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Financial Development and Economic Growth in a Transition Economy: Evidence for Poland

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Abstract

This paper examines the long-run relationship between finance and economic growth for a transition economy, such as Poland using quarterly data from 1994:Q1 until 2004:Q4. It presents the interaction between the financial market and economic growth, and an aggregate production function is then estimated using cointegration analysis. Given that the literature on the transition specific finance-growth relationship has recently started to emerge, this study with a focus on a transition economy contribute to the existing limited research. The findings suggest that, in the long run, credits to the private sector have been one of the main forces in Polish economic growth. Furthermore, we find that economic development is not driven by endogenously determined variables among which is financial development.

Keywords: financial development, economic growth, transition economies, cointegration

1. Introduction

The contribution of capital in the economic growth process is of great importance. With the aid of financial intermediaries, funds are transferred from savers (mainly households) to investors. The nature of the financial intermediaries' sector indicates it as the most important for an economy and thus for economic growth.

Based on endogenous growth models a huge amount of literature was written which related the development in the financial sector with economic growth. The new economic growth theory focuses on how an economy can generate growth in the absence of exogenous technological progress. In this framework, financial markets "have not only level effect but also growth effect" (Pagano, 1993). More particularly financial intermediation can affect economic growth by acting on the level of saving or on the marginal productivity of investment. This theory points out that economic growth is negatively by a malfunctioning financial sector. Endogenous growth theory concluded on same results within particular models using risk distribution and liquidity flows, as services provided by financial intermediaries (see Greenwood and Jovanovic, 1990), while state intervention in the stock market has negative influence in economic development (see King and Levine, 1993b).

Beyond the theory, there is still a debate about whether financial development affects economic growth, the opposite or if there is no relation between them at all. The theoretical perspective that stock market de-

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velopment is caused by the economic one as a result of increasing demand of stock market services has been supported by Robinson (1952) and later on by Friedman and Schwartz (1963) in point of money demand. Researchers on the area of finance and growth follow various methodologies and their results — as we mentioned above — are not unique. Generally, there are two main trends that are followed for the analysis. The first is cross-country. The second is time-series analysis, which presented more uncertain results. Furthermore, some researchers who adopted time-series reached to an inverse conclusion from the cross-country works.

This paper focuses on the examination of the relationship between finance and growth for a transition economy such as Poland. As the relevant empirical evidence regarding the Central-Eastern Europe (CEE) appears to be scarce, this effort intends to provide insight into the patterns of long-run relationships among financial development and economic growth for the most developed Central European country. We contribute to the existing literature by presenting a work for the "finance-growth nexus" with a focus on a transition economy. We stress that because there is not much evidence right now applied to these countries, our findings may be very helpful to understand the nature of the finance-growth relationship in such economies.

In this study we employ time-series analysis because cross-sectional regression results are difficult to interpret due to the heterogeneity of slope coefficients across countries. In our analysis we use the Johansen technique. This is particularly appropriate in identifying the long-run relationship when there is spuriousness among the variables. We make use of an augmented production function where the financial development is captured by the credit to the private sector and the stock market liquidity.

The rest of this paper is organised as follows: Section 2 discusses the theoretical links between finance and economic growth, by explaining the role of financial intermediaries to channel funds into productive investment and what the financial system does. Section 3 presents the review of the empirical literature related to financial development and economic growth for developed and transition economies. Section 4 presents the major methodological issues. Section 5 provides the data used and the empirical results and, finally, in Section 6 we report the main conclusions of this study.

2. Finance and Economic Growth

The role of financial intermediaries is to channel funds (savings) from savers to investors. Financial intermediaries transfer funds from units which present surplus of funds to those units that require funds for their investments. This intermediary position makes this sector the most important for economic growth. Indeed, the more developed this sector, the more efficiently the funds are channelled into more productive and less risky projects.

Financial intermediaries transform savings into investments by repackaging wealth and transferring capital and information. Information is the central word when we refer to the capital markets. Capital markets are dominated by two kinds of frictions:

(i) Information costs.
When there is a channelling of funds from savers (lenders) to investors (borrowers), adverse selection and moral hazard problems arise. This is because lenders and borrowers have different information regarding the nature and the practicability of the financed investment project. This refers to the asymmetric information problem.

(ii) Transaction friction.
The pooling-mechanism and screening mechanism have a cost. Banks exercise these functions and take advantage from the economies of scale. Hence, they grow to reduce these two costs.

According to Levine (1997), the financial system plays five important functions in the economy:

1. Mobilise savings. The presence of efficient financial institutions may improve the willingness of the savers to transfer their surplus into deficit units. Usually, the existence of an insurance mechanism at a government level facilitates this function (e.g., the Central Banks as Lender of Last Resort prevent 'bank runs').
2. Allocate resources. This function is linked with the ability of financial institutions to gather information among different available projects. This allows the channelling of savings into the most profitable investments adjusted for the level of risk.
3. Monitor managers and exert corporate control. This function suggests that the financial system can reduce the risk of moral hazard. Banking and other intermediary institutions, through the 'screening-mechanism', monitor the project during the life of the loan in order to prevent a bad utilisation of the funds.
4. Facilitate the trading, hedging, diversifying and pooling of risk. This function is associated with two different risks; Productivity and future demand risk and liquidity risk. The first type of risk is associated with uncertainties to which an investment project is subjected. The existence of these creates a necessity for a financial system. Savers may diversify their portfolios either indirectly (through the banking system) or directly (through the stock market). The second risk is due to the fact that many profitable investments may require a long-term commitment of capital, but agents are often reluctant to lose control on their savings for long periods. The existence of financial markets, which allow agents to avoid liquidity shocks, can have a positive effect on the level of savings.
5. Facilitate the exchange of goods and services. This basic function refers to the payment system. In fact a necessary condition for economic growth is the exchange mechanism. The channels through which the financial system exercises its influence on economic activity are:
    i) Capital accumulation. Financial system can modify the level of savings in the economy or it can reallocate savings among different users, choosing the more profitable investment among the different levels of risk.
    ii) Change of Technology. The intermediaries may alter the steady-state growth by modifying the rate of technological innovation. Capital markets allow the reduction of profitability shocks. This facilitates investments into more productive and specialised technologies even if more risky.

3. Literature Review

One of the earliest works on the area of financial development and economic growth was by Schumpeter (1912) in which he argued that financial intermediation provides the appropriate conditions for economic growth. He supported his opinion by stating that proper services by the financial intermediaries induce entrepreneurs to foster economic development. On the other hand, Robinson (1952) concluded that financial development is not an important factor that can contribute to economic growth. He stressed that it is because of economic growth that the sector of financial services faces increased importance and through that financial development is achieved.

If someone will read through the empirical literature about finance and growth, he will realize that there exist two main trends concerning the framework that researchers follow. These are cross-country and time-series analysis.

The recent cross-country papers based mostly on Barro's (1991) work. One of the most important approaches, which followed cross-country analysis, was by King and Levine (1993). In their analysis, they took an eighty-country sample for the period 1960-1989. They constructed four bank-related indicators to measure

financial development and four for economic growth. Their findings suggested that their financial indicators were positively correlated with the growth ones. Their regression results pointed out positive and of significant magnitude coefficients leading them to the conclusion that financial development's impact on growth is positive and that the connection between finance and growth has economic importance. We must stress that King and Levine (1993) didn't work on the causality issue between finance and growth. Reversely, Dritsakis and Adamopoulos (2004) use a multivariate autoregressive VAR model in order to test for the causal relationship between the degree of openness in the economy and the stock and economic development for Greece.

Another famous work that followed the cross-country trend was by Levine and Zervos (1996). They focused on stock market development and economic growth. Their findings suggest a strong link between capital markets and growth. Other cross-country studies are from Roubini and Sala-i Martin (1992) and Fry (1997). In both these studies the findings coincide with those of King and Levine (1993), even though they took different countries. The majority of the cross-country results follow the old "Schumpeterian" view that finance promotes growth.

The use of cross-country regressions brought a great deal of scepticism in the last years though. Lee et al. (1996) characterized the convergence test in cross-country results as misleading because of the existence of asymptotic bias in the coefficients. Quah (1993) using a 118-country sample proved that stable growth paths — an assumption in cross-country regressions — do not exist. Moreover, Evans (1995) stresses that there are many problems of econometric nature in the cross-country framework because of heterogeneity of slope coefficients from country to country. All this criticism against cross-country analysis is what motivated us to employ time-series in our paper.

The studies that followed time-series analysis are more recent and their findings don't always agree with the "supply-leading" hypothesis. One of the most known approaches to the area of finance development and economic growth by using time-series was by Arestis and Demetriades (1997). They focused their research on Germany and United States for the period 1978–1991 and they used quarterly data. They divided their proxies for financial development into some for capital market development and some for banking sector development. For the former they used logarithms of stock market capitalisation and they also constructed an index of stock market volatility, while for the latter they took the M2 to GDP ratio and the ratio of domestic bank credit to nominal GDP. By estimating Vector Autoregressions, (VAR), and using the Johansen cointegration procedure they examine the relationship between finance and growth in the two countries and then they test for causality. Their findings for Germany suggest that economic growth is a consequence of financial development. For the United States, they found enough evidence to support the idea of reverse causality in the sense that economic growth contributes to financial development.

Furthermore, Arestis and Demetriades (2001) worked on five developed countries examining the relationship between economic growth and only stock market development and they found that the stock market's contribution to growth was of not so important magnitude leaving a sense that it's the banking sector that carries the most of the weight. Fase and Abma (2003) conducted causality tests on nine Asian countries and concluded that causality runs from finance to growth.

As we can realize, the time-series findings differ across countries or for different periods. This evidence suggests that the debate over the relation between finance and growth in developed and developing countries is still active and much more work has to be done until it comes into an end.

On the contrary to the evidence regarding the developed countries, the literature on the transition specific finance-growth relationship has recently started to emerge. According to Reininger et al. (2002), given

the fact that domestic bond and stock markets have until recently now only played a very limited role in financing firms, the focus has mainly been on the importance of the local banking systems and the role of foreign financing.

Drakos (2002) shows for a sample of transition economies that imperfect competition in the banking sector is associated with lower growth, but he does not provide evidence for the relationship between financial development and economic growth in a quantitative form. In contrast, Koivu (2002) finds, using panel data for 25 transition economies over the period 1993–2000, that the qualitative development of the banking sector, measured as the margin between lending and deposit interest rates, has contributed to economic growth. However, quantitative banking sector, measured by the amount of bank credit to the private sector, has not contributed to economic development. She explains this insignificance of quantitative banking sector by arguing that the numerous banking crises, the importance of foreign direct investment and the relative importance of internal cash flows for financing investments have resulted in a situation in which domestic bank credit has not been very important in stimulating economic growth. Dritsaki et al (2004) analyze the relationship between investment, exports and economic growth in three accession Baltic countries and find that there is a causal relationship among these three variables for the examined countries.

Other "finance-growth" literature in CEE does not concentrate on the domestic banking sectors, but rather on the real effects of international financing and the integration of the CEE financial sectors with the global system. The empirical evidence as regards the real economic effects of financial globalisation and liberalisation are mixed. Eschenbach et al. (2000) show that financial sector openness stimulates economic development through increasing financial sector competition, while Bekaert and Harvey (2003) provide positive evidence as regards the liberalisation of stock markets. However, Stiglitz (2000) supports the existence of adverse effects of premature capital account liberalisation for the volatility of short-term capital, while Durham (2003) take an intermediate position by showing that international financial integration is simply not an important determinant of economic growth.

As regards the role of foreign bank financing in CEE, the studies are still scarce. De Haas and van Lelyveld (2003) support that greenfield foreign banks were a stabilising force during period crisis in CEE, while Fries and Taci (2002) show that the share of foreign banks in the total assets of the CEE banking sectors has a positive effect on real credit expansion. However, empirical evidence on the effects of foreign bank entry on allocative efficiency and on economic growth in CEE is not yet available.

The same holds for the effect of portfolio flows of corporate bonds and stocks. This is due to the relative early establishment of domestic stock and bonds markets in many CEE countries, which currently are still significantly less liquid and capitalised when compared with more developed economies. Central European markets are characterized by stable performance of the domestic economies, higher growth rates compared to 'old' European economies and relatively low valuations (Havlik, 2003). Among the CE stock markets, Poland, the Czech Republic, Hungary, and Slovakia are considered the most developed, in terms of capitalization, turnover and number of traded securities (Hanousek and Filer, 2000; Koke and Schroder, 2002). Although stock markets played an important role in mass privatisation programs in some countries, such as Poland and Czech Republic, equity finance and the issuing of bonds is limited in financing local companies.

On the contrary, Foreign Direct Investment (FDI) has played an important role in financing investments in CEE, as a result of their use in privatisation schemes. Recent empirical evidence shows that the technology transfer associated with FDI has had a positive effect on economic growth in a sample of 25 CEE and former Soviet Union countries (Campos and Kinoshita, 2002), and that FDI is strongly correlated with local institutional quality (Moers, 2001).

4. Methodological Issues

4.1. The Growth Model

The endogenous growth model considers a mechanism in which the marginal productivity of capital does not go to zero when capital grows. This approach is in sharp contrast with the traditional neo-classical growth model. According to the traditional theory, there is no intrinsic characteristic of economies that causes them to grow over extended period of time. In the absence of external 'shocks' or technological change, all economies will converge to zero growth. Hence raising in capita GDP is considered a temporary phenomenon resulting from a change in technology or a short-term equilibrating process in which an economy approaches its long-run equilibrium.

The endogenous growth model, which takes into account the level of financial development and the final result, was that the growth rate at time $t + 1$ is given by:

$$g = A\frac{I}{Y} - \delta = A\phi s - \delta \tag{1}$$

where, Y is the output, I is the gross investment, A is a parameter representing the productivity of capital, δ is the rate of depreciation if the good is invested, S is the gross saving and $(1 - \phi)$ is the part lost in the process of financial intermediation.

The mechanism considered here does not allow the marginal productivity of capital (ϕ) to converge to zero as capital grows. It was seen that financial development could improve the efficiency accumulation (increase in ϕ); it could contribute to a raising in the saving rate (increase in s); it could affect directly the marginal productivity of capital (increase in A). Now if for simplicity we avoid δ (the rate of depreciation of the good invested) we have got that:

$$g_{t+1} = A\phi s_t \tag{2}$$

or using a different terminology:

$$\Delta y_t = A\phi_t s_t \tag{3}$$

In fact if the production function is assumed dependent only upon capital stock: $y_t = Af(k_t)$, by totally differentiating we have got

$$\Delta y_t = A\frac{dk_t}{y_t} f'(k_t) = As_t\phi_t$$

Following the discussion above, the production function will have to contain one or more terms in order to capture the development of the financial development. Analysing the case of Singapore, Leigh (1996) employs an augmented Cobb-Douglas production function in which financial development is proxied by the level of credits.

In this approach, it is inaccurate to approximate the level of financial development only by credits. This is because a firm can obtain external financing not only borrowing money but also through the stock market. Therefore the financial development must be represented by two variables: one to capture the development of the banking system and the other to capture the development of the stock market. This allows to better represent the structure of the economy and to compare economies with different financial structure. In fact we expect that the variable representing the level of credit would be much more significant for Poland than the variable representing the stock market.

Poland as a country has capitalism based on small and medium enterprises, which hardly finance themselves through the stock market. That the level of credits is an essential indicator for the Polish economy can be seen through a quick analysis of the banking system. In Poland there are many banks, the majority of

them are of very small nature. In addition to these, there are also other financial intermediaries (mainly financial companies, leasing and factoring companies).

Their principal business derives from loans to small enterprises. The loans are infrequently of huge amount; indeed borrowers are small entrepreneurs which require liquidity for their business or for the purchase of a new machine.

The augmented production function will have this form:

$$y_t = \phi(\text{DEEPENING})^{\delta_1} k_t^{\alpha} l_t^{\beta} \tag{4}$$

where, following the endogenous growth approach $\phi'(\text{DEEPENING}) > 0$. The term in parenthesis, representing the level of development of the financial system, is decomposed in two variables, as we pointed out in the above discussion:

1. CREDIT (Cr), which represents the level of bank credit to private sector;
2. LIQUIDITY (St) of the stock market.

The reason for the variable CREDIT is quite intuitive: bank-loans are the main source of firm external financing. Concerning the second variable we believe that this variable is the better indicator for representing the stock markets development, because stock markets might affect the economic activity through the creation of liquidity. As we know, investments may require a long-term commitment of capital, but investors are often reluctant to loose their control on saving for long period of time. Hence, liquidity stock market may boost economic activity.

The production function can therefore be written as:

$$y_t = \phi Cr_t^{\gamma_1} Liq_t^{\gamma_2} k_t^{\alpha} l_t^{\beta} \tag{5}$$

where $\gamma_1 + \gamma_2 = \delta_1$ should indicate the impact of financial development on the level of output. Now taking the log of the variables, we obtain the long-run regression equation:

$$Ly_t = \alpha + \alpha_{cr} Lcr_t + \alpha_{St} Lliq_t + \alpha_k Lk_t + \alpha_l Ll_t + \varepsilon_t \tag{6}$$

where α must be interpreted as the log of ϕ.

4.2. Stationarity and Cointegration Tests

In order to test for cointegration, the Johansen's Maximum Likelihood Procedure (Johansen, 1988) is implemented. This is a preferred method of testing for cointegration as it allows restrictions on the cointegrating vectors to be tested directly, with the test statistic being χ^2 distributed. This specific procedure provides a unified framework of estimating and testing the cointegration relationships in a VAR error correction mechanism, which incorporate different "short-run" and "long-run" dynamic relationships in a variable system. Two basic steps are followed:

First, testing the existence of unit roots (integration order) in each index, following Dickey-Fuller (DF) and Augmented Dickey-Fuller (ADF) tests (1981) through the relationship:

$$\text{ADF}: \quad \Delta S_t = \alpha + \beta T + \rho S_{t-1} + \sum_{t=1}^{k} \gamma_i \Delta S_{t-1} + u_t \tag{7}$$

where $\Delta S = (S_t - S_{t-1})$ represents first differences with k time lags, S_t is the index of the examined parameter, u_t to be a white noise and adjusts autocorrelation errors. Coefficients α, β, ρ and γ_i are under estimation. For the best specification of equation (7) we use Akaike (1974) and Schwartz (1978) criteria according to Engle and Yoo's proposal (1987).

A modification of the ADF test was proposed by Phillips and Perron (1988). They relaxed the i.i.d. (identically and independently distributed) assumption for the errors in the ADF test by a non-parametric

correction. The test regression contains a constant term and time trend as in ADF but not lagged differences and is the following:

$$\Delta y_t = \alpha + \beta T + \gamma y_t + \varepsilon_t \tag{8}$$

Instead of allowing for the presence of serial correlation by using lagged differences, Phillips and Perron made a non-parametric correction to the t-statistic of p in (7). The null hypothesis and the critical values are the same with the ADF test.

Second, Johansen extends Engle and Granger's (1987) cointegration to a multivariate framework considering a fairly general unrestricted error-correction model in the following form:

$$\Delta St = \Gamma_1 \Delta S_{t-1} + \ldots + \Gamma_{k-1} \Delta S_{t-k+1} + rS_{t-k} + \mu + e_t \tag{9}$$

where S_t = (px1) vector of stock prices at time t;
r = (pxp) parameter matrix;
μ = (px1) intercept term;
e_t = (pX1) vector of coefficients of disturbance terms

The parameter matrix, r, indicates whether the (px1) vector of prices has long-run dynamic relationship or not. The rank of r equals the number of cointegrating vectors. If r has full rank, then all the stock price series are stationary in levels. If the rank of r is zero, eq. (8) reduces to a standard vector autoregression model. Cointegration is suggested if the rank of r is between zero and the number of stock series. The null hypothesis is that there is no cointegration among the prices series.

Hall (1991) has demonstrated that in using the Johansen test for cointegration it is necessary to carry out tests to establish the appropriate order of VAR. These tests are the multivariate generalizations of the Akaike Information Criterion (AIC) and the Schwarz Bayesian Criterion (SBC):

$$\begin{aligned} \text{AIC} &= T \log|\Sigma| + 2N \\ \text{SBC} &= T \log|\Sigma| + N \log(T) \end{aligned} \tag{10}$$

where T: number of observations;
N: total number of the forecasting parameters;
$|\Sigma|$: variance-covariance matrix of the residuals.

Two test statistics can be used for the hypothesis of the existence of r cointegrating vectors. First, the trace test, i.e. the LR test statistic for the hypothesis that there are at most r distinct cointegrating vectors against a general alternative, given by:

$$\lambda_{\text{trace}}(r) = -2 \log(Q) = -T \sum_{i=r+1}^{n} \log(1 - \hat{\lambda}_i) \tag{11}$$

where $i = r + 1, \ldots, n$, are the $(n - r)$ smallest squared canonical correlations, $r = 0, 1, 2, \ldots, n - 1$, and $\lambda_{\text{trace}}(r) = 0$, when all $\lambda_i = 0$. Asymptotic critical values are provided by Osterwald-Lenum (1992). Alternatively, the maximum eigenvalue test can be used to compare the null hypothesis of r cointegrating vectors against the alternative of $(r + 1)$ cointegrating vectors. The LR test statistic for this hypothesis is given by:

$$\lambda_{\max}(r, r+1) = -2 \log(Q) = -T \log(1 - \hat{\lambda}_{r+1}) \tag{12}$$

where $r = 0, 1, 2, \ldots, n - 1$, and if the estimated value of the characteristic root is close to zero, $\lambda_{\max}$ will be small. The limiting distribution of $2 \log(Q)$, which is a function of a $(n - r)$ dimensional vector Brownian motion, is not independent of the unknown drift term. Critical values have been tabulated for various hypotheses concerning the behavior of the deterministic components (Johansen and Juselius, 1990).

5. Data and Empirical Results

Data was drawn from the International Financial Statistics (IFS) of the International Monetary Fund and statistical indicators published in Poland. Our period of examination covers the period from January 1994 (Q1) to December 2004 (Q4). The variables used are defined as following:

- y_t: measures the level of economic activity. We have chosen the real gross domestic product;
- Cr_t: it is equal to the value of credits by financial intermediaries to the private sector. This variable does not include issued by Central Banks, or credit issued to the government agencies, public enterprises and government. Other studies use different measures. These are: a variable which capture the gross claim on the private sector divided by GDP and another variable which is given by deposit money bank credit to the private sector divided by the level of GDP. These two measures, however, are less precise for the investigation. In fact the former includes credit issued by government agencies and monetary authorities, and the latter does not include credits issued by non-deposit institutions. Furthermore a higher level of credit can give an indication of the level of financial services and therefore of the financial intermediaries development.
- St_t: we measure the stock market liquidity as the value of the shares traded on the country's stock exchange as a percentage of GDP.
- k_t: level of physical capital. It is broadly defined as the Gross Fixed Capital Formation. This includes the total amount of physical good existing at a particular time that has been produced for use in the production of other goods (changes in stocks are excluded).
- l_t: labour. This variable is measured with the level of worked hours per employee non manual workers.

5.1. Unit Root Tests

Before checking for a cointegration long-run relationship among the variables of the augmented production function, we determine if they are stationary or not and the order of integration. In order to test for presence of non-stationarity in the data, the integration order of the individual time series is investigated using the ADF and PP test for the presence of unit roots. The selection of optimal lags is determined by minimizing Akaike and Schwarz criteria, and is set at four lags for the ADF test and at five lags for the PP test. Table 1 reports the results of the unit root tests on the levels of each series. Both the ADF and PP tests are considered with and without trend.

The results of Table 1 suggest that the null hypothesis of a unit root in the time series cannot be rejected at a 5% level of significance in variable levels. Therefore, no time series appear to be stationary in variable levels. However, when the logarithms of the time series are transformed into their first differences, they become stationary and consequently the related variables can be characterized integrated of order one, I(1). Moreover, for all variables in first differences there is no correlation and heteroscedasticity in the disturbance terms (Table 2)

5.2. Cointegration Tests

Since the series are I(1), the Johansen's procedure tests for cointegration are used. The Log Likelihood Function and the Akaike Information Criterion increase with p (order of VAR) while the Schwarz Bayesian Criterion selects a VAR of second order. To verify the correctness of these results, it is important to check the LR test in its adjusted form because of the low number of observation available. The probability value suggest that a selection of a VAR of second order is acceptable since the probability value is 0.766. However, it is necessary to further investigate each equation in order to detect the presence of serial correlation and heteroscedasticity.

Table 1. Unit Roots Tests

	ADF Test		PP Test	
	With Trend	Without Trend	With Trend	Without Trend
LY	−1.9022(4)	−1.8573(4)	−2.1134(5)	−2.4789(5)
DLY	−21.5042(4)	−20.5431(4)	−22.5421(5)	−23.0602(5)
LCR	−1.3689(4)	−1.2511(4)	−2.2160(5)	−2.7022(5)
DLCR	−13.0671(4)	−12.5162(4)	−14.3132(5)	−14.7879(5)
LLIQ	−1.3500(4)	−1.3897(4)	−1.7876(5)	−1.8455(5)
DLLIQ	−7.4261(4)	−6.4211(4)	−9.4148(5)	−9.9191(5)
LK	−0.4876(4)	−0.5216(4)	−0.6453(5)	−0.7013(5)
DLK	−22.3771(4)	−21.7148(4)	−24.5178(5)	−25.0135(5)
LL	−0.38780(4)	−0.1589(4)	−0.4074(5)	−0.2897(5)
DLL	−12.0605(4)	−11.1212(4)	−13.1243(5)	−13.9178(5)

Notes: LY denotes the log of the real gross domestic product.

LCR denotes the log of the value of credits by financial intermediaries to the private sector.

LLIQ denotes the log of the value of the shares traded on the Polish stock exchange as a percentage of GDP (stock market liquidity).

LK denotes the log of the level of physical capital.

LL denotes the log of labour.

The null hypothesis is that series has a unit root.

MacKinnon (1991) 95% critical values for ADF and PP statistics (with trend) is −2.8972, while without trend is −2.8976.

The numbers in parentheses show the least required lag order to have white noise innovations.

Table 2. Tests for Serial Correlation and Heteroscedasticity

	Serial correlation	Heteroscedasticity
LY	1.5765 (.682)	3.76765 (.0251)
LCR	1.8023 (.955)	1.76515 (.339)
LLIQ	0.6739 (.213)	0.67766 (.119)
LK	3.1114 (.062)	2.10493 (.444)
LL	0.9778 (.443)	0.00112 (0.491)

Note: The probability value is given in parenthesis.

The analysis on the residuals indicates no presence of serial correlation and heteroscedasticity with a VAR of second order. Even the risk of a over-parameterisation, given the low number of observations, is avoided. Therefore, we proceed in the analysis adopting a VAR (2).

Departing from the bivariate cointegration regressions, a vector error cointegration model (VECM) is estimated to consider the series jointly, according to the procedure advanced by Johansen. Three alternative models are compared and contrasted: (a) a model with a constant restricted to the cointegrating space; (b) a model with unrestricted constant; and (c) a model with a linear trend in the cointegration vector. The results of the λ_{max} and λ_{trace} tests are reported in Tables 3, and 4 respectively.

The result of the Trace test is similar to the Eigenvalue outcome. It suggests the presence of a single cointegrated vector. The coefficients of each variable along with their t –stats of the estimated vector are reported in Table 5.

All the coefficients have the expected sign. Two points appear immediately. First the coefficient for the stock market does not have a strong magnitude and positive sign. Second, the normalised coefficients for labour and capital inputs present a lower value than their factor share.

Table 3. Model Specification

Null	λ_{trace} test			Critical values (95%)			Eigenvalues		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
$r = 0$	98.12	82.11	101.22	83.24	77.26	79.82	0.0102	0.0102	0.0137
$r \leq 1$	59.77	53.84	62.43	67.06	77.22	76.11	0.0077	0.0072	0.0082
$r \leq 2$	22.54	21.66	28.98	44.33	39.71	42.78	0.0034	0.0042	0.0045
$r \leq 3$	11.34	10.56	14.78	22.31	20.41	21.89	0.0027	0.0029	0.0039
$r \leq 4$	3.43	2.46	5.63	8.67	7.52	8.32	0.0013	0.0017	0.0022

Notes: $H_1(r)$ against $H_1(n)$

Model 1: model with a constant restricted to the cointegrating space

Model 2: model with unrestricted constant

Model 3: model with a linear trend in the cointegration vector

Critical values are obtained from Ostenwald-Lenum (1992).

Table 4. Tests for the Number of Cointegrating Vectors

Null	λ_{max} test			Critical values (95%)		
$n - r$	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
$r = 0$	38.52	39.60	38.67	33.90	34.22	33.77
$r = 1$	32.63	30.77	33.95	36.40	42.66	36.32
$r = 2$	13.08	12.29	14.99	19.33	19.06	22.39
$r = 3$	8.73	7.61	9.87	12.67	11.75	13.47
$r = 4$	1.42	0.93	1.93	7.24	6.92	8.11

Notes: $H_1(r)$ against $H_1(r+1)$

Model 1: model with a constant restricted to the cointegrating space

Model 2: model with unrestricted constant

Model 3: model with a linear trend in the cointegration vector

Critical values are obtained from Ostenwald-Lenum (1992).

Table 5 Estimated Cointegrated Vectors in Johansen Estimation

	Coefficient	*t*-statistic
LY	−1.0000	−7.7448
		(0.000)
LCR	0.16312	2.1789
		(0.000)
LLIQ	−0.0026323	−0.018977
		(0.073)
LK	0.24581	1.9365
		(0.000)
LL	0.14150	0.8945
		(0.001)
Trend	−0.0023162	−0.06389
		(0.065)

Notes: Cointegration with unrestricted intercepts and restricted trends in the VAR.

P-values in parentheses

The value for the 'banking sector' (LCR) variable is of positive and significant magnitude, while liquidity of the stock market (LLIQ) presents a negative sign but its value is not relevant since the figure approximates zero. The variable LCR is statistically significant high; this suggests that the level of credit has played an important role in generating growth in this period. The variable LK is also statistically significant and high. These findings are consistent with our empirical results that show low importance of stock market in the economic development, but strong presence on bank lending and physical capital in driving economic growth.

The sum of the variables explaining economic growth is less than unity, implying decreasing return of scale with respect to the factors in the long run. This is in contrast with the AK model of endogenous growth. A sum of the factor coefficients less than one implies decreasing return, which in the absence of exogenous technological progress implies zero steady state growth.

Another important point to notice is that the trend exhibits a negative value. Following the endogenous growth approach, it has to be interpreted as the marginal productivity of capital. A negative trend implies that the financial sector in Poland has not had a positive impact on economic growth, in other words it has not acted on the efficiency of investment. Polish financial institutions appear not to have taken advantages of the economies of scale.

6. Conclusions

This paper examined the impact of financial development in the economic growth of Poland. Using the Johansen cointegration procedure, we investigated the determinants of long-run growth for the period 1994 (Q1) – 2003 (Q4). We employed an augmented production function, where the output is not only the result of capital and labour, but also of the level of credit available in the economy and the liquidity of the stock market. These two latter variables have been identified as the best proxy of the development of the financial sector. The results suggest that in the long run credits and physical capital are important for the economic growth, but the stock market liquidity is proximate to zero. Credit and capital are the vital factors for economic growth of Poland according to the long run cointegrating relationship (based on the coefficients' significance).

The factors of production function exhibit decreasing return of scale. This implies, in the absence of exogenous technological progress, a steady-state growth of zero. The sum of the variables explaining economic growth in our model is less than unity, suggesting that Polish financial institutions where unable to develop economies of scale. Furthermore, the model estimated exhibit negative return of scale. However, further research could consider the impact of trade and FDI on the economy, and the relevance of the government sector in the Polish economic growth.

References

Akaike, H. (1974), "A new look at the statistical model identification", *IEEE Transaction on Automatic Control*, AC-19, 716–723.

Arestis, P. and Demetriades, P. (1997), "Financial development and economic growth: assessing the evidence", *The Economic Journal*, 107, 783–799.

Arestis, P. and Demetriades, P. (2001), "Financial development and economic growth: the role of stock markets", *Journal of Money, Credit and Banking*, 33, 16–41.

Barro, R.J. (1991), "Economic growth in a cross-section of countries", *Quarterly Journal of Economic*, 56(2), 407–443.

Bekaert, G. and Harvey, C.R. (2003), "Emerging markets finance", *Journal of Empirical Finance*, 10, 3–55.

Campos, N.F. and Kinoshita, Y. (2002), "Foreign direct investment as technology transferred: some panel evidence from the transition economies, CEPR Discussion Paper 3417, London.

De Haas, R.T.A. and van Lelyveld, I.P.P. (2004), "Foreign bank penetration and private sector credit in Central and Eastern Europe", *Journal of Emerging Market Finance*, 3(2), 125–151.

Dickey, D.A. and Fuller, W.A. (1981), "Likelihood ratio test for autoregressive time series with a unit root", *Econometrica,* 49, 1057–1072.

Drakos, K. (2002), "Imperfect competition in banking and macroeconomic performance: evidence from the transition economies, paper presented at the Bank of Finland, Spring 2002.

Dritsakis, N. and Adamopoulos, A. (2004), "Financial development and economic growth in Greece: an empirical investigation with Granger causality analysis", *International Economic Journal*, 18(4), 547 – 559.

Dritsaki, C., Vazakides, A. and Adamopoulos, A. (2004), "Exports, investments and economic growth: an empirical investigation of the three Baltic countries", *Baltic Journal of Economics*, 4(2), 72–79.

Durham, J.B. (2003), "Foreign portfolio investment, foreign bank lending, and economic growth", Board of Governors of the Federal Reserve System International Finance Discussion Paper nr. 757, Washinghton.

Engle, R.F. and Granger, C.W.J. (1987), "Cointegration and error correction: representation, estimation and testing", *Econometrica,* 55, 251–276.

Engle, R.F. and Yoo, B.S. (1987), "Forecasting and testing in cointegrated systems", *Journal of Econometrics,* 35, 143–159.

Eschenbach, F., Francois, J.F. and Schuknecht, L. (2000), "Financial sector openess and economic growth", in: S.Claessens and M. Jansen (ed.), *The Internationalization of Financial Services. Issues and Lessons for Developing Countries*, The Hague, Kluwer Law International, 103–115.

Evans, P. (1995), "How to estimate growth equations consistently", Mimeo*,* Ohio State University, presented at the 7th World Congress of the Econometric Society, Tokyo.

Fase, M.M.G. and Abma, R.C.N. (2003), "Financial development and economic growth in selected Asian countries", *Journal of Asian Economics*, Vol. 14, pp. 11–21.

Friedman, M. and Schwartz, A. (1963), *A Monetary History of the United States,* Princeton: Princeton University Press.

Fries, S. and Taci, A. (2002), "Banking reform and development in transition economies", European Banking for Reconstruction and Development, Working Paper 71, London.

Fry, M. J. (1997), "In favour of financial liberalisation", *Economic Journal*, 107, 745–770.

Greenwood, J. and Jovanovic, B. (1990), "Financial development, growth and distribution of income", *Journal of Political Economy*, 98, 1076–1107.

Hall, S.G. (1991), "The effect of varying length VAR models on the maximum likelihood estimates of cointegrating vectors", *Scottish Journal of Political Economy*, 38, 317–323.

Hanousek, K. and Filer, R.K. (2000), "The relationship between economic factors and equity markets in Central Europe", *Economics of Transition,* 8, 99–126.

Havlik, P. (2003), "Transition countries in 2003; reforms and restructuring keep the global economic slowdown at bay", Working Paper, Vienna Institute for International Economic Studies.

Johansen, S. (1988), "Statistical analysis of cointegrating vectors", *Journal of Economic Dynamics and Control,* 12, 231–245.

Johansen, S. and Juselius, K. (1990), "Maximum likelihood estimation and inference on cointegration with application to the demand for money", *Oxford Bulletin of Economics and Statistics,* 52, 169–210.

King, G. R. and Levine, R. (1993), "Finance and growth: Schumpeter might be right", *The Quarterly Journal of Economics*, 108, 717–737.

King, R.G and Levine, R. (1993b), "Finance entrepreneurship and growth", *Journal of Monetary Economics*, 32, 513–542.

Koivu, T. (2002), "Does financial sector development affect economic growth in transition economies?", paper presented at the Nordic Conference in Development Economics, April 10th 2002, Bergen.

Koke, J. and Schroder, M. (2002), "The prospects of capital markets in Central and Eastern Europe", Working Paper 02–57, Centre for European Economic Research.

Lee, K., Pesaran, M.H. and Smith, R.P. (1996), "Growth and convergence: a multi-country empirical analysis of the Solow growth model", University of Cambridge, Department of Applied Economics Working Papers, Amalgamated Series 953.

Leigh, L. (1996), "Financial development and economic growth: an econometric analysis for Singapore", IMF Working Paper, February, Washington D.C..

Levine, R. (1997), "Financial development and economic growth: views and agenda", *Journal of Economic Literature*, 35, 688–726.

Levine, R. and Zervos, S. (1996), "Stock market development and long-run economic growth", *World Bank Economic Review*, 10(2), 323–339.

MacKinnon, J.G. (1991), "Critical values for cointegration tests", in: R.F. Engle and C.W.J. Granger (ed.), *Long-run Economic Relationships: Readings in Cointegration,* Oxford University Press, Oxford.

Moers, L. (2001), "Institutions, economic performance and transition", PhD Thesis, Tinbergen Institute, University of Amsterdam, Amsterdam.

Osterwald-Lenum, M. (1992), "A note with quartiles as the asymptotic distribution of the maximum likelihood cointegration rank test statistics", *Oxford Bulletin of Economics and Statistics,* 54, 461–472.

Pagano, M. (1993), "Financial markets and growth: an overview", *European Economic Review*, 37(2–3), 613–622.

Patrick, H. T. (1966), "Financial development and economic growth in underdeveloped countries", *Economic Development and Cultural Change*, 14, 174–189.

Phillips, P. C. B. and Perron, P. (1988), "Testing for a unit root in time series regression", *Biometrica,* 75, 335–346.

Quah, D. (1993), "Empirical cross-section dynamics in economic growth", *European Economic Review*, 37, 426–434.

Reininger, T., Schardax, F. and Summer, M. (2002), "Financial system transition in Central Europe: the first decade", SUERF Studies 16, Vienna.

Robinson, J. (1952), "The generalization of the general theory", in: *The Rate of Interest and Other Essays*, MacMillan, London, 67–142.

Roubini, N., and Sala-i Martin, X. (1992), "Financial repression and economic growth", *Journal of Development Economics*, 39, 5–30.

Schwartz, R. (1978), "Estimating the dimension of a model"*, Annuals of Statistics,* 6, 461–464.

Schumpeter, Josef A. (1912), *The Theory of the Economic Development: An Inquiry into Profits, Capital, Credit, Interest and Business Cycle,* Harvard Press, Cambridge.

Stiglitz, J.E. (2000), "Capital market liberalisation, economic growth, and instability", *World Development*, 28(6), 1075–1086.