

Financial system and agricultural growth in Ukraine

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Abstract

We build the simplified models of integral indicator of level of financial system development and agricultural growth using the principles of concept of "moderate middle way". We use the simplified models of integral indicator to compare the level of financial system development, economic and agricultural growth and to explore the trend of financial development and agricultural growth in Ukraine. We use the integral indicators and econometric methodologies to assess the relationship between financial development and agricultural growth in Ukraine. The results of the study revealed the absence of statistical relationship between integral indicators of financial system development and agricultural growth in Ukraine. We can ascertain the presence arguments for the existence of the impact the banking component of the financial system on the agriculture in Ukraine. The regression models showed significant directly proportional relationship between certain aspects of agriculture and resources and effectiveness of the banking sector.

Keywords: *agricultural growth, the integral indicator of the agricultural growth, the integral indicator of the financial system development, financial system*

JEL Classification: *G14, G21, Q13*

1. Introduction

The link between financial development and economic growth was been explored by scholars seriously only last 20 years. The first attempt to define the relationship between financial development and economic growth was made by Goldsmith in 1969. Using cross-country data Goldsmith found evidence of a positive trend of the ratio of financial institutions' assets to GDP for 35 countries over 1860-1963 (Goldsmith, 1969). Later many authors have extended this line of inquiry and have confirmed Goldsmith's findings. They have provided additional information on the finance-growth nexus and have offered a much bolder assessment: firm-level, industry-level, and cross-country studies. Latter offer that the level of financial development exerts a positive effect on economic growth (Beck et al., 2000; Levine et al., 1998; Levine, 2002; Rajan, 2003).

The existing literature on the finance-growth nexus uses three approaches: cross sectional analysis, a time-series approach, panel data methods (a combination of both techniques). Each of these approaches has made useful contributions to the investigation of the relationship between finance and growth. However, how Schmidt emphasized in his work (Schmidt et al, 2006) that all approaches suffer from some important limitations which do not allow us to take all results at face value. The general problem of all empirical studies is that, to examine the relationship between financial development and growth, one has to define appropriate measures of financial development. Researchers come up with various definitions and measures. Some studies use the size of the banking sector typically measured by the deposit liabilities to GDP or bank claims on the private sector to GDP, others use the size of the stock markets, defined as market capitalization to GDP or total value of domestic equities traded on the stock exchanges to GDP. However, these measures have been criticized by others (Schmidt et al, 2006).

In our opinion, the best option solving methodological problems of evaluation of finance-growth nexus is compliance the concept of "moderate middle way", which provides¹:

- using publicly available statistical data – quantitative objective indicators calculated using generally accepted methods and openly published on the Internet;
- maximum avoidance of subjective assessments and indicators that are characterized by uncertainty regarding the methods of collection or calculation;
- using the mathematical approaches of the average level of complexity and using average dimension data sets. However, data sets must be sufficient to identify the main statistical regularities on base of regression analysis;
- visualization of assessment results.

In this paper, we build the simplified models of integral indicator of level of financial system development and agricultural growth using the principles of concept of "moderate middle way". We use the simplified models of integral indicator to compare the level of financial system development, economic and agricultural growth and to explore the trend of financial development and agricultural growth in Ukraine. At last, we use the integral indicators and econometric methodologies to assess the relationship between financial development and agricultural growth in Ukraine.

2. Data and Methods

We suggest using the principles of concept of "moderate middle way", which is mentioned above, to build the simplified model of integral indicator of level development, which is associated with generalization of the three type's indicators: 1) scale (extensity development); 2) resources; 3) efficiency. The composition of these indicators is illustrated in the table 1.

We divide the financial system into two components – banking sector and financial markets. We propose to call the model of integral indicator of the relative level of the financial system development as «3+3»².

Table 1: The indicators of the simplified model of the integral indicator

The integral indicator	Components of integral indicator		
	Scale (extensity development)	The resources	The efficiency
1. Financial system development:			
banking sector	Commercial bank branches (per 100,000 adults)	Bank deposits to GDP (%)	Domestic credit to private sector by banks (% of GDP)
financial markets	Listed domestic companies (per 1,000,000 adults)	Market capitalization of listed companies (% of GDP)	Stocks traded, total value (% of GDP)
2. Economic growth	Employment to population ratio, 15+, total (%) (modeled ILO estimate)	Gross capital formation (% of GDP)	GDP per capita (current US\$)
3. Agricultural growth	Arable land (hectares per person)	Agriculture, value added (% of GDP)	Agriculture value added per worker (constant 2005 US\$)

Source: own development based on data (World Bank 2016a, 2016b).

¹ The more detail explanation of the concept of "moderate middle way" is Wasilewski at el (2015).

² The more detail explanation of the model "3+3" is Oliynyk at el (2015).

We offer to consider the significance of each indicator as equal. It lets us to avoid the result distortion, which is associated with subjective judgments, regards to ranking of each indicator.

The integral indicator of level development is calculated as an area of the geometric figure (triangle is for economic and agricultural growth, hexagon – for financial system), with the tops in a coordinate system of 3 or 6 axes. Each axis corresponds to one of the indicators listed in the table 1. On each of the three or six axes, we plot the relative values, which are defined as a share of the maximum (or reference) value of the indicator.

The integral indicator of the financial system development level as an area of the hexagon can be calculated by the formula:

$$II_{FS} = \frac{1}{2} \times [(I_1 \times I_2) + (I_2 \times I_3) + \dots + (I_6 \times I_1)] \times \sin 60^\circ, \quad (1)$$

where II_{FS} – the integral indicator of the financial system development level;

I_1, I_2, \dots, I_6 – relative values of indicators used in the model "3 + 3" (6 indicators): I_1, I_2, I_3 – relative values of banking sector indicators, I_4, I_5, I_6 – relative values of the financial market indicators (see table 1).

The integral indicator of the economic growth level as an area of the triangle can be calculated by the formula:

$$II_{EG} = \frac{1}{2} \times [(I_1 \times I_2) + (I_2 \times I_3) + (I_3 \times I_1)] \times \sin 120^\circ, \quad (2)$$

where II_{EG} – the integral indicator of the economic growth level;

I_1, I_2, I_3 – relative values of indicators of scale, resources and efficiency.

The integral indicator of the agricultural growth is calculated as well as the integral indicator of the economic growth level by the formula 2 using three indicators according to the table 1.

The integral indicator describes the relative development level and it cannot be calculated only for one country for one year without comparison with another country or establishing reference values or time-series data³.

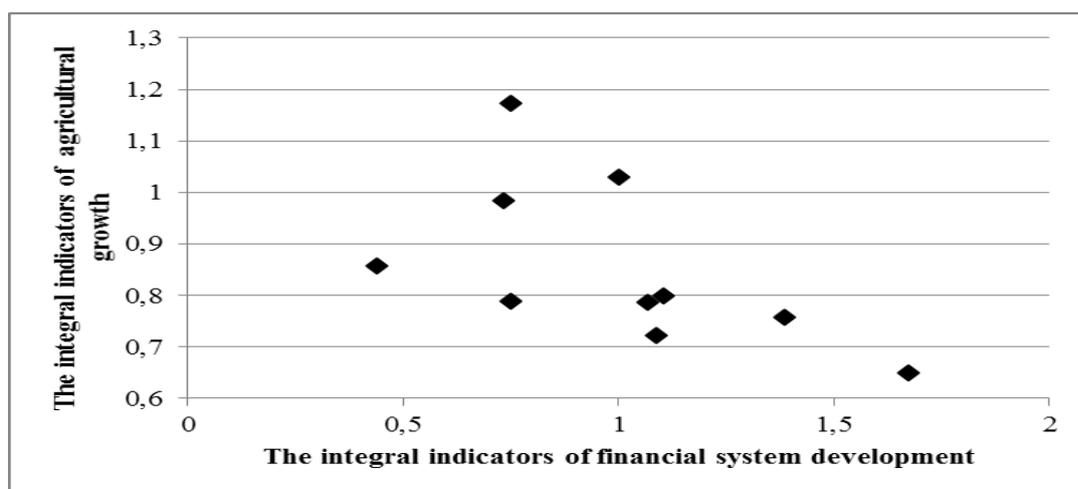
3. Results and Discussion

If the level of the financial system significantly affects the agricultural growth, then, obviously, we should observe a significant statistical relationship between the relevant integral indicators. Nevertheless, the conducted research has revealed that the relationships between the integral indicators of the financial system and agriculture in Ukraine for 2004-2013 are not observed (see Figure 1).

Consistent statistical patterns between integral indicators of financial system development and agricultural growth are absent, but a strong relationship between the integral indicator of financial system development and economic growth is present. In this case, we can assume that agriculture should be viewed as one of those industries, for which the complex impact of the financial system does not have significant value.

³ The more detail explanation of the concept of "moderate middle way" is Wasilewski at el (2015).

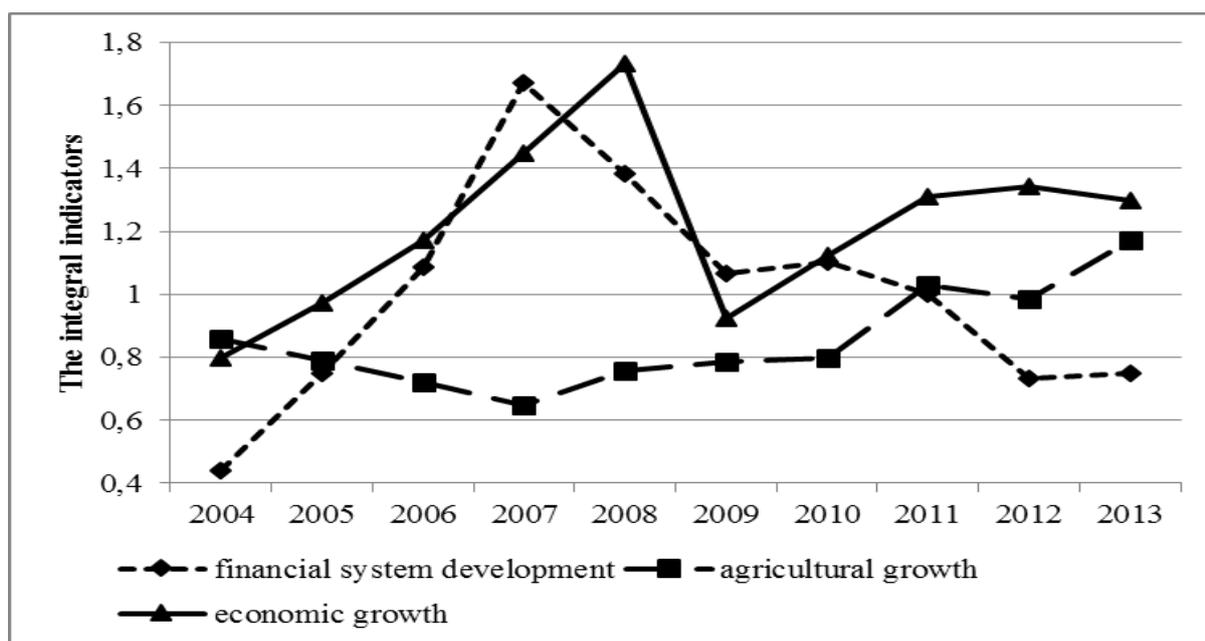
Figure 1: The interdependence between the integral indicators of financial system development and agricultural growth in Poland and Ukraine, 2004 – 2013



Source: author calculations based on data (World Bank 2016a, 2016b).

In general, the relatively stable development of the agriculture in Ukraine took place with turbulent financial system and economic development processes in the background (Figure 2).

Figure 2. The trend of integral indicators of financial system development, economic and agricultural growth in Ukraine, 2004 – 2013



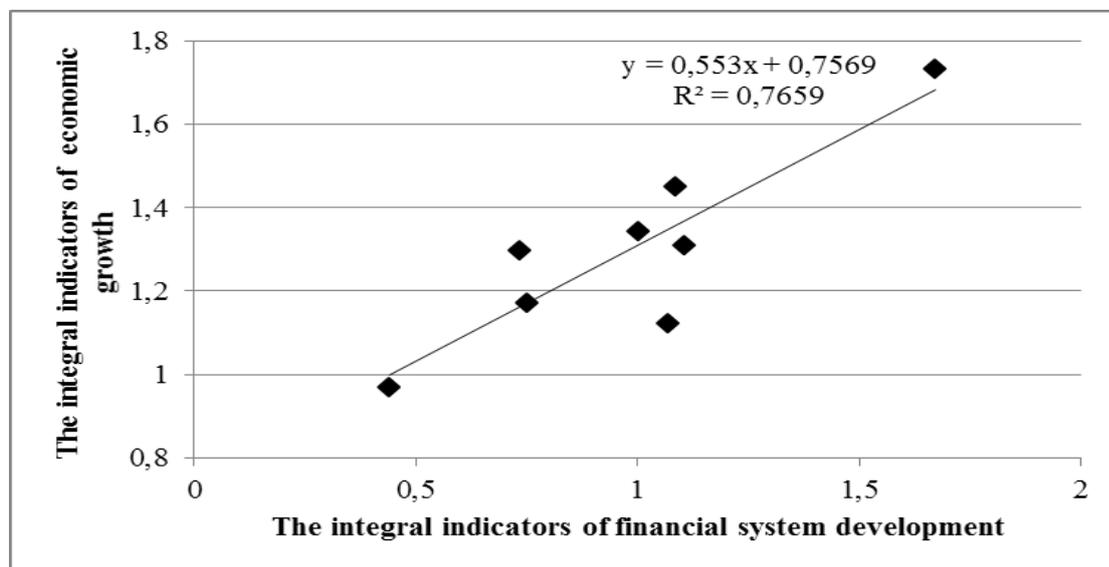
Source: author calculations based on data (World Bank 2016a, 2016b).

The study reveals strong statistical relationship between integral indicator of financial system development (taken with 1 year in advance) and integral indicator of economic growth of Ukraine (Figure 3), despite the fact that any similar interdependencies with integral indicator of agricultural growth were not observed.

Absence of the complex influence of the financial system development on the agricultural growth, which was observed in Poland and Ukraine during the studied period (according on the integral indicators analysis), yet does not give any reasons to conclude that the development of financial system does not influence the development of agriculture in these

countries. Important relations may exist between indicators characterizing separate aspects of financial system and agricultural growth.

Figure 3. The regression model describing the interdependence between integral indicators of the financial system development (for the previous year) and economic growth in Ukraine (the values of integral indicators of the financial system development are for 2004-2012, data of 2008 is excluded; the values of integral indicators of the economic growth are for 2005-2013, data of 2009 is excluded).



Source: author calculations based on data (World Bank 2016b).

Taking into consideration only the development of banking component of financial system, as the most significant one (as many researchers assume) for small and medium agricultural producers, and analyzing the correlation between its integral indicator and separate indicators of agricultural growth, we can identify certain statistical dependencies (Table 2).

Table 2: Correlation coefficients between integral indicator of the banking component of financial system and separate indicators of agricultural growth in Ukraine, 2004-2013

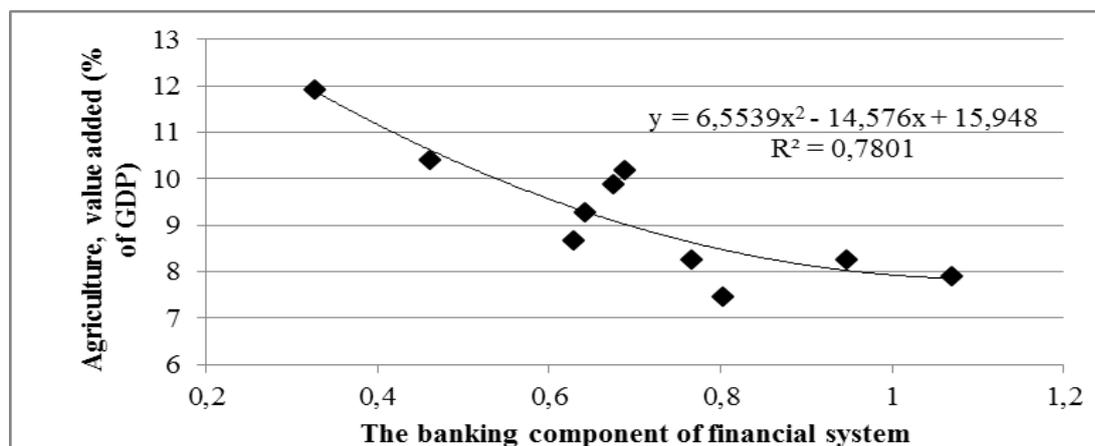
The indicator of agricultural growth	Correlation coefficients with integral indicator of the banking component of financial system
Arable land (hectares per person)	0,450
Agriculture, value added (% of GDP)	-0,843
Agriculture value added per worker (constant 2005 US\$)	0,212

Source: author calculations based on data (World Bank 2016a, 2016b).

Most notably, in the Table 2 we can observe: strong negative correlation between the development of the banking component of the financial system and value added in agriculture (% of GDP). Regression models (Figure 4) illustrate the identified dependencies.

In Ukraine the relationship between the development of the banking component of the financial system and value added per worker in agriculture is very weak. This fact, combined with the existence of inverse relationship between the development of the banking component of the financial system and value added in agriculture (Figure 4), can be evidence to the following: agriculture in Ukraine should be viewed as one of those industries for which the complex influence of the banking component of the financial system development is insignificant or negative.

Figure 4: Regression model that describes the relationship between integral indicator of the banking component of financial system and agriculture, value added (% of GDP) in Ukraine 2004 – 2013



Source: author calculations based on data (World Bank 2016a, 2016b).

To confirm this preliminary conclusion we attempted to check two hypotheses based on statistical data of the National bank of Ukraine.

The first hypothesis: the presence of the above mentioned inverse correlation is the result of the fact that the development of Ukrainian agriculture is less dependent on bank credit compared to other sectors of the economy. According to this hypothesis, the development of banking component in Ukraine has to lead to increase in value added of more credit-dependent sectors as share of GDP with the decrease of share of agriculture, which is less credit-dependent branch of the economy.

According to analysis, this hypothesis is not confirmed. In a result, comparison of the lending and economic activity volume dynamics at current prices revealed that the volume of agricultural production is more sensitive to changes in lending than to the activity of other industries and the economy as a whole (Table 3).

Table 3: Simple linear regression model parameters describing the relationship between the volume of lending and the volume of economic activity at current prices in Ukraine in 2004-2013

Industry	The indicator of the economic activity	Parameters		R-squared values
		slope coefficient	constant	
Agriculture	Gross output	5.061	49.617	0.9224
Trade	Retail turnover	1.619	29.481	0.9616
Economy as a whole	GDP	1.265	265.5	0.9037

Source: author calculations based on data (World Bank 2016a, 2016b; NBU 2015).

Particularly, in trade, which during the period of the study was the driver of economic growth in Ukraine, the UAH 1 increase in lending was accompanied by UAH 1.62 growth in retail turnover on average, while in agriculture – by UAH 5.06 growth in gross output. While comparing agriculture to the economy as a whole, it is possible to identify the 4 times excess sensitivity of this branch to changes in lending. It is observed that the gross output of agriculture increases exponentially in the case of bank lending growth in this sector and nominal GDP growth becomes slower if bank lending volumes in economy decrease (Figure 5, 6). Similarly, slowdown can be seen in the retail trade turnover in the case of volumes of trade sector crediting shrink.

Revealed patterns not only deny the first hypothesis, but also illustrate the importance of bank financing for the development of Ukrainian agriculture, being is even of higher significance for it than for most of other sectors and for the economy as a whole.

Figure 5. Regression model that describes the relationship between the volume of bank loans to agriculture and the gross agricultural output in Ukraine, 2004 - 2013 (at current prices)

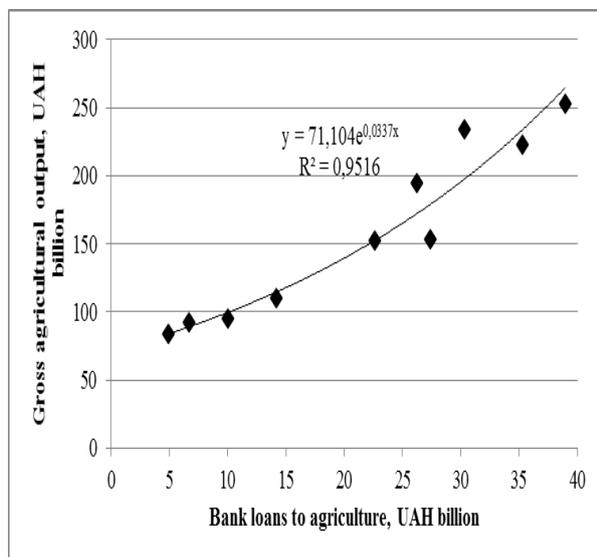
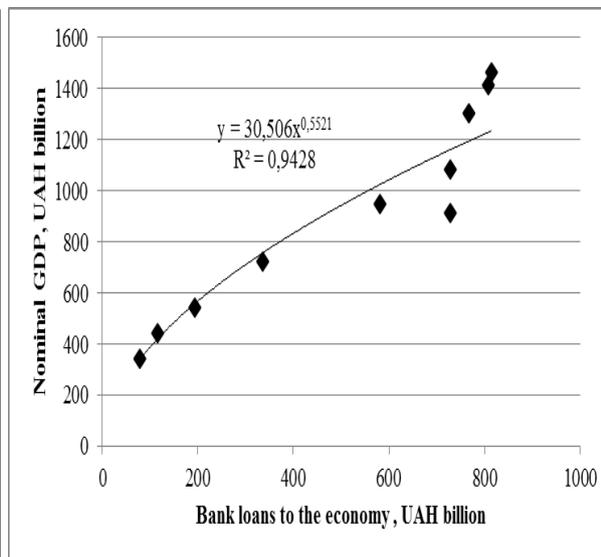


Figure 6. Regression model that describes the relationship between the volume of bank loans to the economy and nominal GDP in Ukraine, 2004 - 2013 (at current prices)



Source: author calculations based on data (World Bank 2016a; NBU 2015).

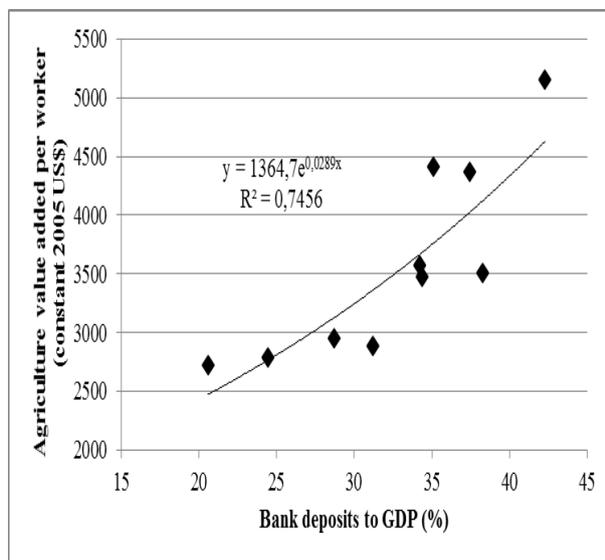
Source: author calculations based on data (NBU 2015).

The second hypothesis: the existence of inversely proportional relationship between the development of the banking component of the financial system and value added in agriculture (% of GDP) in Ukraine is connected with the fact that the indicator that characterizes the performance of the banking sector - domestic credit to private sector by banks (% of GDP) - has inadequate dynamics if the bank loans elasticity to GDP is greater than one. In this case, the banking sector development, accompanied by growth in lending to the real sector, leads to relatively higher GDP growth, as a result the domestic credit to private sector by banks (% of GDP) is decrease.

The analysis of interdependence between the volume of bank credits at current prices and nominal GDP in Ukraine for the period from 2004 till 2013 provides an argument in favor of the second hypothesis – an increase in lending is accompanied by relatively higher GDP growth (as shown in Table 3, the UAH 1 increase in lending is accompanied by an average UAH 1.265 GDP growth). Thus, the existence of inversely proportional relationship between the integral indicator of the banking component of the financial system and agriculture, value added (% of GDP) in Ukraine is not the evidence of the negative financial system development impact on agriculture.

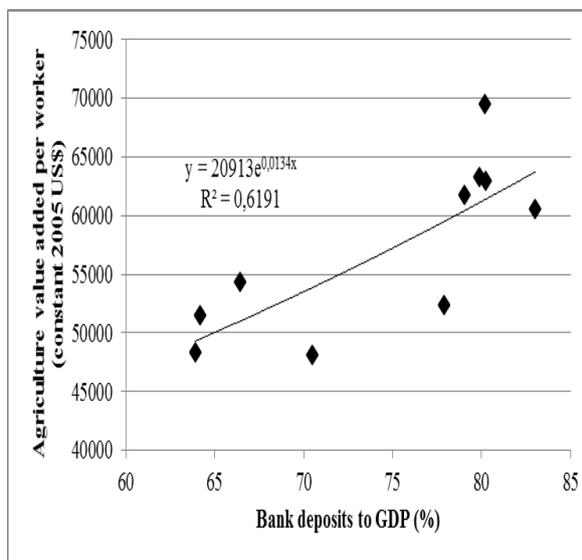
The importance of financial system development (particularly its banking component) for agriculture of Ukraine is confirmed by regression model that describes the relationship between bank deposits to GDP (%) and value added per worker in agriculture (constant 2005 US \$) – see Figure 7. This model provides an exponential growth rate of value added per worker in agriculture, which may indicate the existence of substantial potential for productivity increase in agriculture, which can be reached with stimulation of financial system development through increase of its resource base. It should be noted that the positive relationship between bank deposits to GDP (%) and value added per worker in agriculture (constant 2005 US \$) for the period from 2004 to 2013 was observed also in the US (Figure 8) and in many other countries with developed agriculture.

Figure 7. Regression model that describes the relationship between bank deposits to GDP (%) and Agriculture value added per worker (constant 2005 US\$) in Ukraine, 2004 - 2013



Source: author calculations based on data (World Bank 2016a; NBU 2016).

Figure 8. Regression model that describes the relationship between bank deposits to GDP (%) and Agriculture value added per worker (constant 2005 US\$) in USA, 2004 - 2013



Source: author calculations based on data (World Bank 2016a; FRS 2015).

Market component of the financial system, unlike the banking component, is characterized by absence of significant statistical dependence of certain aspects of agricultural growth of Ukraine, taking into consideration the integral indicator as well as its separate components.

4. Conclusion

This study provided that financial system has positive impact on agriculture growth in Ukraine, despite the lack of significant statistical dependency between the relevant integral indicators in Ukraine. We proved that banking component of the financial system make a significant impact on agriculture grows, as evidenced by regression models built on the basis of effectiveness and resource base indicators.

We found that the indicator “domestic credit to private sector by banks (% of GDP)”, which was used to characterize the performance of the banking sector as part of the integral indicator of financial system development, showed specific dynamics in case of Ukraine. It means when the amount of loans was increased the level of indicator was decreasing over 2004-2013. The reason of that it was a high dependence of Ukrainian economy on bank lending, which was reflected to the high elasticity of GDP to changes in lending. The specific dynamics of indicator “domestic credit to private sector by banks (% of GDP)” may be considered as one of the reasons for the absence of statistical dependence between the integral indicators of financial system development and agricultural growth. As evidenced by the results of the study, agriculture is much more dependent on bank lending than the vast majority of other branches of economy.

The results indicate the feasibility of scientific search for the ways to increase the efficiency of agricultural activities in Ukraine due to the creation of conditions for further development of financial system, especially its banking component.

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