Financial development and economic growth in Poland in transition: causality analysis

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Abstract

The economic literature suggests that the efficient allocation of resources by the financial system speeds up economic development and reduces poverty. However, there are economists who find financial development to be the result of economic growth. This study examines causal relationship between economic growth and financial development in Poland on the basis of quarterly data for the period Q1 2000 – Q4 2009.

The empirical research was performed in two variants: bank– and stock market–oriented approaches. The results suggest causality running from the development of the stock market to economic growth and from economic growth to the development of the banking sector. This implies that the direction of causality strongly depends on which particular area of the financial sector is considered.

Empirical results were found to be robust both to the type of common variable applied and the specification of testing procedure, which clearly validates major conclusions of this paper.

Keywords: financial development, economic growth, transition economies, Granger causality.

JEL classification: C32, O16, E44.

1. Introduction

Economists have always been fascinated by the interdependence between financial development and economic growth. In one of the earliest contributions on this subject Bagehot (1873) argued that the financial system played a critical role in starting industrialization in England by supporting the mobilization of capital for growth.

In general, two schools of economic thought justify the importance of financial development for economic growth and their causal relationship. However, these schools have starkly contrasting points of view.

The most prominent representative of the first school is Joseph Schumpeter. Schumpeter (1934) claimed that economic growth is a result of new combinations of resources or innovations in existing resources. He stressed that well–functioning banks are able to identify innovative entrepreneurs, i.e. support the creation of new goods, new markets, and new production processes. These entrepreneurs receive funds from banks which finance the most promising investment projects. Therefore, such credit becomes critical to growth, implying causality running from financial development to economic growth.

Most representative of the second school was Joan Robinson. She thought that economic growth creates demand for more financial services and thereby leads to financial development (Robinson, 1952).

Previous empirical studies have been based either on time series data or on cross–sectional data. Time series analyses are related to an individual country. Cross–sectional contributions are often subject to criticism, because cross–country heterogeneity is not taken into account.

The main objective of our study is an investigation of the causal relationship between financial development and economic growth by using time series data for Poland for the period 2000–2009. The plan of the paper is as follows. Theoretical and empirical contributions concerning the relationship between financial development and economic growth are reviewed in the next section. The main conjectures are presented in the third section. The methodology applied is outlined in section 4. Data description and descriptive statistics are shown in section 5. The empirical results and their discussion are provided in section 6. Brief conclusions and some policy recommendations are given in the last part of the paper.

2. Literature overview

The Schumpeterian tradition of economic thought was followed by McKinnon (1973) and Shaw (1973), who focused on the relationship between financial development and economic growth. However, in the opinion of Lucas (1988), finance is not a major determinant of economic growth and its role in economic growth is overstated.

Kemal et al. (2007) presented a more detailed review of the literature on the relation between financial development and economic growth. According to these authors previous empirical studies may be assigned to one of four schools of economic thought:

- *Finance supports economic growth*: Banks are engines of economic growth, while the stock market is a barometer of an economy. This point of view is expressed in previously mentioned contributions by Bagehot (1873), Schumpeter (1934), and also Hicks (1969), McKinnon (1973), Shaw (1973), among others.
- *Finance harms growth*: In extensive review of the literature presented by Beck and Levine (2004) it is stressed that empirical evidence is mixed. As noted by the authors, some researchers think that banks and stock markets have done more harm than good to the morality, transparency, and wealth of societies. Financial institutions should control risk and conduct the efficient allocation of resources. However, they may not speed up economic growth because better development of financial institutions implies greater returns on saving and lower risk. This may cause lower savings. In consequence bank activity can even hamper economic growth.
- *Financial development follows economic growth*: This point of view originates in Robinson (1952). According to this school of economic thought economic growth creates a demand for financial services. In a market economy the financial sector adjusts to these demands.
- *Financial development does not matter*: According to Lucas (1988) the role of the financial sector in economic growth is neutral.

Causality methodology has been used in many previous papers to check these hypotheses. Results by Demetriades and Hussein (1996) provided little evidence in favour of the view that financial development is a precondition for economic development. The authors found support for bidirectional causal relationship and causation from economic growth to financial development. However, the direction of causality varied across countries.

Shan et al. (2001) used a Granger causality procedure to investigate the relationship between financial development and economic growth. They conducted their investigations for nine OECD countries and China. The authors draw the conclusion that five out of ten countries showed bilateral Granger causality. Three of the countries exhibited reverse causality with economic growth leading to financial development. In the case of two countries no causal effects could be recognized.

Sinha and Macri (2001) checked the relationship between financial development and economic growth for eight Asian countries. These countries were divided into two categories. The first one included only Japan and the second one included seven developing Asian countries. The main goal of their study was to check (using a multivariate causality test) whether there are differences between financial development and economic growth for these categories. The empirical results were not consistent. The authors established a unidirectional causal relationship from financial development to economic growth for Japan and Thailand and a reverse causality from economic growth to financial development for Korea, Pakistan and the Philippines. In addition, a feedback relationship between financial development and economic growth for India, Malaysia, and Sri Lanka was detected.

Evans et al. (2002) checked the contribution of financial development to economic growth in a panel dataset of 82 countries. They used the translog production function as a framework for estimating the relationships between economic growth and the factor inputs: labour, physical capital, human capital and the monetary factor, i.e. money or credit. The results reported in their paper supported the hypothesis that for economic growth financial development is not less important than human capital.

Shan and Morris (2002) used quarterly data for the period 1985–1998 for 19 OECD countries in order to examine the causal relationships between the following economic categories: real GDP, the ratio of total credit to GDP, a range of borrowing and lending interest rates, productivity, the ratio of gross investment to GDP, the ratio of total trade to GDP, the consumer price index, the official interest rate, and the stock market price index. From this research it follows that financial development leads to economic growth in different ways, either directly or indirectly through its impact on other variables under study. However they observed for most countries that there is no causal relationship in either direction, in the Granger sense, between financial development and economic growth.

Deidda and Fattouh (2002) investigated nonlinear interdependencies between financial development and economic growth by means of a threshold regression model. The results reported in the paper were in favour of the conjecture that in low–income countries there is no significant relationship between financial development and economic growth. However in high–income countries this dependence is positive and strongly significant.

Further evidence on the finance–led–growth hypothesis was documented by Fase and Abma (2003). Using pooled data on Bangladesh, India, Malaysia, Pakistan, the Philippines, Singapore, South Korea, Sri Lanka, and Thailand, they concluded that financial development is important for economic growth and that causality runs from the level of financial development to economic growth.

Lopez–de–Silanes et al. (2004) demonstrated that the improvement of court procedures enhanced the development of capital markets. Therefore, they stressed that the causality direction between financial development and economic growth depends on the institutional environment.

Thangavelu and Ang (2004) provided empirical evidence on the causal impact of the financial market on the economic growth of the Australian economy. In particular they found causality from economic growth to the development of financial intermediaries. However, according to the authors while development in financial markets causes economic growth, there is no evidence of any causality running from economic growth to financial markets. A sensitivity test using different interest rates does not change the results.

Granger causality tests based on error correction models conducted for Greece by Dritsakis and Adamopoulos (2004) showed that there is a causal relationship between financial development and economic growth, but also between the degree of openness of the economy and economic growth. The authors used growth of the gross domestic product as a proxy for economic expansion, and the ratio of domestic bank credit to nominal GDP as a proxy of financial development. Dritsaki and Dritsaki–Bargiota (2006) have shown by Granger causality tests that there was a bilateral causal relationship between banking sector development and economic growth and a unidirectional causality between economic growth and stock market development in Greece, but with no causal relationship between the stock market and banking sector development.

Recent empirical studies investigating the link between growth and financial intermediation have used a variety of econometric techniques and were performed for different sets of countries. For instance, Shan (2005) used variance decomposition and impulse response functions for 10 OECD countries and China. In particular, he examined the relationship between financial development, approximated by total credit and economic growth. At best, weak support was found for the hypothesis that financial development "leads" economic growth. Tang (2006) conducted two–stage least squares (TSLS) in a study of the APEC countries. His results suggest that among the three financial sectors (the stock market, the banking sector and capital flow), only stock market development shows a strong growth enhancing effect, especially among the developed member countries.

A study by Shan and Jianhong (2006) concerning China has supported the view that financial development and economic growth exhibit a two–way causality and provided evidence against the finance–led–growth hypothesis. The results by Al–Awad and Harb (2005) indicated that in the long run financial development and economic growth may be related to some extent. In the short run the panel causality tests point to real economic growth as the force that drives changes in financial development, while individual countries' causality tests fail to give clear evidence of the direction of causation.

Zang and Kim (2007) with a dataset in the form of a panel of seven time periods and 74 countries covering the period 1961–1995 concluded that the importance of financial development in economic growth might be very badly over–stressed and that Robinson and Lucas may be right.

In a paper by Abu–Bader and Abu–Qarn (2008) empirical results strongly supported the hypothesis that finance leads to growth in five out of the six countries that were analyzed. Only for Israel the weak support for causality running from economic growth to financial development was detected, and there was no causality in the other direction. These findings suggest the need to accelerate the financial reforms that have been launched since the mid 1980s and to improve the efficiency of these countries' financial systems to stimulate saving/investment and, consequently, long–term economic growth.

The contributions on interdependencies between economic growth and financial development suggest as a proxy for financial development the ratio of money supply (M2) to the level of GDP (Liu et al., 1997). However this ratio measures the level of monetization rather than financial deepening. In particular it is possible that this indicator may increase due to the monetization process. An alternative method is to derive the active currency in circulation from M2, or to apply the ratio of domestic bank credit to nominal GDP.

The motivation to analyze the case of the Polish economy is twofold. First, Poland is the largest economy in the CEE region and, to the best of our knowledge, there are no papers dealing with recent data on economic growth and the financial development of this country. The lack of reliable datasets of sufficient size is a common feature of most of former centrally planned economies, which can be a serious problem for the researcher. However, the application of recent quarterly data and modern econometric techniques (described in section 5) provided a basis for conducting this research, which is important for both Poland as well as other European economies in transition. Second, in the last decade one could observe stable economic growth in Poland. It seems to be interesting to examine whether this was a cause or an implication of the rapid development of various components of the financial sector, which also took place in Poland in the last decade.

The next section contains a formulation of the main research hypotheses concerning the link between economic growth and financial development in the case of the Polish economy. These conjectures will be tested by a number of models and methods to control for robustness and the stability of the empirical findings.

3. Main research conjectures

In this paper we use abbreviations for all the variables. Table 1 contains some initial information.[1]

[1] Details on applied dataset are presented in section 4.

Description of variable	Unit	Abbreviation for seasonally adjusted and logarithmically transformed variable
Real quarterly per capita gross domestic product in Poland (at prices of 2000)	thousand PLN	*GDP*
Ratio of bank claims on private sector to nominal GDP	–	$BANK_c$
Ratio of bank deposits liability to nominal GDP	–	$BANK_d$
Ratio of Warsaw Stock Exchange (WSE) turnover to nominal GDP	–	*TURNOVER*
Reserve bank discount rate	%	*R*
Interbank offer rate	%	*I*

Table 1. Units, abbreviations and a short description of examined variables

At the very beginning of our computations we will check the stationarity of the time series listed in Table 1. Stationarity is the main assumption of most statistical causality tests. Preliminary information from the mass media and visual inspection of the dataset encouraged us to formulate the following:

Conjecture 1: *All time series under study are nonstationary.*

The lack of stationarity suggests using the concept of cointegration or simply differencing the respective time series. The applied tests allow us to establish the order of nonstationarity, i.e. to determine the order of integration of the individual time series.

From economic literature it may be seen that the most common questions concerning interdependencies between financial development and economic growth are the following:

- Does the banking sector cause economic growth or does causality run in the opposite direction?
- Do stock–market–related variables cause economic growth or does economic growth cause stock market development?
- Is there a bilateral causal relationship (feedback) between banking sector development and economic growth?
- Is there a bilateral causal relationship (feedback) between stock–market–related variables and economic growth?

These questions concern both short and long run linear links as well as nonlinear relationships.

According to the Schumpeterian tradition banks stimulate economic growth. There are a number of empirical contributions whose results support this point of view.

However, in the more recent literature the opposite direction of causality is also reported, i.e. the impact of economic growth on the development of the banking system. This kind of economic thought is based on Robinson's point of view. It the light of the empirical results in the contributions reviewed, it seems that this point of view may be true for highly developed countries. For countries like China and Greece feedback between economic growth and the development of the banking system was reported. Causality running from banking development to economic growth means that a better developed banking system finances productive projects in a more successful way. An important result that clarifies the theoretical findings is that causality is more marked in countries with a more developed institutional environment (expressed by the rule of law and regulation). Feedback means that causality also runs from economic growth to banking, which indicates that a more developed economy has a more developed banking system. This implies, in particular, that credit for the private sector increases and the interest spread diminishes as the economy develops. Poland, in respect to economic development, is somewhat between these two countries. Both the Polish banking system and economic growth experienced considerable development and growth in the last decade. Therefore it is not easy to say in advance that "finance leads growth" or that "finance follows growth". Thus we formulate the following conjecture:

Conjecture 2: *There is feedback between the development of the banking system and economic growth in Poland.*

Most theoretical and empirical contributions report a significant causal relationship running from stock market behaviour to economic growth. This observation is likely to be true also in the case of the Warsaw Stock Exchange (WSE). Since July 2007 the WSE has experienced drops, although the main macroeconomic indicators did not decline. Market participants were assured that drops in share prices on the Warsaw stock market were of a temporary nature and did not detract from the good state of the Polish economy. However, in the following year the condition of many Polish companies worsened dramatically.

Large institutional investors (like banks or investment funds), which operate on the stock market have good information about the financial state of companies and consumer demand. Insiders also play an important role. Confidential information about an upcoming unprofitable event with respect to a company or whole sector or just fear of crisis encourages the sale of equities. In consequence the prices of shares decline and therefore a bear phase of the stock market begins. The companies have no incentives to issue shares. Disposable capital is reduced, investment and, in consequence employment decrease. Therefore output (GDP) and demand (consumption) also fall.

A different scenario takes place if the economic situation improves. Share issues start because capital is demanded. This makes the development of companies, a rise in employment and a rise in GDP possible.

According to the empirical contributions in the literature the more developed the country the closer the dependence between the stock market and the economic growth. Current movements on the stock exchange determine the future economic situation.

In order to check the interdependence between turnover changes on the WSE and economic growth we formulated the following:

Conjecture 3: *There exists significant short and long run causality from turnover on the WSE to economic growth in Poland.*

The conjectures listed above will be checked by some recent causality tests. The details of the testing procedures will be shown in the following sections. The test outcomes depend to some extent on the testing methods applied. Therefore, testing for the robustness of the empirical results is one of our main tasks. Before describing the methodology, in the next section we will give descriptive statistics of the time series included in our sample.

4. The dataset and its properties

The major problem in most empirical studies is the selection of indicators reflecting the level of financial development. The diversity of services involved makes the construction of financial development indicators extremely difficult. Agents and institutions involved in financial intermediation activities are also highly diversified, which causes additional difficulties. Taking into consideration previous empirical studies (see e.g. Thangavelu and Ang, 2004; Shan and Morris, 2002) we performed an investigation of the causal dependencies between economic growth and financial development in Poland in the last decade using three indicators, namely the ratio of bank claims in the private sector to nominal GDP, the ratio of bank deposit liability to nominal GDP, and the ratio of Warsaw Stock Exchange turnover to nominal GDP. Therefore, our paper combines bank– and market–based approaches for modelling the dynamic dependencies between GDP and the financial sector.

Since the development of the financial sector and economic growth can be driven by a common variable (Rajan and Zingales, 1998; Luintel and Khan, 1999; Dritsakis and Adamopoulos, 2004; Thangavelu and Ang, 2004), we applied the interest rate as this common factor. Moreover, to examine the stability of the links we used two types of interest rate – the reserve bank discount rate and the interbank offer rate.

Further parts of this section contain statistical details on the data. Subsection 4.1 contains plots and descriptive statistics of the applied dataset, which provides some basic detail about the variables under study. In subsection 4.2 the stationarity properties of all the time series are examined. The identification of the orders of integration of the time series under study is a crucial stage of causality analysis.

4.1. Description of the dataset

The dataset applied in this paper includes quarterly data on real per capita GDP (at constant prices of year 2000), the ratio of bank claims in private sector to nominal GDP, the ratio of domestic bank deposit liabilities to nominal GDP and the ratio of WSE turnover to nominal GDP in the period Q1 2000 – Q4 2009.[2] Besides the *GDP* (measure of economic growth) and three measures of financial development for bank–based ($BANK_c$, $BANK_d$) and market–based system (*TURNOVER*) two interest rates (R, I) were applied to avoid the problem of the omission of important variables and additionally to test the robustness of the empirical findings. Data on real GDP per capita, $BANK_c$ and $BANK_d$ was

[2] The dataset is provided by the authors in a separate file, which is downloadable from the Journal's webpage.

obtained from Central Statistical Office in Poland, data on *TURNOVER* was gained from WSE Monthly Bulletins. Finally data on R and I was gained from the National Bank of Poland.[3]

Since each variable used (except for the two interest rates) was characterized by significant quarterly seasonality, and this feature often leads to spurious results in causality analysis, the X–12 ARIMA procedure (which is currently used by the U.S. Census Bureau for seasonal adjustment) of Gretl software was applied to adjust the variables. Finally, each seasonally adjusted variable was transformed into logarithmic form, since this Box–Cox transformation may stabilize variance and therefore improve the statistical properties of the data, which is especially important for parametric tests.

The application of quarterly data is important for two main reasons. First, since the data necessary covered only the recent few years, a causality analysis based on annual data could not be carried out due to lack of degrees of freedom. Moreover, as shown in some papers (Granger et al., 2000) the application of lower frequency data (e.g. annual) may seriously distort the results of Granger causality analysis because some important interactions may stay hidden.

In the initial part of our analysis some descriptive statistics of all the variables were calculated. The results of this part of the preliminary examination are presented in Table 2.

Variable / Quantity	*GDP*	$BANK_c$	$BANK_d$	*TURNOVER*	*R*	*I*
Minimum	8.474	–0.010	0.199	–1.887	0.037	0.041
1st quartile	8.509	0.042	0.297	–1.408	0.047	0.046
Median	8.618	0.077	0.355	–0.976	0.057	0.058
3rd quartile	8.771	0.322	0.416	–0.397	0.096	0.094
Maximum	8.851	0.665	0.630	0.079	0.215	0.197
Mean	8.641	0.188	0.377	–0.897	0.083	0.08
Std. deviation	0,127	0.217	0.105	0.583	0.056	0.05
Skewness	0.266	1.199	0.578	0.014	1.358	1.343
Excess kurtosis	–1.412	–0.045	–0.191	–1.123	0.282	0.233

Table 2. Descriptive statistics of examined variables

A comprehensive preliminary analysis requires analysis of the charts for all the variables under study. Figure 1 contains suitable plots of seasonally adjusted and logarithmically transformed variables (as already mentioned seasonal adjustment was not required for R and I).

[3] Strictly speaking, R in quarter t is the rediscount rate measured at the end of period and I is the average of daily values of 3–Month Warsaw Interbank Offer Rate (WIBOR 3M) for a quarter t.

INSERT FIGURE 1 AROUND HERE

In the last decade there was relatively stable growth of the Polish economy, which is reflected in the graph of *GDP* (upward tendency). One cannot forget that the Polish economy was one of the few that managed to avoid an undesirable impact of the crisis of 2008. However, before 2002 (crisis of 2001) and after September 2008 one can observe a slight slowdown in the rate of growth of the Polish economy.

Similarly, Figure 1 provides strong evidence for claiming that in the recent decade there was also stable development of the financial sector in Poland. This is shown for the bank– ($BANK_c$, $BANK_d$) and market–related (*TURNOVER*) variables. In contrast with economic growth, the financial sector in Poland significantly reacted to the economic crises of 2001 and 2008. Figure 1 provides details about significant drops in *TURNOVER* before 2002 and after September of 2008. The negative impact of both economic crises is also demonstrated in plots of the ratios of bank claims in the private sector and bank deposit liabilities to nominal GDP.

The plots of the last two examined time series describe some key aspects of the monetary policy of the National Bank of Poland in the last decade. Both rates dropped from a level of about 20% in year 2000 to a level of around 5% in year 2004. In general, starting from year 2004 both rates were still dropping, although at a much slower pace, reaching values of 3.75% (*R*) and 4.20% (*I*) in the last quarter of 2009. It seems very likely that such large fluctuations in both types of interest rate should have an effect (individual and mutual) on economic growth and on the performance of the financial sector in Poland in years 2000–2009. Thus we included these variables as additional (common) factors.

In the next subsection the descriptive analysis of the time series included in our dataset will be extended by stationarity testing. This is a crucial step of traditional causality analysis.

4.2. Stationarity properties of the dataset

An Augmented Dickey–Fuller (ADF) unit root test was conducted as the first step of this part of the research. Before conducting the test, we set the maximal lag length at a level of 6 and then we applied information criteria (namely, the AIC, BIC and HQ) to choose the optimal lag. While applying the

ADF test one should bear in mind two important facts. First, this test is relatively sensitive to incorrect setting of lag parameter. Second, as shown in some papers[4] the ADF test tends to under–reject the null hypothesis detecting nonstationarity too often. Thus, a Kwiatkowski–Phillips–Schmidt–Shin (KPSS) test was additionally conducted to confirm or reject the results of the ADF one. It is important to note that in contrast to the ADF test the null hypothesis of a KPSS test refers to the case of stationarity.

To deal with the situation where two unit root tests lead to contradictory conclusions one should apply a third test to make a final decision about the stationarity of the analyzed time series. In this paper the Phillips–Perron (PP) test was applied for this purpose. This test is based on a nonparametric method of controlling for serial correlation when testing for a unit root. As with ADF, the null hypothesis refers to nonstationarity.

A summary of the results of the stationarity analysis is presented in Table 3. Bold face was used to indicate finding nonstationarity at a 5% level.

Test type / Variable	ADF				KPSS[c]		PP[c]	
	with constant		with constant and linear trend		with constant[a]	with constant and linear trend[b]	with constant	with constant and linear trend
	p–value	Optimal lag	*p*–value	Optimal lag	Test statistic		*p*–value	
GDP	**0.98**	1	**0.21**	1	**0.75**	**0.16**	**0.99**	**0.52**
$BANK_c$	**0.99**	1	**0.87**	1	**0.59**	**0.19**	**0.99**	**0.96**
$BANK_d$	**0.99**	0	**0.99**	0	**0.53**	**0.18**	**0.99**	**0.98**
TURNOVER	**0.68**	0	**0.19**	0	**0.59**	0.12	**0.73**	**0.20**
R	**0.14**	1	**0.57**	1	**0.57**	**0.17**	**0.27**	**0.88**
I	**0.07**	1	**0.40**	1	**0.55**	**0.18**	**0.34**	**0.88**

Table 3. Results of stationarity analysis

[a] *critical values:* 0.347 (10%), 0.463 (5%), 0.739 (1%).
[b] *critical values:* 0.119 (10%), 0.146 (5%), 0.216 (1%).
[c] *Bandwidth parameter was established according to Newey and West* (1987).

An analysis of the results presented in Table 3 shows that each time series was found to be nonstationary at a 5% level, regardless of the type of deterministic term, which clearly supports

[4] Low power of this test against stationary alternatives has been frequently reported by many authors, see e.g. Agiakoglu and Newbold (1992).

Conjecture 1.[5] Some further calculations (conducted for first differences) confirmed that all the variables under study are integrated of order one.[6]

5. Methodology

In this paper several econometric tools were applied to test for both linear and nonlinear Granger causality between GDP and financial development in the Polish economy. The main part of our research was conducted in three variants, each of which involved *GDP* and one variable related to financial sector ($BANK_c$, $BANK_d$ and *TURNOVER*). As already mentioned, for the sake of the correctness of computations (allowing common variables) and the robustness of the empirical results two types of interest rate were also applied. Therefore our analysis was based on six modelling schemes.

5.1. Linear short and long run Granger causality tests

The concept of causality applied in this paper is due to Granger (1969). This idea is well known and has been commonly applied in previous empirical studies, thus we will not explain it in detail. By and large, it is used to check whether the past and current values of one stationary variable are helpful in predicting the future values of another one or not.

If the precondition of stationarity is not fulfilled a standard linear Granger causality test is likely to produce spurious results.[7] In this paper we applied three econometric methods suitable for testing for linear short and long run Granger causality for nonstationary variables integrated in the same order, namely, the analysis of unrestricted vector error correction model (VECM), the sequential elimination of insignificant variables in VECM, and the Toda–Yamamoto procedure. Moreover, besides the asymptotic variant, each procedure was additionally performed in a bootstrap framework. The application of such a variety of methods is believed to ensure a verification of robustness and the validation of empirical findings.

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[5] For *TURNOVER* time series trend–stationarity was confirmed by the KPSS test, although the ADF and PP tests clearly rejected this posibility.

[6] It should be underlined that detailed results of all computations which are not presented directly in the text in detailed form (usually to save space) are available from the authors upon request.

[7] Previous empirical (Granger and Newbold, 1974) and theoretical (Phillips, 1986) deliberations investigated this phenomenon in detail

Since all variables under study were found to be I(1), the idea of cointegration and analysis of unrestricted VEC model allowed an examination of both short and long run causal dependencies. The finding that the variables are cointegrated implies the existence of long run Granger causality in at least one direction (Granger, 1988). The simplest way to establish the direction of causality is based on checking (using a t–test) the statistical significance of the error correction terms in VECM. The test of joint significance (F–test) of lagged differences allows for short run causality investigations.

The application of an unrestricted VEC model has one serious drawback, however. In order to avoid the consequences of the autocorrelation of residuals it is often necessary to use a relatively large number of lags, which may simultaneously reduce the number of degrees of freedom. This in turn may have an undesirable impact on test performance, especially for small samples. Another problem related to testing for linear causality using a traditional Granger test is multicollinearity, which is especially significant for dimensions higher than two. For these reasons, a sequential elimination of insignificant variables was additionally applied for each VECM equation separately. This procedure sequentially omits the variable with the highest p–value (t–test) until all remaining variables have a p–value no greater than a fixed value (in this paper it was 0.10).[8]

An alternative method for testing for linear Granger causality was formulated by Toda and Yamamoto (1995). The prevalence of this method is due to the fact that it is relatively simple to perform and free of complicated pretesting procedures, which may bias the test results, especially when dealing with nonstationary variables (Gurgul and Lach, 2011). However, the key advantage is the fact that this procedure is applicable even if the variables under study are characterized by different orders of integration.[9] On the other hand, the Toda–Yamamoto (TY) approach does not allow us to distinguish between short and long run causal effects.[10]

[8] More technical details of this approach can be found in Gurgul and Lach (2010).

[9] In such cases a standard linear causality analysis cannot be performed by the direct application of a basic VAR or VEC model. On the other hand, differencing or calculating the growth rates of some variables allows the use of the traditional approach, but it can also cause a loss of some information and lead to problems with the interpretation of results.

[10] The long run dependencies between GDP and financial sector are especially important, as short run causal links may be related to business cycle or multiplier effects and die out without having lasting efects.

Since the idea behind the Toda and Yamamoto approach for causality testing is relatively simple and well known we will not provide a detailed description. By and large, this approach requires the establishment of parameter p_1 (order of VAR model), parameter p_2 (highest order of integration of all examined variables) and then a calculation of the standard Wald test applied for the first p_1 lags of the augmented VAR(p_1+p_2) model. If some typical modelling assumptions hold true for the augmented model then the test statistic has the usual asymptotic $\chi^2(p_1)$ distribution (Lütkepohl, 1993).[11]

All the aforementioned parametric methods have a few serious drawbacks. First of all, the application of asymptotic theory requires specific modelling assumptions to hold true. Otherwise spurious results may occur. Second, for extremely small samples the distribution of the test statistic may be significantly different from an asymptotic pattern even if all modelling assumptions hold true. One possible way of overcoming these difficulties is the application of the bootstrap method. By and large, this procedure is used for estimating the distribution of a test statistic by resampling data. Since the estimated distribution depends only on the available dataset, bootstrapping does not require such strong assumptions as parametric methods. However, in some specific cases this concept is also likely to fail, so it should not be treated as a perfect tool for solving all possible model specification problems (Horowitz, 1995).

The bootstrap test applied in this paper was based on resampling leveraged residuals, because such an approach may minimize the undesirable influence of heteroscedasticity. In recent years the problem of the establishment of the number of bootstrap replications has attracted considerable attention (Horowitz, 1995). The procedure of establishing the number of bootstrap replications recently developed by Andrews and Buchinsky (2000) was applied in this paper. In all cases our goal was to choose such a value of number of replications which would ensure that the relative error of establishing the 10%–critical value would not exceed 0.05 with a probability equal to 0.95.[12] All aforementioned procedures were implemented using the Gretl software.

[11] Since we dealt with relatively small samples we applied the TY test statistic in its asymptotically *F*–distributed variant, which performs better for small samples (Lütkepohl, 1993).

[12] A detailed description of the resampling procedure applied in this paper may be found in Hacker and Hatemi (2006).

5.2. Nonlinear Granger causality test

The motivation to use nonlinear methods in testing for Granger causality is twofold. First, the traditional linear Granger causality test was found to have very low power in detecting certain kinds of nonlinear causal interrelations.[13] Second, since linear tests are mainly based on checking the statistical significance of suitable parameters only in a mean equation, testing for causality in any higher–order structure (e.g. variance) is impossible (Diks and DeGoede, 2001).

The nonlinear causality testing procedure proposed by Diks and Panchenko (2006) was used in this paper. We set up a common lag parameter (denoted as l_{DP}) at a level of 1 and 2 while the bandwidth (denoted as b_{DP}) was set at the order of 0.5, 1 and 1.5.[14] A nonlinear causality is significant if it was found for at least one combination of b_{DP} and l_{DP}. The detailed description of the role of these technical parameters and the form of test statistic may be found in Diks and Panchenko (2006).

In practical applications of this nonlinear test heteroscedasticity is also a problem, which may lead to over–rejection (Diks and Panchenko, 2006). Therefore, before conducting nonlinear tests we additionally tested all time series for the presence of various heteroscedastic structures (using, among others, White's test and a Breusch–Pagan test).

6. Empirical results

This section contains the results of the short and long run linear Granger causality analysis as well as the outcomes of nonlinear causality tests. The main goal of our empirical study was to examine the research hypotheses presented in section 3. As already mentioned, the reserach was performed on the basis of six schemes. Table 4 contains some initial details.

Model structure	Variables used	Description
1	GDP, $BANK_c$, R	Bank–based approach: focusing on interrelations between banking sector and economic growth.
2	GDP, $BANK_c$, I	
3	GDP, $BANK_d$, R	
4	GDP, $BANK_d$, I	
5	GDP, $TURNOVER$, R	Market–based approach: focusing on interrelations between stock market and economic growth.
6	GDP, $TURNOVER$, I	

Table 4. Specification of models applied in empirical study

[13] See, for example, Brock (1991).

[14] In all testing variants the hypothesis of full rank was clearly accepted, which additionally validates the results of the previously performed unit root tests (Lütkepohl, 1993).

The empirical results presented in the following subsections are related in most cases only to an examination of the causal links between economic growth and financial development. The results of testing for causality between interest rates and economic growth, as well as interest rates and financial development are not the main focus of this study and hence they are not presented explicitly in the text. However, some short remarks about the analysis of these links (less important for the subject of the paper) are also made.

6.1. Results obtained for bank–based models

The examination of causal dependencies between economic growth and financial development was first performed for bank–based models. Since all variables examined in this part of the research (*GDP*, $BANK_c$, $BANK_d$, *R, I*) were found to be I(1), a cointegration analysis was first performed.

6.1.1. Bank claims and economic growth

Before conducting cointegration tests the type of deterministic trend was first specified using the five possibilities listed in Johansen (1995). The results presented in subsection 4.2 (no trend–stationarity) provided a basis to assume Johansen's third case, that is the presence of a constant in both the cointegrating equation and the test VAR. Next, we set the maximal lag length (for levels) at a level of 6 and then we established the appropriate number of lags using the information criteria (AIC, BIC, HQ). Table 5 contains a summary of the results of Johansen cointegration tests.

				Johansen Trace test		Johansen Maximal Eigenvalue test	
Model structure	Optimal lag (levels)	Hypothesized number of cointegrating vectors	Eigenvalue	Trace statistic	*p*–value	Maximal Eigenvalue statistic	*p*–value
1	2	Zero	0.37	27.50	0.09	18.05	0.12
		At most one	0.19	9.44	0.32	8.38	0.34
		At most two	0.02	1.06	0.30	1.06	0.30
2	2	Zero	0.40	31.15	0.03	19.73	0.07
		At most one	0.22	11.41	0.18	9.68	0.23
		At most two	0.04	1.736	0.18	1.73	0.18

Table 5. Results of cointegration analysis for model structure 1 and 2

In general, the results of both variants of Johansen's test provided solid evidence to claim that *GDP*, each bank–related variable and the interest rate are indeed cointegrated. Three out of the four tests supported the hypothesis that the dimension of cointegration space is equal to one at a 10%

significance level.[15] After performing an analysis of the cointegration properties, we estimated suitable VEC models assuming 2 lags (for levels) and one cointegrating vector in each case. Table 6 contains the *p*–values obtained while testing for linear short and long run Granger causality using an unrestricted VEC model and the sequential elimination of insignificant variables. Testing for causality in each direction was based on asymptotic– and bootstrap–based critical values (bootstrap *p*–values are presented in square brackets).[16]

Model structure	Null hypothesis	Short run		Long run	
		p–value[a]		*p*–value of error correction component[a]	
		Unrestricted	Sequential	Unrestricted	Sequential
1	$BANK_c \neg\rightarrow GDP$	0.14 [0.15]	NCL [NCL]	**0.07** [**0.04**]	NCL [NCL]
	$GDP \neg\rightarrow BANK_c$	0.41 [0.43]	NCL [NCL]	**0.01** [**0.03**]	**0.01 [0.00]**
2	$BANK_c \neg\rightarrow GDP$	0.18 [0.16]	NCL [NCL]	0.11 [**0.08**]	NCL [NCL]
	$GDP \neg\rightarrow BANK_c$	0.47 [0.54]	NCL [NCL]	**0.00** [**0.00**]	**0.00** [**0.00**]

Table 6. Analysis of causal links for model structure 1 and 2 (VEC–based approach)

[a] *Number of bootstrap replications established by the Andrews and Buchinsky* (2000) *method varied between* 2869 *and* 3779.

An analysis of the results presented in Table 6 leads to the conclusion that in the short run no causality was detected. This result was found to be roboust when exposed to VEC–based analysis as well as a type of interest rate used. Similarly, the long run impact of *GDP* on $BANK_c$ was also found to be robust to changes of testing procedure and the choice of common variable. On the other hand, evidence of long run causality from $BANK_c$ to *GDP* was markedly weaker (it was suported neither by the results of an asymptotic–based analysis of the unrestricted VEC /model structure 2/ nor any sequential variant).

For the sake of comprehensiveness the Toda–Yamamoto approach for testing for causal effects between bank claims and economic growth was additionally applied. The outcomes of this procedure are presented in Table 7.

[15] In all testing variants the hypothesis of full rank was clearly accepted, which additionally validates the results of the previously performed unit root tests (Lütkepohl, 1993).

[16] Throughout this paper the notation "$x \neg\rightarrow y$" is equivalent to "*x* does not Granger cause *y*". Moreover, the symbol "NCL" is the abbreviation of "No coefficients left". Finally, bold face always indicates finding a causal link in a particular direction at a 10% significance level.

Model structure	Parameters for TY procedure	Null hypothesis	p–value	
			Asymptotic	Bootstrap[a]
1	p_1=2, p_2=1	$BANK_c \neg\rightarrow GDP$	0.24	0.15 (N=3239)
		$GDP \neg\rightarrow BANK_c$	0.16	0.22 (N=3079)
2	p_1=2, p_2=1	$BANK_c \neg\rightarrow GDP$	0.13	0.21 (N=3459)
		$GDP \neg\rightarrow BANK_c$	0.24	0.54 (N=2919)

Table 7. Analysis of causal links for model structure 1 and 2 (TY approach)

[a] *Parameter N denotes the number of bootstrap replications established according to the Andrews and Buchinsky* (2000) *procedure.*

In general, the results presented in Table 7 are in line with the outcomes contained in Table 6. Short run causality was not reported in any direction, regardless of the type of critical values used.

In the last step of the causality analysis we performed nonlinear tests for two sets of residuals resulting from linear models, that is the residuals of unrestricted VECM, the residuals resulting from individually (sequentially) restricted equations and the residuals resulting from the augmented VAR model applied in the Toda–Yamamoto method.[17] For each combination of b_{DP} and l_{DP} three p–values are presented. In the upper row the p–value for residuals of unrestricted VEC model (left) and p–value for residuals of sequentially restricted equations (right) are presented. In the lower row the p–value obtained after analysis of residuals of TY procedure is placed.

Table 8 presents p–values obtained while testing for nonlinear Granger causality between $BANK_c$ and economic growth. In all examined cases no filtering was used since no significant evidence of heteroscedasticity was found.

<table>
<tr><th rowspan="2">Model structure</th><th rowspan="2">Null hypothesis</th><th colspan="12">p–value</th></tr>
<tr><th colspan="2">b_{DP}=0.5, l_{DP}=1</th><th colspan="2">b_{DP} =1, l_{DP}=1</th><th colspan="2">b_{DP} =1.5, l_{DP}=1</th><th colspan="2">b_{DP} =0.5, l_{DP}=2</th><th colspan="2">b_{DP} =1, l_{DP}=2</th><th colspan="2">b_{DP} =1.5, l_{DP}=2</th></tr>
<tr><td rowspan="4">1</td><td rowspan="2">$BANK_c \neg\rightarrow GDP$</td><td>0.76</td><td>0.85</td><td>0.64</td><td>0.76</td><td>0.79</td><td>0.68</td><td>0.24</td><td>0.64</td><td>0.43</td><td>0.79</td><td>0.65</td><td>0.81</td></tr>
<tr><td colspan="2">0.65</td><td colspan="2">0.58</td><td colspan="2">0.62</td><td colspan="2">0.82</td><td colspan="2">0.33</td><td colspan="2">0.28</td></tr>
<tr><td rowspan="2">$GDP \neg\rightarrow BANK_c$</td><td>0.08</td><td>0.65</td><td>0.22</td><td>0.43</td><td>0.09</td><td>0.54</td><td>0.55</td><td>0.31</td><td>0.32</td><td>0.59</td><td>0.06</td><td>0.66</td></tr>
<tr><td colspan="2">0.71</td><td colspan="2">0.82</td><td colspan="2">0.81</td><td colspan="2">0.71</td><td colspan="2">0.81</td><td colspan="2">0.69</td></tr>
<tr><td rowspan="4">2</td><td rowspan="2">$BANK_c \neg\rightarrow GDP$</td><td>0.62</td><td>0.71</td><td>0.72</td><td>0.54</td><td>0.77</td><td>0.62</td><td>0.54</td><td>0.47</td><td>0.24</td><td>0.68</td><td>0.23</td><td>0.73</td></tr>
<tr><td colspan="2">0.15</td><td colspan="2">0.43</td><td colspan="2">0.80</td><td colspan="2">0.65</td><td colspan="2">0.67</td><td colspan="2">0.64</td></tr>
<tr><td rowspan="2">$GDP \neg\rightarrow BANK_c$</td><td>0.24</td><td>0.29</td><td>0.32</td><td>0.25</td><td>0.23</td><td>0.83</td><td>0.31</td><td>0.55</td><td>0.69</td><td>0.37</td><td>0.07</td><td>0.69</td></tr>
<tr><td colspan="2">0.06</td><td colspan="2">0.19</td><td colspan="2">0.50</td><td colspan="2">0.51</td><td colspan="2">0.31</td><td colspan="2">0.48</td></tr>
</table>

Table 8. Analysis of nonlinear causal links for $BANK_c$ and GDP

[17] The residuals are believed to reflect strict nonlinear dependencies as the structure of linear connections had been filtered out after an analysis of linear models (Baek and Brock, 1992).

As one can see, nonlinear causality running from *GDP* to the ratio of bank claims in the private sector to nominal GDP was found for residuals resulting from the unrestricted VECM (Model structure 1) as well as for residuals from unrestricted VEC model and post–TY residuals (Model structure 2). On the other hand, nonlinear causality in the opposite direction was not reported in any research variant.

To summarize, we found strong support to claiming that *GDP* causes $BANK_c$ both in the short and long run. Evidence of causality running in the opposite direction is markedly weaker (no short run impact, the possibility of long run impact excluded by the results of the sequential procedure). It is important to note that in general both these findings were supported by the results of different econometric methods (linear VEC–based and TY–based procedures supplemented with Diks and Panchenko's nonlinear test) and different choices of common variable. The stability of these results is especially important in terms of the robustness and validation of empirical findings.

6.1.2. Bank deposit liability and economic growth

This subsection contains results obtained after an analysis of causal dependencies between real per capita GDP and the ratio of bank deposit liability to nominal GDP. Table 9 contains the results of the cointegration analysis.[18]

Model structure	Optimal lag (levels)	Hypothesized number of cointegrating vectors	Eigenvalue	Johansen Trace test: Trace statistic	Johansen Trace test: *p*–value	Johansen Maximal Eigenvalue test: Maximal Eigenvalue statistic	Johansen Maximal Eigenvalue test: *p*–value
3	1	Zero	0.67	59.49	0.00	44.19	0.00
		At most one	0.32	15.29	0.05	15.27	0.03
		At most two	0.00	0.01	0.91	0.01	0.91
4	1	Zero	0.62	55.75	0.00	38.69	0.00
		At most one	0.34	17.05	0.02	16.49	0.02
		At most two	0.01	0.56	0.45	0.56	0.45

Table 9. Results of cointegration analysis for model structure 3 and 4

At a 10% significance level both variants of Johansen's test provided solid evidence for claiming that for Model structures 3 and 4 the dimension of cointegration space is equal to two. As in the previous case (Table 5) the nonstationarity of all variables was confirmed once again. Next, we estimated a

[18] The preliminary part of the cointegration analysis (specification of the type of deterministic trend, lag selection procedure) was performed in exactly the same way as in the previous subsection.

suitable VEC model assuming 1 lag (for levels) and two cointegrating vectors to test for causality. As in previous subsection, a TY procedure was additionally applied. Finally, a nonlinear test was applied to the residuals resulting from all linear models. Table 10 contains a summary of results. Causality (non–causality) at a10% significance level is marked in Table 10 by ✓ (✗). Symbols in square brackets refer to the results of bootstrap–based procedures.

Model structure	Null hypothesis	VEC–based approach (unrestricted)[a,b]	VEC–based approach (sequential)[a,b]	TY–based approach[a,c]	Nonlinear test (after unrestricted VEC)	Nonlinear test (after sequential elimination)	Nonlinear test (after TY procedure)
3	$BANK_d \neg\rightarrow GDP$	✓ [✗]	✗ [✗]	✗ [✗]	✗	✗	✗
	$GDP \neg\rightarrow BANK_d$	✓ [✓]	✓ [✓]	✗ [✗]	✗	✗	✓
4	$BANK_d \neg\rightarrow GDP$	✓ [✗]	✗ [✗]	✗ [✗]	✗	✗	✗
	$GDP \neg\rightarrow BANK_d$	✓ [✓]	✓ [✓]	✗ [✗]	✗	✗	✓

Table 10. Results of causality analysis for model structure 3 and 4

[a] *Number of bootstrap replications established using the Andrews and Buchinsky* (2000) *method varied between* 2429 *and* 3959.
[b] *One lag (in levels) was found as optimal, thus short run causality could not be examined within a VECM framework.*
[c] *Parameters for TY procedure*: p_1=1, p_2=1.

In general, the results contained in Table 10 are in line with the results presented in previous subsection. Swapping $BANK_c$ with $BANK_d$ did not change the conclusion that real per capita GDP in Poland caused bank sector development in the short and long run in the last decade. The supposition that causality running in the opposite direction is much less likely was confirmed once again (no linear or nonlinear short run impact, long run impact option excluded by the results of the sequential procedure and the results of the bootstrap procedure). This way only weak evidence supporting Conjecture 2 was found. As in the previous subsection, all these empirical findings were supported by the results of different econometric methods and different choices of common variable, which surely validates our empirical findings.

6.2. Results obtained for stock market–based models

This subsection contains the results of the examination of causal dependencies between real per capita GDP in Poland and the ratio of WSE turnover to nominal GDP, i.e. the dynamic links between financial development and the economic growth of Poland in years 2000–2009 were examined within a market–based framework.

As in subsection 6.1, a cointegration analysis was performed. First, we followed the previously described preliminary procedure (selection of lag and the type of deterministic term). The testing procedure was based on 2 lags (in levels) and the assumption of Johansen's third case. Table 11 presents the outcomes of both variants of Johansen's test applied to model structure 5 and 6.

				Johansen Trace test		Johansen Maximal Eigenvalue test	
Model structure	Optimal lag (levels)	Hypothesized number of cointegrating vectors	Eigenvalue	Trace statistic	*p*–value	Maximal Eigenvalue statistic	*p*–value
5	2	Zero	0.40	29.49	0.05	19.82	0.07
		At most one	0.20	9.66	0.30	8.76	0.30
		At most two	0.02	0.90	0.34	0.90	0.34
6	2	Zero	0.41	28.56	0.06	20.33	0.06
		At most one	0.17	8.23	0.44	7.22	0.46
		At most two	0.02	1.00	0.31	1.00	0.31

Table 11. Results of cointegration analysis for model structure 5 and 6

At a 10% significance level both variants of Johansen's test provided solid evidence for claiming that for model structures 5 and 6 the dimension of cointegration space is equal to one. After performing the cointegration analysis, linear and nonlinear causality tests were also conducted. To ensure ease of interpretation and to save space the results are briefly presented in Table 12.

Model structure	Null hypothesis	VEC–based approach (unrestricted) [a]		VEC–based approach (sequential) [a]		TY–based approach [a,b]	Nonlinear test (after unrestricted VEC)	Nonlinear test (after sequential elimination)	Nonlinear test (after TY procedure)
		Short run	Long run	Short run	Long run				
5	*TURNOVER* ¬→ *GDP*	×[×]	✓[✓]	×[×]	✓[✓]	✓[✓]	×	×	×
	GDP ¬→ *TURNOVER*	×[×]	×[×]	×[×]	×[×]	×[×]	✓	×	✓
6	*TURNOVER* ¬→ *GDP*	×[×]	✓[✓]	×[×]	✓[✓]	✓[✓]	×	×	×
	GDP ¬→ *TURNOVER*	×[×]	×[×]	×[×]	×[×]	×[×]	✓	×	✓

Table 12. Results of causality analysis for model structure 5 and 6

[a] *Bootstrap–based results are presented in square brackets. Number of bootstrap replications established using the Andrews and Buchinsky* (2000) *method varied between* 2649 *and* 3579.
[b] *Parameters for TY procedure*: $p_1=2$, $p_2=1$.

As one can see, the results presented in this table lead to a different conclusion from the one drawn in subsection 6.1. The real per capita GDP was found to be caused by *TURNOVER* both in the short and long run. This phenomenon was indicated regardless of the choice of common variable and type of linear test applied, which provides clear evidence of robustness. On the other hand, causality in the opposite direction was found to be much less likely and possible only in the short run nonlinear sense. To summarize, Conjecture 3 was clearly supported.

6.3. Supplementary results

As already mentioned, the results of testing for causality between interest rates and economic growth, as well as interest rates and financial development are not the main focus of this study and hence they are not presented in details. Moreover, a number of the results obtained for the pairs *GDP vs* interest rate and financial development *vs* interest rate were found to depend on the type of testing procedure applied and the type of interest rate. However, there is a group of results which was found to be stable and valid. We will briefly report these major observations.

For model structures 1–4 the interest rate was found to have a short and long run impact on $BANK_c$ and $BANK_d$. Evidence of causality running in the opposite direction was markedly weaker and reported only in the nonlinear test. In general, a similar long run causal pattern was also found for real per capita GDP and the interest rate within the framework of model structures 1–4. Moreover, solid support for claiming that *GDP* caused both interest rates in the short run was also found, which indicated the indirect short run impact from *GDP* to both bank–related variables. It is worth noting that these indirect links were confirmed by testing direct causality between *GDP* and $BANK_c$ as well as between *GDP* and $BANK_d$.

On the other hand, no causal links were found between the ratio of WSE turnover to nominal GDP and either interest rate in both the short and long run. This lack of causality in any direction implies that fluctuations in WSE turnover were not affected directly by the monetary policy of the National Bank of Poland and vice versa. Moreover, it proves that in the years 2000–2009 dynamic relations between GDP, interest rates and financial development were not consistent for different variables related to the financial sector in Poland.[19]

[19] These findings lead to the conclusion that development of stock market was an indirect causal factor for development of the banking sector in Poland in the last decade. Since this causal link is of great importance for a number of social groups in Poland (investors, bankers, policy makers, savers) we additionally performed an analysis of causal dependences between both bank–related variables and *TURNOVER* within a two–dimensional framework. The results confirmed that *TURNOVER* causes $BANK_c$ and $BANK_d$ both in the short and long run. Evidence of causality in the opposite direction was markedly weaker (indicated only by nonlinear tests).

7. Concluding remarks

Most contributors have stressed that economic growth does not seem, as a rule, to depend on "prior" changes in the financial system. Further deregulation of financial systems and financial institutions in developed economies should improve and extend financial services. But this liberalization of policy will not necessarily cause (in the Granger sense) a subsequent speeding up of economic growth. Moreover, some economists think that financial crises might be caused by too intensive liberalization of the financial sector, far in excess of the growth of the real sector. Other studies however are in line with the conviction that financial development promotes economic growth, thus supporting the old Schumpeterian hypothesis. The literature overview suggests that the link between financial development and economic growth may be country–specific and probably depends on differences in the industrial structures and cultures of societies.

The main goal of this paper was to examine the nature of the causal interrelations between economic growth and financial development in Poland. The empirical study was based on quarterly data from period Q1 2000 – Q4 2009. In general, the research was divided into two main parts. We focused on two key areas of financial sector, i.e. bank– and stock market–based systems. Both traditional and recently developed econometric methods were applied to provide tools for conducting comprehensive research. Moreover, the stability of the empirical findings was also verified as two different interest rates were taken into consideration as a possible common variable.

In general, the results of the causality analysis indicated the existence of a significant unidirectional short and long run impact of real per capita GDP on both bank–related proxies for financial development in Poland. These results were found to be robust to the econometric method applied and the type of common variable used. Causality running from economic growth to the banking sector may indicate that a more developed economy has a more developed banking system.

On the other hand, evidence of causality in the opposite direction was considerably weaker and not supported by the results of some econometric procedures.

By contrast, causality tests performed for market–based models supported the existence of significant short and long run causality from financial development to economic growth in Poland in the last decade. The robustness of this major finding was also confirmed. In general, causality from real per capita GDP to the ratio of WSE turnover to nominal GDP could not be confirmed by some of the methods applied, which lead to serious doubts about its existence.

To summarize, the empirical results provided evidence for claiming that the causal links between economic growth and the financial development of the Polish economy strongly depend on which segment of the financial sector is considered. In general, we found that development of the Warsaw Stock Exchange caused real per capita GDP growth and that economic growth caused the development of the banking sector in Poland. These findings lead to the conclusion that the development of the stock market was a causal factor for the development of the banking sector in Poland in the last decade, which was also confirmed by direct causality tests performed within a two–dimensional framework.

Research on the direction of causality between financial development and economic growth is important because it has special policy implications on the best economic strategy to enhance the growth, particularly, of economies in transition. Financial development in Poland seems to stimulate to some extent the economic growth of the country. Moreover, we can conclude (on the basis of the data set for Poland) that a better developed stock market leads to higher economic growth. This occurs because the development of stock markets can imply risk diversification and better resource allocation. Financial deregulation conducted in the period of transition improved competition and allowed greater accessibility to financial products. Therefore we can take for granted that financial deregulations in Poland in transition had a positive impact on economic growth.

We recognize, however, that our study might have inherent limitations. For example, our tests could suffer from omitting some variables. Nevertheless, these probable shortcomings are likely to exist in most, if not in all, time series analyses of this kind. The reason for this is lack of sufficient dataset. In our opinion, future time series analyses should examine whether banking is related to certain components of GDP, such as investments, or to certain intensive sectors on the supply side of the economy, such as the manufacturing industry.

Finally, we believe that our study provides a basis for further time–series quantitative investigations of the historical and contemporary role of banking and the stock market in the economic development of Poland and other countries in transition.

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List of figures:

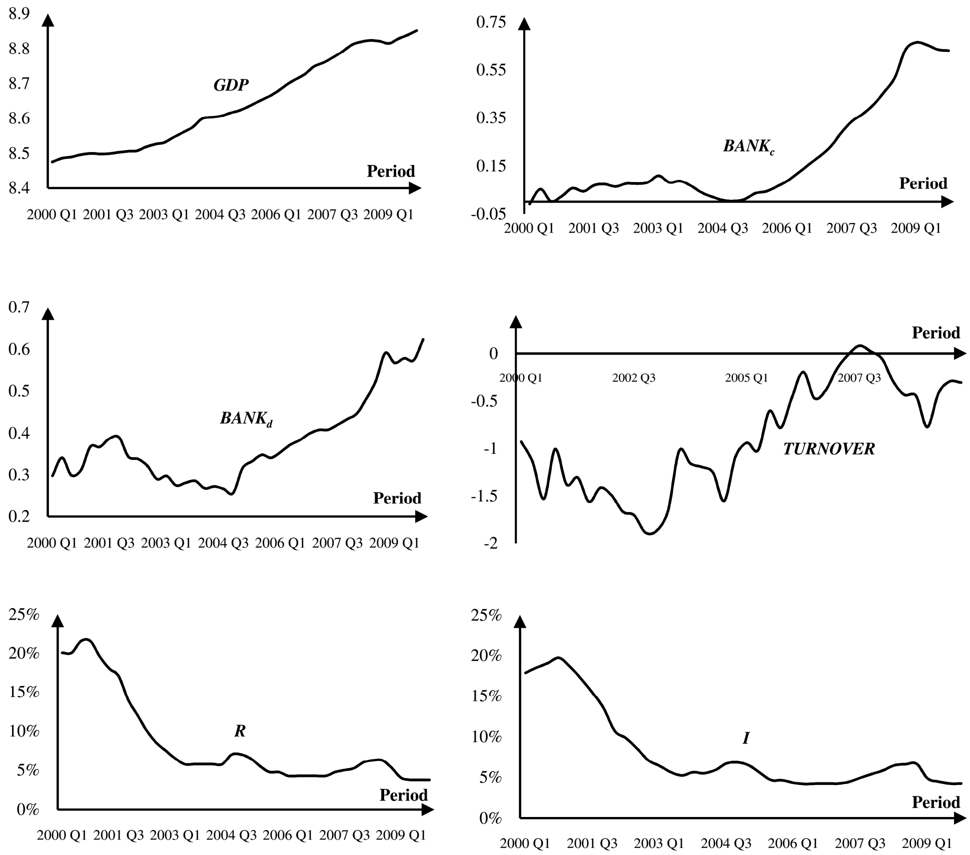

Figure 1. Plots of examined time series