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The nexus between the financial system and economic growth: GMM estimation with panel data

Introduction

Financial systems around the world have increased in both size and complexity over time and exert an ever growing influence over the business cycle and the real economy. In this context, the 1980s marked the beginning of a new era, as a process commonly referred to as 'financialisation' began to gather momentum. Financialisation is a process that is characterised by changes within the financial sector itself (change in the nature and operations of financial markets), as well as by changes relative to other sectors (financial markets and tools become more powerful and exert power on the real economy). What resulted from financialisation is a complex yet fragile construction in which the financial system and economy are closely intertwined. This forced economists and politicians alike to rethink the nexus between the financial system and economic growth in order to be able to draft and implement new and effective policy measures that safeguard economic prosperity on the basis of the financial system.

Even though more and more scholars conduct research in this area, the nexus between the financial system and the real economy remains a mystery in many ways. On first sight, it may appear paradoxical that scholars have put increasing efforts into examining the nexus and yet, it is still seen as insufficiently researched. In spite of the large amount of research, there is a substantial amount of unanswered questions and a lively debate with contrasting positions on basic processes. Importantly, this is mainly due to the complexity of the relationship between the financial system and the real economy. There are numerous factors that influence either some part of the financial system or economic growth (economic development), or both. The nexus cannot be explained using a simple bifactorial model, since most of the factors interact with each other and are bidirectional, time-varying and dependent on the stage of development. At this point it is important to acknowledge that the financial system is not a demon that needs to be liquidated, but a vital set of tools that stimulates economic growth and allows economies to prosper. However, the positive impact of the financial system

can only be fully realised if there are certain rules that prevent financial markets from exerting negative influence on the economy.

The purpose of this paper is to explore, identify and characterise the relationship between the financial market and the real economy, and to amplify its understanding. In order to achieve this goal, the following research question has been formulated: What is the relationship between the financial system and economic growth?

The paper is organised as follows: Chapter 1 presents the theoretical framework of the analysis and presents the economic and financial variables used in this paper. Chapter 2 comprises the methodology applied to conduct the analysis, including model specification and information on the dataset and research design. The empirical analysis and results can be found in chapter 3, which is followed by concluding remarks.

1. Theoretical framework

The model comprises one dependent variable, as well as a set of independent variables. The dependent variable to measure economic growth is gross domestic product (GDP) per capita based on purchasing power parity (GDPCAP). GDPCAP represents "the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products"[1] divided by midyear population of each country.

As regards the independent variables, it is important to distinguish between two types of variables that are used in the model of this paper. The first type is a set of macroeconomic variables that are included as control variables and held constant for each regression of a given panel. The second type comprises financial variables that are utilised to measure the impact of the financial system on economic growth.

The first control variable is trade openness (OPEN), which is defined as "the sum of exports and imports of goods and services"[2].The next control variable is investment (INV), also called gross fixed capital formation. It refers to changes in the stock of companies' fixed capital, and includes "land improvements [...]; plant, machinery, and equipment purchases"[3], among others. Another variable the model controls for is human capital (HC). The measure of human capital used in this paper is an index of human capital per person, based on years of schooling

[1] World Bank, World Development Indicators, http://data.worldbank.org/data-catalog/world-development-indicators [access: 27.12.2015].

[2] Ibidem.

[3] Ibidem.

Barro and Lee[4] and returns to education Psacharopoulos[5].The last control variable that will be included in the model is regulatory quality (REGQ). Regulatory quality is represented by an index variable and "captures perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development"[6].

The set of financial variables used in this paper can be divided into two groups: variables in the first group measure the depth of the stock market and variables in the second group measure the depth of the banking system. Importantly, according to economic theory, all six financial variables are expected to be positively related to economic growth. The analysis will show to which extent this assumption holds true for the dataset at hand. It has also been tested that both the banking system and stock markets are independent factors of economic growth.

The first stock market variable is market capitalisation (MKTCAP), also known as market value. It is defined as the "share price times the number of shares outstanding (including their several classes) for listed domestic companies". The next variable is value of stocks traded (VALST). It is defined as the "total number of shares traded, both domestic and foreign, multiplied by their respective matching prices"[7], where matching price refers to the price of each share when it was traded. The last variable that will be used to measure stock market performance is turnover ratio (TRNOVR). It refers to the value of shares traded per period, as a percentage of market capitalisation for the same period. It is a measure of both liquidity and transaction costs. The first banking system variable is domestic credit provided by financial sector (CREDFS), which includes all credit to various sectors on a gross basis, as well as credit to the central government on a net basis, including by monetary authorities and deposit money banks, finance and leasing companies, money lenders, insurance corporations, pension funds, and foreign exchange companies"[8].Domestic credit to private sector by banks (CREDBS) refers to financial resources provided to the private sector by depository corporations (which refers to commercial banks, but excludes central banks ,"such as through loans, purchases of non-equity securities, and trade credits and other accounts receivable, that establish a claim for repayment"[9].The last banking system variable is domestic credit provided to the private sector (CREDPS). It refers to financial resources provided to the private sec-

[4] R. Barro, J.-W. Lee, *Barro-Lee Educational Attainment Dataset*, http://www.barrolee.com [access: 24.02.2016].

[5] G. Psacharopoulos, *Returns to Investment in Education: A Global Update*, "World Development" 1994, vol. 22, no. 9, pp. 1325–1343.

[6] World Bank, Regulatory Quality, http://info.worldbank.org/governance/wgi/pdf/rq.pdf [15.03.2016].

[7] World Bank, World Development Indicators...

[8] Ibidem.

[9] Ibidem.

tor by financial corporations, such as "monetary authorities and deposit money banks, as well as finance and leasing companies, money lenders, insurance corporations, pension funds, and foreign exchange companies"[10].

2. Methodology

The methodology chapter builds upon and complements the preceding theory chapter, specifies the central regression model, and explains how the list of variables presented in the theory chapter is used in the model and analysis. The analysis will be executed by means of a panel study, a special type of longitudinal study in which data are collected from the same units over a given time period[11]. The dataset comprises data on 11 variables from 74 countries for the time period 1988-2014. All data are extracted from the World Development Indicators and Worldwide Governance Indicators, both provided by the World Bank, as well as from the Penn World Table. The dataset covers countries from virtually all regions in the world, as well as from different stages of development. A total of ten panels are analysed: Main, European Union (EU), eurozone (EZ), high income countries (HIC), low and middle income countries (LMI), Organisation for Economic Co-operation and Development (OECD), Latin and Middle America (LMA), Middle East and North Africa (MENA), South Asia and East Asia (SAEA) and Brazil, Russia, India, China and South Africa (BRICS). As one can see, the individual panels are established either along geographical lines (Middle East and North Africa, for example), organisational/institutional lines (OECD, for example) or according to the level of development of a particular variable (high income countries, for example).

The analysis is based on a dynamic model, which incorporates temporal dependency (lags) of the dependent variable as regressor. This simply means that the dependent variable in period t is influenced by its own past performance, for instance in t-1.In the context of economic growth analyses, dynamic models have substantial advantages over static models, such as fixed effect and random effect models. This paper estimates a one-step dynamic model from panel data using the dynamic Arellano-Bond generalized method of moments (GMM) estimator. The central regression model takes the following form:

$$lnGDPCAP_{i,t} = \alpha + (1-\beta_1) lnGDPCAP_{i,t-1} + \beta_2 X_{i,t} + \beta_3 FS_{i,t} + v_{i,t} + \eta_i + \xi_{i,t}$$

where $lnGDPCAP$as dependent variable is the natural logarithm of GDP per capita in panel i in year$t$, α is the constant, β_1, β_2 and β_3 are parameters to be

[10] Ibidem.

[11] E. Babbie, *The Practice of Social Research*, Cengage Learning, Wadsworth 2010, p. 109.

estimated (regression coefficients), X is a matrix of control variables where all variables except for REGQ are transformed to their natural logarithms, FS is the natural logarithm of a financial variable, υ is a year-specific fixed effect, η is a country-specific fixed effect, and ξ is the error term. The matrix of control variables (X) contains INV, OPEN, HC and REGQ. FS stands for MKTCAP, VALST, TRNOVR, CREDPS, CREDBS or CREDFS. Importantly, it has been confirmed that there is no inter-correlation between the variables that enter the model at the same time. In other words, there is no inter-correlation between the control variables or between one of the control variables and the financial variables. The financial variables are positively correlated with each other, but they enter the model separately. The model used in this paper accounts for time dependency and is specified in a way that six regressions will be run for each panel (one for each financial system variable). The natural logarithm of variables is used when feasible to eliminate as much noise as possible from the data. The regression will be run using the xtabond command (Arellano-Bond dynamic panel-data estimation) within the data analysis and statistical software Stata12.

3. Data analysis

This chapter presents the results of the analysis. The results show to which extent different parts (variables) of the financial system impact economic growth. Moreover, they help to identify possible patterns between panels. This knowledge in turn helps in understanding economic development in various groups of countries and offers valuable insights into how the relationship between the financial system and the real economy looks like.

Tables 1 through 10 show the results of the GMM estimation for all ten panels under analysis. The control variables are not presented in detail due to space constraints. In short, it has been found that INV and OPEN are significant at the 1% level in all except three panels (MENA panel, SAEA panel and BRICS panel). By contrast, HC and REGQ are somewhat less significant throughout the majority of panels.

Table 1. Mainpanel

l_GDPCAP	Coef.	Std. Err.	z	P>|z|
l_MKTCAP	.0165847	.0026411	6.28	0.000
l_VALST	.0041625	.0017818	2.34	0.019
l_TRNOVR	.0018064	.0022268	0.81	0.417
l_CREDFS	-.011938	.0032892	-3.63	0.000
l_CREDBS	-.0088959	.0022989	-3.87	0.000
l_CREDPS	-.0101252	.0033154	-3.05	0.002

Table 2. EUpanel

l_GDPCAP	Coef.	Std. Err.	z	P>|z|
l_MKTCAP	.0143927	.0036569	3.94	0.000
l_VALST	-.0032569	.002449	-1.33	0.184
l_TRNOVR	-.0076784	.0028124	-2.73	0.006
l_CREDFS	-.004925	.0029144	-1.69	0.091
l_CREDBS	-.001696	.0018528	-0.92	0.360
l_CREDPS	-.0049763	.0029475	-1.69	0.091

In the main panel (Tab. 1), MKTCAP (significant at the 1% level), VALST (significant at the 5% level) and TRNOVR (insignificant) have positive coefficients, whilst CREDFS, CREDBS and CREDPS exhibit negative coefficients and are significant at the 1% level. In the EU panel (Tab. 2), VALST is insignificant and negative, and TRNOVR is significant at the 1% level and negative. This is in stark contrast to MKTCAP, which is positive and significant at the 1% level. All three banking variables are negative, but CREDBS is insignificant, whilst CREDFS and CREDPS are significant at the 10% level.

Table 3. EZpanel

l_GDPCAP	Coef.	Std. Err.	z	P>|z|
l_MKTCAP	.0194667	.0034843	5.59	0.000
l_VALST	.0076292	.0027491	2.78	0.006
l_TRNOVR	.0012732	.0034002	0.37	0.708
l_CREDFS	-.0016837	.0038779	-0.43	0.664
l_CREDBS	-.0011212	.002156	-0.52	0.603
l_CREDPS	-.0033439	.0041022	-0.82	0.415

Table 4. HICpanel

l_GDPCAP	Coef.	Std. Err.	z	P>|z|
l_MKTCAP	.0250058	.0032141	7.78	0.000
l_VALST	.0017502	.0023298	0.75	0.453
l_TRNOVR	-.0069146	.0027632	-2.50	0.012
l_CREDFS	-.008013	.0034422	-2.33	0.020
l_CREDBS	-.0055838	.0019377	-2.88	0.004
l_CREDPS	-.0118052	.0035651	-3.31	0.001

In the EZ panel (Tab. 3), MKTCAP and VALST are positive and significant at the 1% level and TRNOVR is positive but insignificant. The three banking variables are negative, but insignificant. In the HIC panel (Tab. 4), CREDFS is negative and significant at the 5% level, whilst CREDBS and CREDPS are negative and significant at the 1% level. TRNOVR is negative and significant at the 5% level, VALST is positive but insignificant and MKTCAP is positive and significant at the 1% level.

Table 5. LMIpanel

l_GDPCAP	Coef.	Std. Err.	z	P>|z|
l_MKTCAP	.007897	.0037824	2.09	0.037
l_VALST	.0057593	.0024142	2.39	0.017
l_TRNOVR	.0100765	.0031316	3.22	0.001
l_CREDFS	-.0176887	.0055273	-3.20	0.001
l_CREDBS	-.0130958	.0053697	-2.44	0.015
l_CREDPS	-.012432	.0052105	-2.39	0.017

Table 6. LMA panel

l_GDPCAP	Coef.	Std. Err.	z	P>|z|
l_MKTCAP	-.0083645	.0062235	-1.34	0.179
l_VALST	.0036183	.0030656	1.18	0.238
l_TRNOVR	.0094547	.0038277	2.47	0.014
l_CREDFS	-.0256438	.0132292	-1.94	0.053
l_CREDBS	.0031201	.0136203	0.23	0.819
l_CREDPS	-.0013798	.0132341	-0.10	0.917

In the LMI panel (Tab. 5), CREDFS is negative and significant at the 1% level, and CREDBS and CREDPS are negative and significant at the 5% level. MKTCAP and VALST are positive and significant at the 5% level and TRNOVR is positive and significant at the 1% level. The results of the LMA panel (Tab. 6) are remarkable in two ways: Firstly, MKTCAP is negative though insignificant and secondly, CREDBS is positive and insignificant. In the majority of panels, MKTCAP is significant and positive and CREDBS has a negative coefficient. VALST is found to be positive but insignificant and TRNOVR is positive and significant at the 5% level. CREDFS, (significant at the 5% level) and CREDPS (insignificant) exhibit negative coefficients.

In the MENA panel(Tab. 7), all three banking system variables are negative but insignificant, whilst MKTCAP is positive and significant at the 10% level, and

VALST and TRNOVR are positive and significant at the 5% level. In the SAEA panel (Tab. 8), MKTCAP is positive and significant at the 1% level, whilst VALST is positive and insignificant and TRNOVR is negative and insignificant. CREDFS and CREDPS are negative and insignificant, whilst CREDBS is positive and insignificant.

Table 7. MENApanel

l_GDPCAP	Coef.	Std. Err.	z	P>|z|
l_MKTCAP	.0103767	.0055684	1.86	0.062
l_VALST	.006454	.0029933	2.16	0.031
l_TRNOVR	.0086816	.0039089	2.22	0.026
l_CREDFS	-.0090248	.0118124	-0.76	0.445
l_CREDBS	-.0091324	.016645	-0.55	0.583
l_CREDPS	-.0102034	.0166678	-0.61	0.540

Table 8. SAEApanel

l_GDPCAP	Coef.	Std. Err.	z	P>|z|
l_MKTCAP	.023646	.0073985	3.20	0.001
l_VALST	.0082056	.0059945	1.37	0.171
l_TRNOVR	-.0038488	.0075485	-0.51	0.610
l_CREDFS	-.0290952	.0298972	-0.97	0.330
l_CREDBS	.013606	.0302426	0.45	0.653
l_CREDPS	-.0052475	.0334831	-0.16	0.875

Table 9. BRICSpanel

l_GDPCAP	Coef.	Std. Err.	z	P>|z|
l_MKTCAP	.0157057	.0104389	1.50	0.132
l_VALST	.0179449	.0111622	1.61	0.108
l_TRNOVR	-.0054905	.0175483	-0.31	0.754
l_CREDFS	-.0653828	.0389754	-1.68	0.093
l_CREDBS	-.002332	.032809	-0.07	0.943
l_CREDPS	.0085507	.030629	0.28	0.780

Table 10. OECDpanel

l_GDPCAP	Coef.	Std. Err.	z	P>|z|
l_MKTCAP	.0222952	.0031639	7.05	0.000
l_VALST	-.0022361	.0024335	-0.92	0.358
l_TRNOVR	-.0123945	.0027852	-4.45	0.000
l_CREDFS	-.0037064	.0031906	-1.16	0.245
l_CREDBS	-.0045403	.0032155	-1.41	0.158
l_CREDPS	-.0042658	.0032018	-1.33	0.183

In the BRICS panel (Tab. 9), CREDFS is negative and significant at the 10% level. CREDBS and TRNOVR are negative but insignificant, whilst CREDPS is positive but insignificant. MKTCAP and VALST are positive and insignificant. In the OECD panel (Tab. 10), MKTCAP is positive and significant at the 1% level, VALST is negative but insignificant, TRNOVR is negative and significant at the 1% level, and all three banking variables are negative but insignificant.

Even though the results differ from panel to panel, some patterns are identifiable across a vast majority of panels. As regards the financial variables, MKTCAP is the best predictor of economic growth among the stock market variables, followed by VALST. TRNOVR is the weakest predictor of economic growth; however, the results for both VALST and TRNOVR vary substantially between panels. Nonetheless, the stock market variables behave more or less as expected. By contrast, the banking system variables exhibit negative coefficients in most cases. What is more, the negative relationship between economic growth and the banking system variables is often significant. The negative role of the banking system is not a unique finding of this analysis, but rather a conclusion drawn by many other scholars as well[12].

[12] . Mishra, P.K. Narayan, *A Nonparametric Model of Financial System and Economic Growth*, "International Review of Economics and Finance" 2015, vol. 39; A. De la Torre, A. Ize, S. Schmukler, *Financial Development in Latin America and the Carribbean: The Road Ahead*, World Bank Publications, Washington DC 2011; J. Arcand, E. Bereks, U. Panizza, *Too Much Finance?*, "Journal of Economic Growth" 2015, vol. 20, No. 2.

Based on these findings, it can be claimed that the theory does not hold for all countries and under all circumstances.

Conclusion

This paper has used the Arellano-Bond generalized method of moments (GMM) estimator based on panel data to illuminate the relationship between the financial system and economic growth. The GMM estimator is a dynamic model that incorporates temporal dependency (lags) of the dependent variable as regressor into the model.

In several panels, the results of the analysis deviate from what one would expect based on economic theory. As regards the stock market variables, in a majority of panels market capitalisation is the most robust contributor to economic growth. However, there are also panels for which the value of stocks traded or the turnover ratio is a better predictor. As regards the banking variables, the results are surprising on first sight, and contradict the theory presented in this paper. Whilst the theory presented assumed a positive relationship, the banking variables exhibit negative coefficients in many cases. Importantly, the results of this paper are largely in line with findings of previous contributions.

It is important to acknowledge that there is no universal answer to the formulated research question. Instead, the relationship between the financial system and economic growth is very complex and dependent on multiple factors, which interact with each other and may be bidirectional, time-varying and dependent on the stage of development or geographical location, for instance. Consequently, the question would need to be answered individually for different panels or even countries.

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Summary

This paper investigates the relationship between the financial system and economic growth. Understanding this nexus is important in order to draft and implement policy measures that safeguard economic welfare based on sound financial markets. In spite of the growing number of scholars who research in this area, there is a substantial amount of unanswered questions and a lively debate with contrasting views on basic processes.The main research question that will be answered in this paper is: What is the relationship between the financial system and economic growth? This question also answers which variables of the financial system have an impact on the real economy, which variables are most relevant contributors to economic growth and if differences between different groups of countries can be identified. The analysis is executed using the Arellano-Bond generalized method of moments (GMM) estimator based on panel data. The dataset consists of macroeconomic control variables and financial stock market and banking system variables from 74 countries over the time period 1988–2014. The results vary substantially between the panels under analysis. At the same time it can be said, that market capitalisation is the strongest predictor of economic growth. The analysis further shows that the banking system variables are largely negatively correlated with economic growth.

Keywords: economic growth, financial system, financialisation, GMM estimation, panel analysis

ZWIĄZEK POMIĘDZY SYSTEMEM FINANSOWYM I WZROSTEM GOSPODARCZYM: ESTYMACJA GMM NA PODSTAWIE DANYCH PANELOWYCH

Streszczenie

W artykule badana jest relacja zachodząca między systemem finansowym a wzrostem gospodarczym. Zrozumienie tej relacji jest bardzo ważne przy opracowywaniu i wdrażaniu programów politycznych, mających na celu rozwój ekonomiczny oparty na solidnej bazie rynków finansowych. Mimo coraz większej liczby naukowców, którzy badają tę dziedzinę, znaczna ilość pytań pozostaje bez odpowiedzi, a ożywiona debata uwypukla przeciwstawne poglądy na temat podstawowych procesów. Główne pytanie badawcze brzmi: Jaki związek występuje pomiędzy systemem finansowym a wzrostem gospodarczym? To pytanie pozwala udzielić odpowiedzi także na to, jakie zmienne systemu finansowego wpływają na realną gospodarkę, które zmienne uchodzą za najistotniejsze czynniki wzrostu gospodarczego, oraz czy można zidentyfikować różnice pomiędzy różnymi grupami krajów. Analiza została przeprowadzona za pomocą uogólnionej metody momentów (GMM) Arellano-Bonda na podstawie danych panelowych. Zestaw danych składa się ze zmiennych kontrolnych gospodarki oraz ze zmiennych finansowych z 76 krajów w okresie 1988–2014 r. Wyniki analizy różnią się znacznie pomiędzy panelami. Jednocześnie można stwierdzić, że kapitalizacja giełdowa jest najsilniejszym czynnikiem wzrostu gospodarczego. Analiza pokazuje ponadto, że zmienne systemu bankowego są negatywnie skorelowane ze wzrostem gospodarczym.