q1-q2*, 2010q1** |
| Number of lags in the dynamic analysis | *3* | *2* | *3* |
| *PcGive unit root test,* $t_{ur}$ | -36.50** | -29.70** | -93.49** |

*Note: Standard errors are given in parenthesis. * - denotes significance at 5%-level, ** - at 1%-level.*

Estimations of long-term relationships for capital investments are provided in Table 5:

Table 5: Long-Term Relationships for RI

| Explanatory variables | Response variable | | |
|---|---|---|---|
| | *ri (rdl-model)* | *ri (rdla model)* | *ri (rdlh model)* |
| *rdl* | **0.454**** **(0.016)** | - | - |
| *rdla* | - | **0.422**** **(0.027)** | |
| *rdlh* | - | - | **0.495**** **(0.026)** |
| *sp* | - | - | - |
| *tfp* | 1.180** (0.198) | 1.719** (0.332) | 0.722** (0.306) |
| *const* | 4.305** (0.065) | 4.626** (0.114) | 4.45** (0.102) |
| *impulse dummy* | 2000q3*-q4**, 2003q2-q3**, 2004q2*, 2005q1*, 2007q2**-q3*, 2008q1*, 2008q4**, 2009q4** | 2000q4**, 2003q2**, 2007q2*, 2009q4** | 2000q4**, 2003q2*, 2007q2*, 2008q4*, 2009q4** |
| Number of lags in the dynamic analysis | *1* | *1* | *1* |

| | | | |
|---|---|---|---|
| *PcGive unit root test,* $t_{ur}$ | -44.54** | -26.89 | -28.87** |

*Note: Standard errors are given in parenthesis. * - denotes significance at 5%-level, ** - at 1%-level.*

The results reported in Tables 3–5 determine correspondent error correction term specified in the equations (11)–(13). Hence, we may make a next step in model identification, namely estimation of equations (15)–(17). The results are reported in Tables 6–8.

Table 6: Short-Term Relationships for TFP

| Explanatory variables | Response variable | | |
|---|---|---|---|
| | *d(tfp) (rdl-model)* | *d(tfp) (rdla model)* | *d(tfp) (rdlh model)* |
| *d(tfp(-1))* | - | - | *-0,472***<br>*(0.148)* |
| *const* | - | - | *0.016***<br>*(0.003)* |
| *d(rdlh(-1)* | | | *-0.135***<br>*(0.037)* |
| *d(sp)* | -0.054**<br>(0.015) | -0.064**<br>(0.014) | -0.070**<br>(0.013) |
| *ecm_tfp(-1)* | -0.167*<br>(0.072) | -0.287**<br>(0.147) | -0.192**<br>(0.067) |

*Note: Standard errors are given in parenthesis. * - denotes significance at 5%-level, ** - at 1%-level.*

Table 7: Short-Term Relationships for RML

| Explanatory variables | Response variable | | |
|---|---|---|---|
| | *d(rml) (rdl-model)* | *d(rml) (rdla model)* | *d(rml) (rdlh model)* |
| *const* | 0.020*<br>(0.090) | | |
| *d(rml(-1))* | 0.471**<br>(0.088) | - | 0.546**<br>(0.089) |
| *d(rdl)* | 0.493**<br>(0.104) | | |
| *d(rdl(-2))* | -0.457** | | |

| | | | |
|---|---|---|---|
| | (0.086) | | |
| *d(rdla)* | - | 0.528**<br>(0.092) | |
| *d(rdla(-1))* | - | 0.340**<br>(0.120) | |
| *d(rdla(-2))* | - | -0.402**<br>(0.097) | |
| *d(rdlh)* | | | 0.500**<br>(0.092) |
| *d(sp(-2))* | -0.064*<br>(0.026) | | |
| *d(ri(-4))* | 0.121*<br>(0.054) | | |
| *ecm_rml(-1)* | -0.165<br>(0.032) | -0.093**<br>(0.018) | -0.045*<br>(0.018) |

*Note: Standard errors are given in parenthesis. * - denotes significance at 5%-level, ** - at 1%-level.*

Table 8: Short-Term Relationships for RI

| Explanatory variables | Response variable | | |
|---|---|---|---|
| | *d(ri) (rdl-model)* | *d(ri) (rdla model)* | *d(ri) (rdlh model)* |
| *const* | 0.042*<br>(0.016) | - | - |
| *d(sp(-1))* | | | *0.118**<br>*(0.059)* |
| *d(rdlh(-1))* | | | *0.310***<br>*(0.113)* |
| *d(ri(-1))* | | *0.373***<br>*(0.133)* | |
| *d(tfp)* | | *1.367***<br>*(0.441)* | |
| *d(rml)* | | *0.535***<br>*(0.143)* | |
| *d(rml(-3))* | -0.367* | - | - |

| | | | |
|---|---|---|---|
| | (0.188) | | |
| *ecm_ri(-1)* | -0.225<br>(0.125) | -0.292**<br>(0.100) | -0.180<br>(0.112) |

*Note: Standard errors are given in parenthesis. * - denotes significance at 5%-level, ** - at 1%-level.*

Finally, we estimate the model specified by the equations (10)–(17). This model allows impulse responses of the model variables to be traced to the shock in *rdl* (and *rdla*, *rdlh*). We formulate stress-scenario as one percent permanent shock in *RDL* (*RDLA*, *RDLH*) and then observe the response of other variables computed as a percentage change with respect to a baseline scenario. Impulse response functions of the model variables with respect to the policy variable under various shocks are shown in the Figure 4 (*rdl*), Figure 5 (*rdla*), and Figure 6 (*rdlh*).

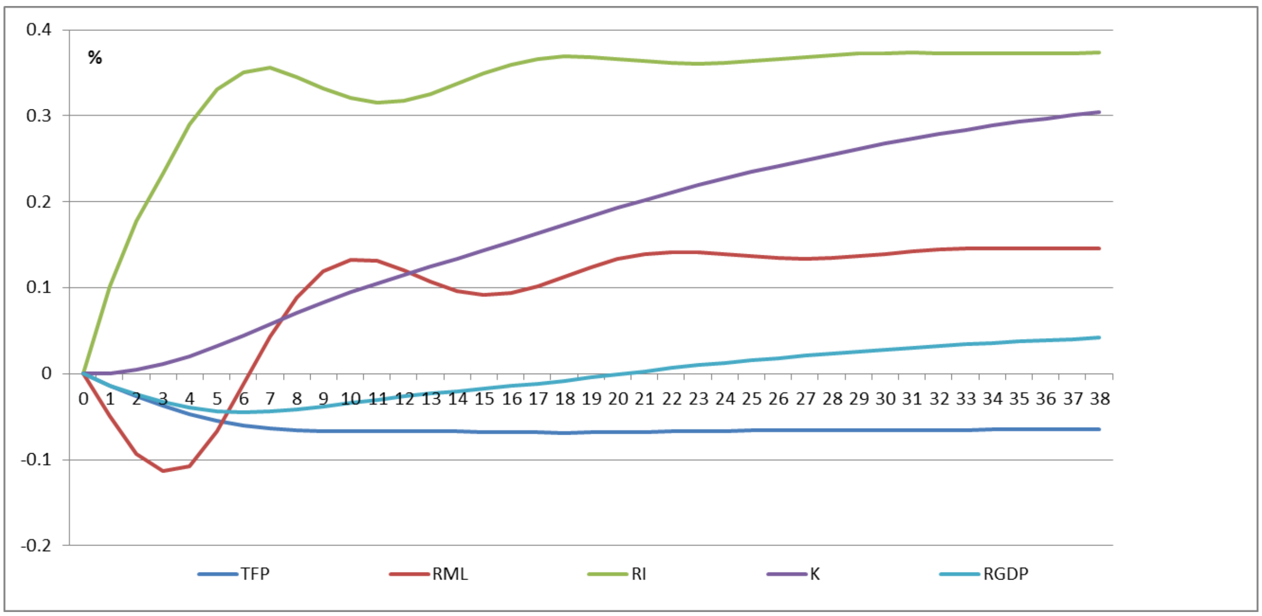



Figure 4: Impulse responses to 1% shock in RDL.

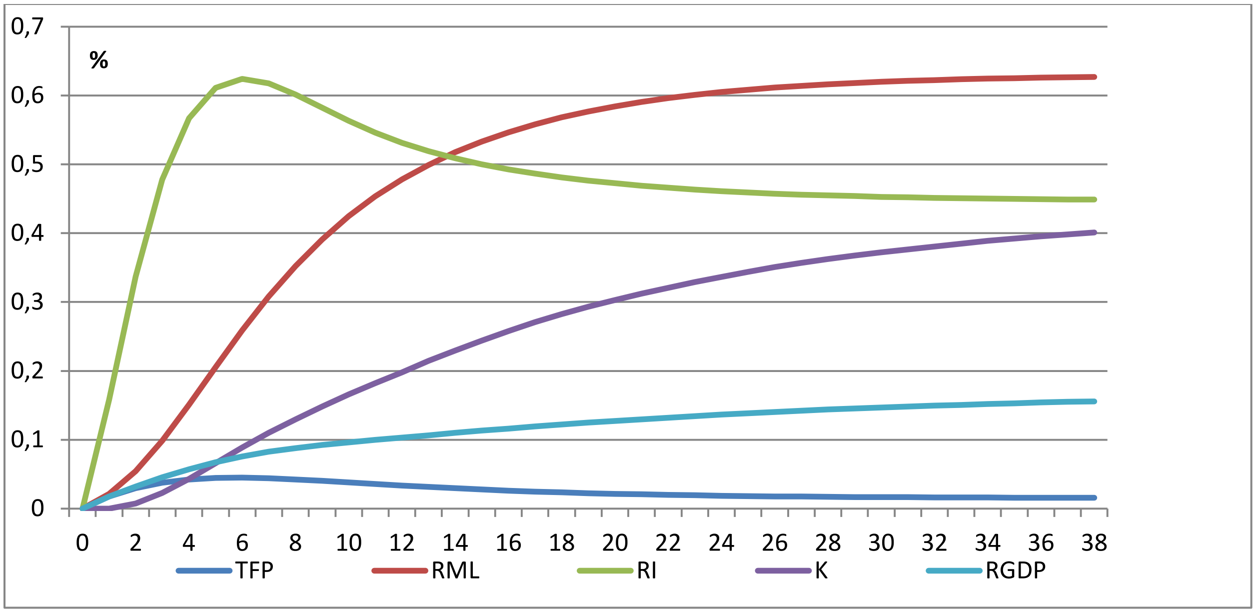



Figure 5: Impulse responses to 1% shock in RDLA.

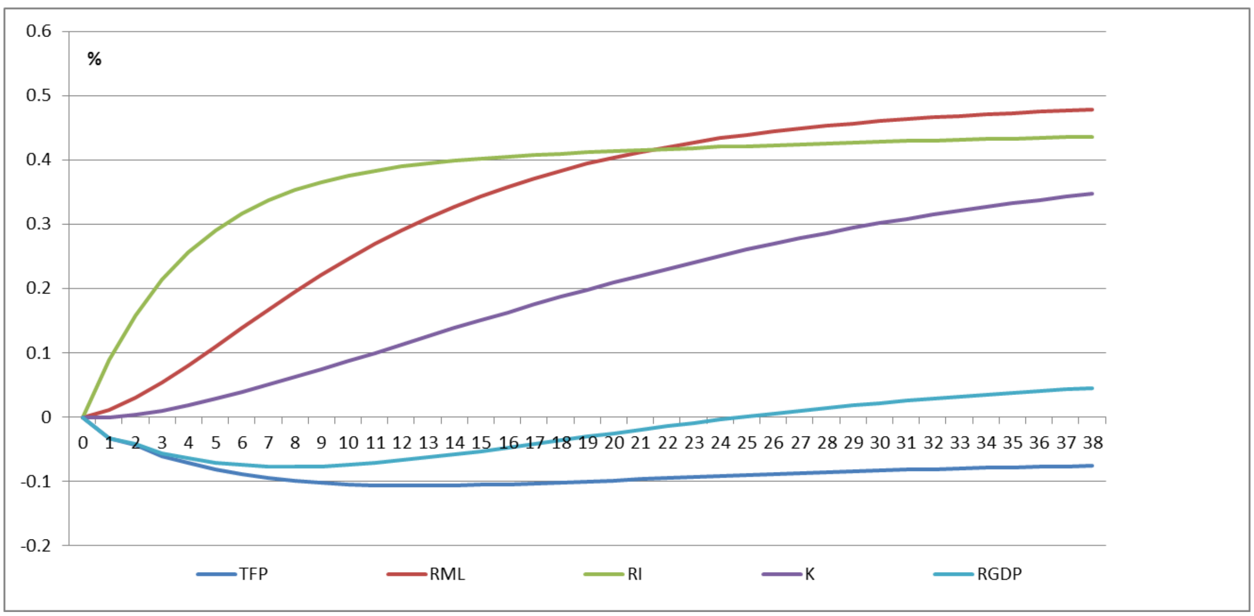



Figure 6: Impulse responses to 1% shock in RDLH.

A further step is a cointegration analysis, based on Johansen method. We apply this test to a set of four variables: *tfp, rml, spmd, rdl (rdla, rdlh).* For all cases of a set of policy variables (rdl, rdla, rdlh), based on a trace-test, we reject the null hypothesis of no cointegration, and also reject the hypothesis of more than one cointegration vector. Correspondent cointegration vectors (depending on the policy variable under consideration) are reported in Table 9.

Table 9: Cointegration Vectors in a VECM framework

| Variables | Used policy variable | | |
|---|---|---|---|
| | *rdl* | *rdla* | *rdlh* |
| *tfp* | 1 | 1 | 1 |
| *rml* | -0.538<br>(0.083) | -0.215<br>(0.023) | -0.067<br>(0.027) |
| *rdl* | 0.451<br>(0.079) | - | - |
| *rdla* | - | 0.151<br>(0.024) | - |
| *rdlh* | - | - | 0.058<br>(0.024) |
| *sp* | 0.227<br>(0.035) | 0.107<br>(0.012) | 0.133<br>(0.010) |
| *const* | - | - | -0.790<br>(0.087) |
| Number of lags in the dynamic analysis | *3* | *3* | *3* |
| *Trace-test (H0: no cointegration), p-value in parenthesis* | 42.13*<br>(0.03) | 50.63**<br>(0.003) | 55.67*<br>(0.034) |
| *Trace-test (H0: at most 1 cointegrating vector), p-value in parenthesis* | 17.9<br>(0.261) | 23.79<br>(0.057) | 31.12<br>(0.129) |

*Note: Standard errors are given in parenthesis.*

Having rejected the hypothesis of no cointegration in all sub-models, we may exploit the VECM framework and estimate correspondent sub-models according to the equation (18). Furthermore, in each model we test the hypothesis of weak exogeneity of the variables in the system (i.e. correspondent α-coefficient should be zero), other than *tfp*. The results of estimation with respect to different policy variables under consideration (*rdl*, *rdla*, *rdlh*) are provided in the Appendices A, B, and C.

Correspondent impulse response functions in the VECMs with different policy variables are shown in the Figures 7–9.

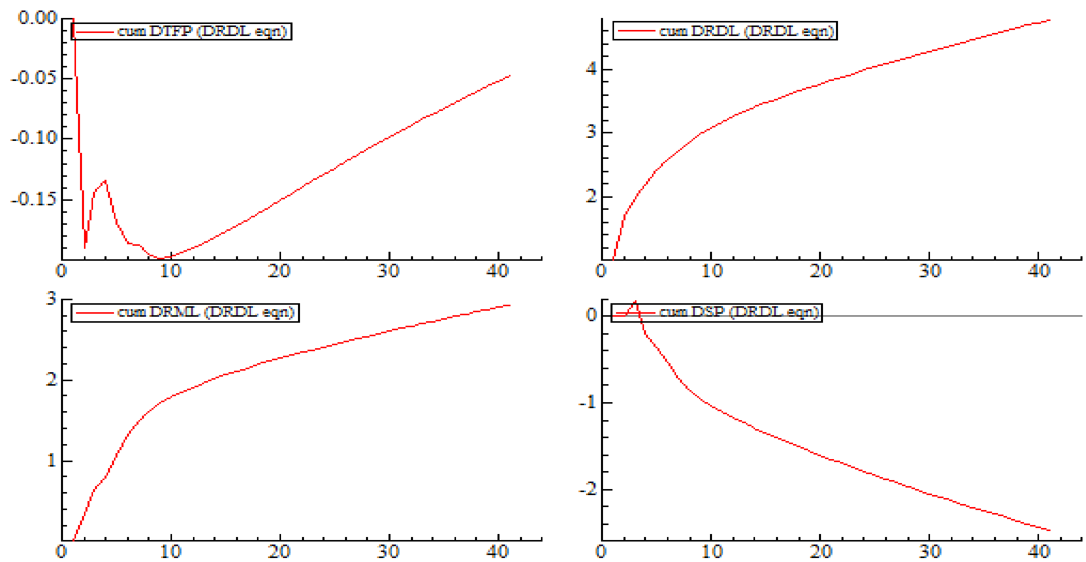



Figure 7: Cumulative impulse responses to a shock in d(rdl) (unit start, VECM framework)

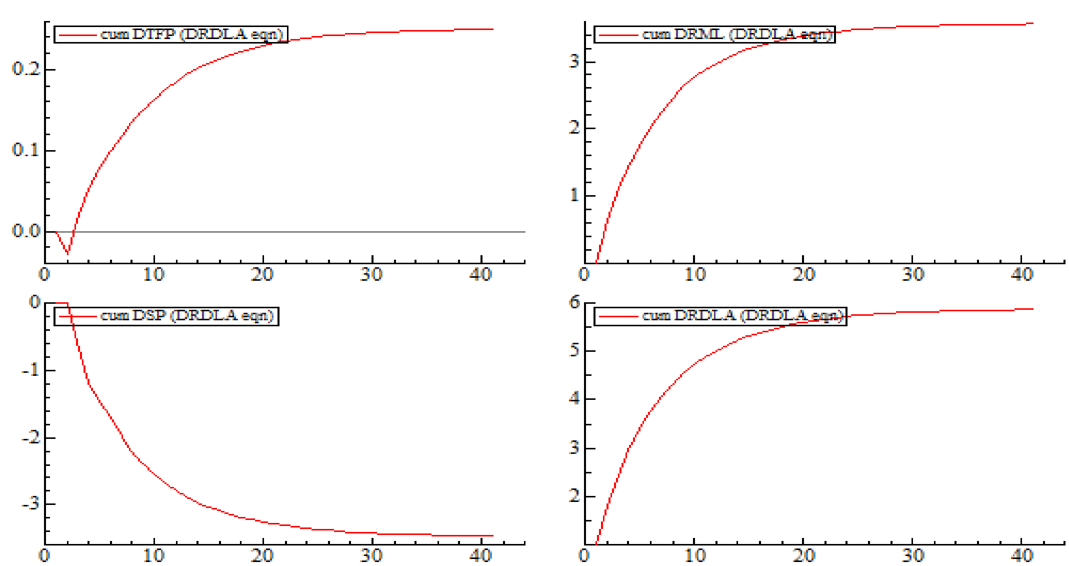


Figure 8: Cumulative impulse responses to a shock in d(rdla) (unit start, VECM framework)

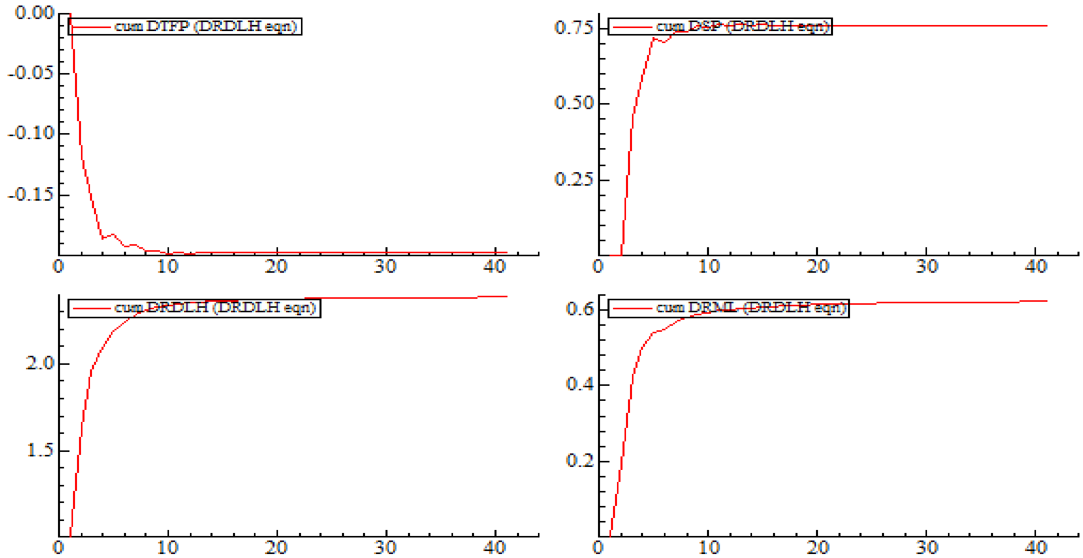



Figure 9: Cumulative impulse responses to a shock in d(rdlh) (unit start, VECM framework)

The application of both techniques leads to very similar results: the impact of housing directed loans on TFP appears to be negative over the long run, while the impact of agricultural directed loans is slightly positive. The total effect on TFP tends to be negative: this implies that distortions associated with housing loans outweigh a positive impact associated with agricultural loans. However, the picture changes if we shift the focus from TFP to potential output.

Another surprising result, observed in both types of models, is a positive linkage between directed loans and market loans. It implies there is no trade-off between market and directed loans. This outcome can be explained by a massive backup of the system of directed loans by the government, which mitigates the impact on productivity, say, through intensifying inflationary pressure on the entire economy. Through this we may argue, that to the extent fiscal and monetary regulation is tightened (e.g. to combat inflation), the trade-off between directed loans and market loans resurfaces.

## v. Conclusions

This study analyzes the effects of directed lending on TFP dynamics and economic growth. Selective credit programs influence the dynamics of physical capital accumulation and total factor productivity as government commands the provision of loans and thus assumes the functions of banks. As a result, financial intermediation is distorted. While cross-country studies generally point to the adverse effects of distorted financial intermediation upon growth as investment are channeled to lower-yielding projects that dampen growth, several in-country studies show that directed lending might be associated with higher growth rather. We consider the case of Belarus, where directed lending remains an important policy tool, with loans concentrated in agriculture and housing construction sectors.

*Our key finding is that directed lending negatively affects total factor productivity*. One of the individual components of directed lending, namely loans for residential construction to households, negatively affects total factor productivity. Moreover, it is through housing loans the adverse effects of directed lending on productivity are mainly realized. The interest rate spread – between preferential interest rate and market interest rate – amplifies these negative relationships. Lower preferential rates result in larger TFP losses.

Moreover, we find that for Belarus, an increase in the total volume of directed loans leads to an increase in the volume of market loans. In fact, the NBB used to inject liquidity into the banking system, and this prevents the emergence of the trade-off between directed loans and market loans. A rise in the market loans diminish the negative effect of directed lending on TFP.

The effects of individual components of selective credit programs, such as directed loans to agricultural firms and to households, varies. In the case of housing loans, we observe negative relationships, so the warning issued by the IMF that such loans may damage the productive capacity of the economy and reduce the returns on investment, appears to be valid. In case of agricultural loans, the results remain ambiguous. The results of our analysis show that over certain period of time, the impact of directed lending on TFP is slightly positive and afterwards approaches zero.

It is important to stress that the detected negative impact of selective credit programs on total factor productivity, which is enfeebled by expansion of market loans, can be augmented in the future. Banks cannot infinitely stretch their portfolios. Moreover, liquidity constraints could severely limit the possibility of such stretching. These liquidity constraints are related to the NBB's restrictive monetary policy, which is currently a desirable measure in the Belarusian economy.

## Appendices

*Appendix A*. VECM estimation in I(0) space (policy variable - rdl).

| Regressors | Dependent Variables | | | |
|---|---|---|---|---|
| | d(tfp) | d(rdl) | d(rml) | d(sp) |
| d(tfp(-1)) | - | 0.850*<br>(0.366) | 0.779*<br>(0.334) | -2.535*<br>(1.189) |
| d(rdl(-1)) | -0.139**<br>(0.046) | 0.684**<br>(0.077) | 0.235**<br>(0.081) | - |
| d(rml(-1)) | 0.109*<br>(0.046) | - | 0.557**<br>(0.100) | -0.898**<br>(0.305) |
| d(sp(-1)) | - | - | - | - |
| d(tfp(-2)) | - | 0.690*<br>(0.345) | 1.236**<br>(0.323) | - |
| d(rdl(-2)) | 0.147**<br>(0.040) | - | - | - |
| d(rml(-2)) | -0.087*<br>(0.040) | 0.215*<br>(0.085) | - | - |
| d(sp(-2)) | - | - | - | - |
| const | - | - | - | - |
| CIa(-1) | -0.112**<br>(0.027) | - | 0.237**<br>(0.075) | - |
| Dummy(2008q1-2009q2) | -0.037**<br>(0.006) | 0.023<br>(0.020) | 0.045*<br>(0.020) | 0.259**<br>(0.074) |
| LR-test for restrictions on α-coefficients, p-value in parenthesis | $\chi$^2=28.03 (0.1086) | | | |

*Note: Standard errors are provided in parenthesis. * - denotes significance at 5%-level, ** - at 1%-level.*

*Appendix B.* VECM estimation in I(0) space (policy variable - rdla).

| Regressors | Dependent Variables | | | |
|---|---|---|---|---|
| | d(tfp) | d(rdla) | d(rml) | d(sp) |
| d(tfp(-1)) | - | 0.654*<br>(0.334) | 0.460**<br>(0.084) | -2.806*<br>(1.219) |
| d(rdla(-1)) | - | 0.811**<br>(0.085) | 0.561**<br>(0.103) | - |
| d(rml(-1)) | - | - | - | 1.023**<br>(0.302) |
| d(sp(-1)) | - | - | - | - |
| d(tfp(-2)) | - | 0.917*<br>(0.458) | 0.970**<br>(0.325) | - |
| d(rdla(-2)) | 0.064**<br>(0.019) | | -0.335**<br>(0.080) | - |
| d(rml(-2)) | - | | - | - |
| d(sp(-2)) | - | 0.081*<br>(0.043) | - | -0.254*<br>(0.134) |
| const | - | | - | - |
| CIa(-1) | -0.191**<br>(0.052) | - | 0.543**<br>(0.120) | - |
| Dummy(2008q1-2009q2) | -0.033**<br>(0.006) | 0.030<br>(0.025) | | 0.287**<br>(0.071) |
| LR-test for restrictions on α-coefficients, p-value in parenthesis | $\chi^2=32.40$ (0.0707) | | | |

*Note: Standard errors are provided in parenthesis. * - denotes significance at 5%-level, ** - at 1%-level.*

*Appendix C*. VECM estimation in I(0) space (policy variable - rdlh).

| Regressors | Dependent Variables | | | |
|---|---|---|---|---|
| | d(tfp) | d(rdlh) | d(rml) | d(sp) |
| d(tfp(-1)) | - | 0.787*<br>(0.360) | - | -3.849**<br>(1.222) |
| d(rdlh(-1)) | -0.085**<br>(0.025) | 0,639**<br>(0.072) | 0.194*<br>(0.074) | - |
| d(rml(-1)) | - | - | 0.536**<br>(0.010) | - |
| d(sp(-1)) | 0.036**<br>(0.012) | - | - | - |
| d(tfp(-2)) | - | 0.762*<br>(0.359) | 0.882*<br>(0.349) | - |
| d(rdlh(-2)) | - | - | - | - |
| d(rml(-2)) | -0.058*<br>(0.083) | 0.265**<br>(0.086) | - | - |
| d(sp(-2)) | - | - | - | - |
| const | - | - | - | - |
| CIa(-1) | -0.569**<br>(0.083) | - | - | - |
| Dummy(2008q1-2009q2) | -0.027**<br>(0.04) | 0.014<br>(0.021) | 0.026<br>(0.020) | 0.133<br>(0.067) |
| LR-test for restrictions on α-coefficients, p-value in parenthesis | χ^2=39.798 (0.0225)* | | | |

*Note: Standard errors are provided in parenthesis. * - denotes significance at 5%-level, ** - at 1%-level.*

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